

INVITATION TO BID

1. a. Sealed proposals will be received by **Rowan/Kannapolis ABC Board** in the ABC Board Room located at 510 North Lee Street, Salisbury, North Carolina, up to **3:00 PM on Thursday, February 2nd, 2017** and immediately thereafter publicly opened and read for the furnishing of labor, materials and equipment entering into the construction of the new ABC Store and Warehouse, Jake Alexander Blvd., Salisbury, North Carolina, including all required work described on the plans and specifications for general work (which includes site/civil, structural, plumbing, mechanical and electrical work).

- b. The Project is a 7754 sq. ft. (one story) retail and warehouse building with a 290 sq. ft. entry canopy. Typical construction is brick veneer-on-metal stud walls, steel (columns & beams) frame with metal roof deck on steel bar joists/beams with single ply TPO roofing membrane. Base bid work also includes associated site grading; water and sewer utility work; storm water system with Bio-Cell; sidewalks; basic landscaping (grassing) and paved parking.

General Construction work includes major subcontractors:

Site, Civil and Utility work
Plumbing work.
HVAC work.
Electrical work.

Alternates (if any) per requirements of Division 1, listed in Section 01030.

- c. Proposals shall be received for a **Single Prime** contract for General Construction, including Plumbing, Mechanical, and Electrical work.
2. a. After Wednesday, January 11th, 2017, complete plans, specifications, and contract documents will be available for inspection on our website at www.rbsarch.com or in the following offices:

RAMSAY BURGIN SMITH ARCHITECTS, INC. - 225 N. Main Street, Suite 501, Salisbury, NC
And on the RBSA web site www.rbsarch.com

- b. Procedure for Obtaining Bidding Documents (General Contractors): Contact the Architect, Ramsay Burgin Smith Architects, Inc, 225 North Main Street, Suite 501, Salisbury, NC 28144. Phone: 704-633-3121 to **register for Bidding** and to receive any addenda to follow. Plans and Specifications may be viewed (and down-loaded from) without charge on the architect's website www.rbsarch.com by clicking "**Currently Bidding Projects**".

General Contractors are responsible for downloading and printing of all Bidding Documents.

Contractors shall access bid documents from RBSA Website and order printing from ACCENT IMAGING of Hickory, NC at 828-322-5050 or printer of their choice.

All printing costs shall be paid for by the General Contractor.

- c. Subcontractors and material suppliers may purchase single sheets of plans as they so chose. Subcontractors and material suppliers are invited to visit RBSA Website (www.rbsarch.com) to ascertain the quantity and specific sheets desired. The Architect will assume no responsibility in the selection of required drawings or specification sheets.
3. **A Pre-Bid Conference** will be held **on site on Wednesday, January 25th, 2017 beginning at 11:00 am** to allow contractors the opportunity to ask questions and/or clarify pertinent issues. **Attendance is not mandatory but strongly recommended** for project clarity. In the event of bad weather, the Conference will be held in ABC Board Room, located at 510 North Lee Street, Salisbury.
4. All Contractors and Subcontractors must have all required construction licenses under North Carolina State laws governing their respective trades.

5. Each proposal must be accompanied by a certified check drawn on a bank or trust company insured by the Federal Deposit Insurance Corporation in an amount equal to not less than 5% of the proposal. In lieu thereof, a bidder may offer a bid bond of 5% of the bid, executed by a surety company licensed under the laws of North Carolina to execute such bonds, conditioned that the surety will, upon demand forthwith make payment to the Obligee upon said bond, if the bidder fails to execute the contract in accordance with the bid bond. Upon failure to forthwith make payment, the surety will pay to the Obligee an amount equal to the amount of said bond. Said deposit shall be retained by the Owner as liquidated damages in the event of failure of the successful bidder to execute the contract within ten days after the award, or to give satisfactory surety as required by law. (General Statutes of North Carolina, C0143, Article 85 - 129).
6. Bonds: Separate Performance and Payment Bond will be required each for one hundred percent (100%) of the contract price.
7. Payments will be made at ninety five percent (95%) of approved monthly applications until a maximum of two and one half percent (2.5%) retainage is reached per N.C.G.S. 143-134.1 (b1)-through (e). Final Certificates and payment will be issued upon acceptance of the work as complete.
8. No bid may be withdrawn after time set for receiving bids for a period of **forty-five (45) days**.
9. **Low bidders** shall be required to submit to the Architect a *Contractor's Qualification Statement (AIA Document A305)* prior to award of bid. This information shall be considered privileged and confidential. Owner reserves the right to award or not to award contracts based on qualifications.
10. Rowan County maintains the goal of ten percent (10%) minority participation in all contracts. All bidders are expected to make and document a good faith effort to achieve this goal. **All the MBE documents are at the front of this project manual.**
11. The Owner reserves the right to waive irregularities and to reject any or all proposals.

RAMSAY BURGIN SMITH ARCHITECTS, INC.
225 North Main Street, Suite 501
Salisbury, North Carolina 28144

for

Rowan/Kannapolis ABC Board
Mr. Terry Osborne, Director
510 N. Lee Street
28144

December 2016

INSTRUCTIONS TO BIDDERS

SECTION 1. SITE CONDITIONS:

Bidders shall inform themselves fully of site conditions relating to construction and labor as well as other pertinent conditions before submitting a proposal.

SECTION 2. EXAMINATION OF PLANS, SPECIFICATIONS AND CONTRACT DOCUMENTS:

Should a bidder find discrepancies in or omissions from the plans, specifications, and/or contract documents, or should he be in doubt as to their meaning, he should at once notify the Architect who will send written instructions to all bidders. Neither Owner nor Architect will be responsible for any oral instructions.

Bidders must verify that they have received all drawings and specification by comparing their drawing sheets and specification sections with the projects drawing index and specification index. Neither Owner or Architect will be responsible for any claim of missing drawings of specifications listed on the indexes.

Every request for such interpretation or clarification shall be in writing addressed to the Architect, RAMSAY BURGIN SMITH ARCHITECTS, INC., 225 North Main Street, Suite 501, Salisbury, North Carolina 28144. **To be given consideration, the request must be received at least five (5) days prior to the bid date of the project. The interpretation and/or supplementary information will be mailed (AND/OR Emailed) to all prospective bidders generally not later than three (3) days prior to the date fixed for the receipt of bids.**

Bulletins or Addendum issued and received during the bidding period become a part of the contract documents and must be acknowledged on the Form of Proposal by all bidders. Addendum will posted on the architect's website www.rbsarch.com.

SECTION 3. PROPOSALS:

Each bid must be submitted on the prescribed form. All blank spaces must be filled in with ink or typewritten in both words and figures.

Each bid must be submitted in a sealed envelope bearing on the outside the name of the bidder, listing their address and license number, and stating that the proposal is for General Construction, including Plumbing, Mechanical, and Electrical work. Address proposals to the Owner, in care of the Architect, at the place set for opening of bids. If forwarded by mail (mailed to the Owner at the bid site address), the sealed envelope containing the bid must be enclosed in another envelope addressed as specified in the bid form and must be received prior to the closing time for bids. Proposals not received by the Architect prior to the closing of bids, no matter what the post mark date, shall be rejected.

SECTION 4. PROCEDURE TO FOLLOW IN EXECUTING CONTRACT DOCUMENTS:

The Form of Proposal on which all bids must be submitted is inserted herewith. Duplicate copies may be made by the Contractor for recording his bid and for his records. The current AIA contract form will be used for Owner-Contractor agreement. Invoices will be presented on appropriate AIA Form G702. See Article 24 of General Conditions.

Signatures: Each Contractor shall execute all copies of the Form of Proposal, Bid Bond, Contract and Performance Bond.

If the contract documents are executed by a sole owner, that fact shall be evidenced by the word "Owner" appearing after the name of the person executing them.

If the contract documents are executed by a partnership, that fact shall be evidenced by the words "Co-Partner" appearing after the name of the partner executing them.

If the contract documents are executed on the part of a corporation, they shall be executed by either the President or the Vice President and attested by the Secretary in either case, and the title of the office of such persons shall appear after their signatures. The seal of the corporation shall be impressed on each copy of the contract documents.

Signatures shall be properly witnessed.

Performance Bond:

Where the Performance Bond is executed by an Attorney-in-fact, there shall be attached to each copy of the Performance Bond a certified copy of Power of Attorney properly executed and dated.

Each copy of the Performance Bond shall be counter-signed by an authorized individual agent of the Bonding Company licensed to do business in North Carolina (see Section 58-44 General Statutes of North Carolina). The title "Licensed Resident Agent" shall appear after the signature.

The seal of the Bonding Company shall be impressed on each copy of the Performance Bond. The Contractor's signature(s) on the Performance Bond shall correspond with that on the Contract.

Form of Proposal:

Single Prime proposals will be received for general construction, including, plumbing, mechanical, and electrical work. See proposal form bound herein.

Owner reserves the right to waive irregularities and to reject any or all proposals.

Bids must be based on these specifications, addendum, bulletins and working drawings (as listed in Division 1), dated DECEMBER 2016 for Rowan/Kannapolis ABC Board, Salisbury, North Carolina.

Rowan County in compliance with the NC Senate Bill 914 has a goal of soliciting 10% participation in the project from Minority Business Enterprises (MBE). **See bidding requirements attached in the front of this project manual.**

Low Bidder's shall be required to submit a completed "Contractor's Qualification Statement" AIA Form A305 prior to award of contract.

Approval of Documents:

Upon completion of the execution of the contract documents, the documents, together with insurance certificates and other pertinent appendages, shall be returned to the Architect for checking and forwarding to the Owner. Following approval by the Owner, documents will be forwarded to the Architect for distribution.

SECTION 5. CONSTRUCTION ADMINISTRATION:

Though this job will be regularly and carefully administered by the Architect, or his representative, and though every reasonable effort will be made to protect the best interest of the Owner, and to assist the Contractor in the interpretation of the contract documents, this project does not include the services of a full-time clerk of the works. The desirability, frequency and timing of the Architect's visits to the site will be decided by the Architect.

END OF INSTRUCTIONS TO BIDDERS

TABLE OF CONTENTS

Cover Sheet	1
BIDDING REQUIREMENTS:	
Description	Page No.
Invitation to Bid	1 - 2
Instructions to Bidders	1 - 2
Table of Contents	1 - 4
Form of Proposal	1 - 4
Guidelines for Recruitment and Selection of Minority Businesses for Participation in Construction Contracts	1 - 8
MBE Documentation for Contract Payments	1
Identification of Minority Business Participation	1
State of NC Affidavit A – Listing of Good Faith Effort	1
State of NC Affidavit B – Intent to Perform Contract with Own Workforce	1
State of NC Affidavit C – Portion of the Work to be Performed by Minority Firms	1
State of NC Affidavit D – Good Faith Efforts	1 - 2
MBE Documentation for Contract Payments – Appendix E	1
RBSA Office Standard Rate Sheet	1
General Conditions	1 - 42
Supplementary General Conditions	1 - 10

SPECIFICATIONS

DIVISIONS:		
Section	Description	Page No.
<u>DIVISION 1 - GENERAL REQUIREMENTS:</u>		
01011	Summary of the Work (Schedule of Drawings)	1 - 6
01020	Allowances	1 - 3
01026	Unit Prices	1 - 2
01027	Applications for Payment	1 - 3
	Amendment to Protect Stored Materials	1
	State and County Sales Use Tax	1
01030	Alternates	1 - 2
01041	Project Coordination - Single Prime Contracts	1 - 3
01045	Cutting and Patching	1 - 2
01050	Field Engineering	1 - 2
01095	Reference Standards and Definitions	1 - 3
01200	Project Meetings	1 - 2
01300	Submittals	1 - 6
01400	Quality Control Services	1 - 3
	Statement of Special Inspections	1 - 4
01501	Temporary Facilities (with Project Sign)	1 - 9
01600	Materials and Equipment	1 - 3
01631	Product Substitutions	1 - 3

01700	Project Closeout	1 - 5
01740	Warranties and Bonds	1 - 2
	Contractor's General Warranty/Certification	1
 <u>DIVISION 2 - SITEWORK:</u>		
02110	Site Clearing	1 - 2
02200	Earthwork	1 - 9
02361	Termite Control	1 - 3
02513	Asphalt Concrete Paving	1 - 5
02514	Portland Cement Concrete Paving	1 - 4
02720	Sanitary Sewer Construction	1 - 8
02721	Storm Sewer System	1 - 4
02900	Landscape Work	1 - 8
 <u>DIVISION 3 - CONCRETE:</u>		
03310	Concrete Work	1 - 14
03451	Cast Stone	1 - 5
 <u>DIVISION 4 - MASONRY:</u>		
04200	Unit Masonry	1 - 14
 <u>DIVISION 5 - METALS:</u>		
05120	Structural Steel	1 - 6
05220	Steel Joists and Joist Girders	1 - 3
05310	Steel Deck	1 - 4
05400	Cold-Formed Metal Framing	1 - 4
05500	Metal Fabrications	1 - 6
 <u>DIVISION 6 - WOOD AND PLASTICS:</u>		
06105	Miscellaneous Carpentry	1 - 4
06200	Finish Carpentry	1 - 4
 <u>DIVISION 7 - THERMAL AND MOISTURE PROTECTION:</u>		
07160	Bituminous Dampproofing	1 - 2
07180	Water Repellents	1 - 3
07200	Insulation	1 - 4
07275	Weather Barriers	1 - 2
07530	Single Ply Roofing – TPO	1 - 9
07600	Flashing and Sheet Metal	1 - 5
07900	Joint Sealers	1 - 4
 <u>DIVISION 8 - DOORS & WINDOWS:</u>		
08110	Steel Doors and Frames	1 - 5
08211	Flush Wood Doors	1 - 4
08361	Sectional Overhead Doors	1 - 5
08410	Aluminum Entrances and Storefronts	1 - 6
08413	Glazed Unitized Aluminum Curtain Wall	1 - 5
08710	Door Hardware	1 - 14
08800	Glass and Glazing	1 - 7

DIVISION 9 - FINISHES:

09250	Gypsum Board Assemblies	1 - 8
09300	Tile (Slate Window Sills)	1 - 6
09510	Acoustical Ceilings	1 - 5
09650	Resilient Flooring (preparation)	1 - 5
09680	Carpet (preparation)	1 - 4
09911	Exterior Painting	1 - 5
09912	Interior Painting	1 - 8

DIVISION 10 - SPECIALTIES:

10000	Miscellaneous Accessories:	1 - 4
	Exterior Signage – Yard Sign	
	Wall Signage – See Allowance	
	911 Exterior Signage	
	Interior Signage	
	Metal Awnings	
	Metal Column Covers	
	Drain Chain and Install Kits	
	Dock Leveler	
	Ash Butt Receptacle – By Owner	
	Fire Extinguisher Cabinets	
	Knox Box – Rapid Entry System	
10800	Toilet Accessories	1 - 4

DIVISION 11 - EQUIPMENT NOT USED

DIVISION 12 - FURNISHINGS NOT USED

DIVISION 13 - SPECIAL CONSTRUCTION NOT USED

DIVISION 14 - CONVEYING SYSTEMS NOT USED

DIVISION 15 - MECHANICAL AND PLUMBING:

	Table of Contents	1
15050	Basic Mechanical Materials and Methods	1 - 15
15060	Hangers and Supports	1 - 8
15071	Mechanical Vibration and Seismic Controls	1 - 7
15075	Mechanical Identification	1 - 5
15081	Duct Insulation	1 - 11
15082	Equipment Insulation	1 - 9
15083	Pipe Insulation	1 - 9
15100	Valves	1 - 7
15121	Pipe Expansion Fittings and Loops	1 - 5
15122	Meters and Gages	1 - 7
15170	Motors	1 - 3
15194	Fuel Gas Piping	1 - 9
15410	Plumbing Fixtures	1 - 11
15411	Water Distribution Piping	1 - 8

15420	Drainage and Vent Piping	1 - 9
15430	Plumbing Specialties	1 - 16
15485	Electric, Domestic Water Heaters	1 - 7
15510	Hydronic Piping	1 - 10
15738	Split-System Air Conditioning Units	1 - 5
15815	Metal Ducts	1 - 9
15820	Duct Accessories	1 - 6
15838	Power Ventilators	1 - 7
15855	Diffusers, Registers, and Grilles	1 - 3
15900	HVAC Instrumentation and Controls	1 - 12
15990	Testing, Adjusting, and Balancing	1 - 13

DIVISION 16 - ELECTRICAL:

	Table of Contents	1
16010	General Requirements	1- 4
16110	Raceways and Fittings	1- 3
16111	Cable Tray	1- 4
16120	Wires and Cables	1- 3
16130	Outlet and Junction Boxes	1- 2
16134	Panelboards	1- 4
16140	Wiring Devices	1- 2
16190	Fastenings and Supports	1- 3
16450	Grounding and Bonding	1- 3
16491	Safety Switches	1
16492	Motor, Controllers and Equipment Connections	1- 2
16500	Lighting Fixtures	1- 10
16740	Telephone, Data Systems	1

MISCELLANEOUS:

The Report of Subsurface Exploration
dated October 31, 2016

ECS CAROLINAS, LLP
1812 Center Park Drive Suite D
Charlotte, NC 28217
tel# 704.525.5152

-Full Reports are posted on line at www.rbsarch.com .

END OF TABLE OF CONTENTS.

FORM OF PROPOSAL
Rowan/Kannapolis
ABC STORE & WAREHOUSE
Salisbury, NC

Contractor Name: _____

Submitted herewith is my/our proposal for the **ABC Store & Warehouse, Salisbury, North Carolina.**

SECTION 1. PRELIMINARY:

The undersigned, as bidder, hereby declares that the only person(s) interested in this proposal as principal(s) is/are named herein; that no other person than herein mentioned has any interest in this proposal or in the contract to be entered into; that this proposal is made without connection with any other person, company or parties making a bid or proposal; and that it is in all respects fair and in good faith without collusion or fraud.

The undersigned bidder further declares that he has examined the site of the work and informed himself fully in regard to all conditions pertaining to the place where the work is to be done; that he has examined the specifications for the work and the contract documents relative thereto, and has read all special provisions furnished prior to the opening of bids; and that he has satisfied himself relative to the work to be performed.

If this proposal is accepted, the undersigned bidder proposes and agrees to contract with **Rowan/Kannapolis ABC Board** in the form of contract specified, to furnish all necessary materials, equipment, machinery, tools, apparatus, means of transportation and labor necessary to complete the construction in full and complete accord with the plans, specifications and contract documents and to the full and complete satisfaction of the Architect and Owner with a definite understanding that no money will be allowed for extra work except as set forth in the General Conditions and contract documents for the sum of:

Single Prime Contract:

BASE BID: _____ **DOLLARS (\$ _____)**
(including allowances specified in Section 01020)

LIST THE FOLLOWING MAJOR SUBCONTRACTORS PART OF BID:

Grading/Site Work: _____
Plumbing: _____
HVAC: _____
Electrical: _____
Masonry: _____
Metal Stud Framing: _____
Roofing: _____

SECTION 2. ALTERNATES:

Each alternate price listing in this proposal shall cover all costs required for this particular part of the work, complete and in place, including all changes, alterations or modifications to surrounding work required to accommodate the substitution, addition, deletion or other change.

The Architect reserves the right to recommend to the Owner the acceptance or rejection of any or all alternates. The Owner reserves the right to accept or reject any or all such recommendations. The Owner further reserves the right to accept or reject alternates in any order they preferred without regard to whether or not their selected order effects bid outcome.

Should any of the alternates as described in the specifications be accepted, the amount written below shall be the amount to "add to" or "deduct from" the Base Bid. Signify the option intended by the words "add" or "deduct" in front of the written figures and the like "plus" or "minus" signs in front of the numerals.

NO ALTERNATES.

SECTION 3. UNIT PRICES:

Unit prices are for complete work and no profit or overhead shall be added or deducted when applying unit prices. No work described on the drawings or specifications is to be bid as a unit price. Unit price costs will be used only for additional work the owner may want to include in the work by change order.

UNIT PRICE #1: Undercut including compacted refill, per cubic yard: - GENERAL WORK -

This price must also include cost of hauling and LEGALLY DISPOSING of undercut soil from site and hauling structural quality soil to site and compaction. Testing costs of soil material characteristics and appropriateness of use as structural fill shall be part of unit cost (or otherwise is considered part of general contractor's base bid).

_____ DOLLARS (\$ _____ /cu.yd.)

NOTE: This unit price cost will be used to determine the exact Allowance dollar amount figure used by the contractor in their base bid for the **3000 cu. yds.** of undercut and fill specified in Division 1 - Allowances.

Unit Price #1 Breakout Costs

Provide breakout costs comprising the Unit Price #1 amount listed above.

Excavating Undercut Soil on Site:

_____ DOLLARS (\$ _____ /cu.yd.)

Hauling and LEGALLY DISPOSING Undercut Soil from Site:

_____ DOLLARS (\$ _____ /cu.yd.)

Hauling Structural Quality Soil to Site:

_____ DOLLARS (\$ _____ /cu.yd.)

Compacting Structural Quality Soil on Site:

_____ DOLLARS (\$ _____ /cu.yd.)

Note: The Four Breakout Costs listed here must TOTAL the dollar amount listed as Unit Price #1.

UNIT PRICE #2: Undercut including compacted ABC stone, per cubic yard:- GENERAL WORK -

This price must also include cost of hauling and LEGALLY DISPOSING of undercut soil from site and hauling ABC stone to site and compaction. Testing costs of soil material characteristics and appropriateness of use as structural fill shall be part of unit cost (or otherwise is considered part of general contractor's base bid).

_____ DOLLARS (\$ _____ /cu.yd.)

Unit Price #2 Breakout Costs

Provide breakout costs comprising the Unit Price #1 amount listed above.

Excavating Undercut Soil on Site:

_____ DOLLARS (\$ _____ /cu.yd.)

Hauling and LEGALLY DISPOSING Undercut Soil from Site:

_____ DOLLARS (\$ _____ /cu.yd.)

Hauling ABC Stone to Site:

_____ DOLLARS (\$ _____ /cu.yd.)

Compacting ABC Stone on Site:

_____ DOLLARS (\$ _____ /cu.yd.)

Note: The Four Breakout Costs listed here must TOTAL the dollar amount listed as Unit Price #2.

SECTION 4. COMPLETION OF WORK:

If the undersigned bidder is notified of the acceptance of this proposal, he agrees to execute a contract for the above stated compensation in the form of the Standard Agreement of the American Institute of Architects and to commence work within ten (10) days after signing of the contract. The undersigned bidder proposes to complete the construction and have the work ready for Final Inspection on or before the schedule listed below from date of "commencement of work".

Construction Duration - 10 Months.

The undersigned further agrees that in the case of failure on his part to execute the said contract and required bonding within ten (10) consecutive calendar days after written notice of award of the contract has been given, the check, cash, or bid bond accompanying this bid shall be paid into the funds of the Owner for this project as liquidated damages for such failure.

SECTION 5. ADDENDA/BULLETINS:

The undersigned bidder acknowledges receipt of the following Addenda and/or Bulletins:

Addendum No. _____ Dated _____

Addendum No. _____ Dated _____

Addendum No. _____ Dated _____

Addendum No. _____ Dated _____

WITNESS

(seal)

SIGNATURE AND TITLE

FIRM NAME

ADDRESS

ADDRESS

LICENSE NUMBER

DATE

GUIDELINES FOR RECRUITMENT AND SELECTION OF MINORITY BUSINESSES FOR PARTICIPATION IN ROWAN COUNTY CONSTRUCTION CONTRACTS

In accordance with G.S. §143-128.2, these Guidelines establish goals for minority participation in single-prime bidding, separate-prime bidding, construction manager at risk, and alternative contracting methods on County construction projects in the amount of \$300,000 or more. The ROWAN COUNTY has established a verifiable goal of 10% for participation by minority businesses in building construction contracts.

SECTION A: INTENT

It is the intent of these Guidelines that the ROWAN COUNTY, as awarding authority for construction projects, and the contractors and subcontractors performing the construction contracts awarded, shall cooperate and in good faith do all things legal, proper and reasonable to achieve the goal of ten percent (10%) for participation by minority businesses in each construction project as mandated by G.S. §143-128.2. Nothing in these Guidelines shall be construed to require contractors or awarding authorities to award contracts or subcontracts to or to make purchases of materials or equipment from minority-business contractors or minority-business subcontractors who do not submit the lowest responsible, responsive bid or bids.

SECTION B: DEFINITIONS

1. Minority - a person who is a citizen or lawful permanent resident of the United States and who is:
 - a. Black, that is, a person having origins in any of the black racial groups in Africa;
 - b. Hispanic, that is, a person of Spanish or Portuguese culture with origins in Mexico, South or Central America, or the Caribbean Islands, regardless of race;
 - c. Asian American, that is, a person having origins in any of the original peoples of the Far East, Southeast Asia and Asia, the Indian subcontinent, the Pacific Islands;
 - d. American Indian, that is, a person having origins in any of the original peoples of North America; or
 - e. Female
2. Minority Business - means a business:
 - a. In which at least fifty-one percent (51%) is owned by one or more minority persons, or in the case of a corporation, in which at least fifty-one percent (51%) of the stock is owned by one or more minority persons or socially and economically disadvantaged individuals; and
 - b. Of which the management and daily business operations are controlled by one or more of the minority persons or socially and economically disadvantaged individuals who own it.
3. Socially and economically disadvantaged individual - means the same as defined in 15 U.S.C. 637. "Socially disadvantaged individuals are those who have been subjected to racial or ethnic prejudice or cultural bias because of their identity as a member of a group without regard to their individual qualities." "Economically disadvantaged individuals are those socially disadvantaged individuals whose ability to compete in the free enterprise system has been impaired due to

diminished capital and credit opportunities as compared to others in the same business area who are not socially disadvantaged.”

4. Public Entity - means the Owner and all public subdivisions and local governmental units.
5. Owner - The **ROWAN COUNTY**.
6. Designer - Any person, firm, partnership, or corporation, which has contracted with the Owner to perform architectural or engineering work.
7. Bidder - Any person, firm, partnership, corporation, association, or joint venture seeking to be awarded a public contract or subcontract.
8. Contract - A mutually binding legal relationship or any modification thereof obligating the seller to furnish equipment, materials or services, including construction, and obligating the buyer to pay for them.
9. Contractor - Any person, firm, partnership, corporation, association, or joint venture which has contracted with the Owner to perform construction work or repair.
10. Subcontractor - A firm under contract with the prime contractor or construction manager at risk for supplying materials or labor and materials and/or installation. The subcontractor may or may not provide materials in his subcontract.

SECTION C: RESPONSIBILITIES

1. Office for Historically Underutilized Businesses, Department of Administration (hereinafter referred to as HUB Office).

The HUB Office has established a program which allows interested persons or businesses qualifying as a minority business under G.S. §143-128.2 to obtain certification in the State of North Carolina procurement system. The information provided by the minority businesses will be used by the HUB Office to:

- a. Identify those areas of work for which there are minority businesses, as requested.
- b. Make available to interested parties a list of prospective minority business contractors and subcontractors.
- c. Assist in the determination of technical assistance needed by minority business contractors.

In addition to being responsible for the certification/verification of minority businesses that want to participate in a government construction program, the HUB Office will:

- a. Maintain a current list of minority businesses. The list shall include the areas of work in which each minority business is interested.
- b. Inform minority businesses on how to identify and obtain contracting and subcontracting opportunities through the State Construction Office and other public entities.
- c. Inform minority businesses of the contracting and subcontracting process for public

- construction building projects.
- d. Work with the North Carolina trade and professional organizations to improve the ability of minority businesses to compete in government construction projects.
- e. The HUB Office also oversees the minority business program by:
 - (1) Monitoring compliance with the program requirements.
 - (2) Assisting in the implementation of training and technical assistance programs.
 - (3) Identifying and implementing outreach efforts to increase the utilization of minority businesses.
 - (4) Reporting the results of minority business utilization to the Secretary of the Department of Administration, the Governor, and the General Assembly.

2. Owner

The Owner shall do the following:

- a. Develop and implement a minority business participation outreach plan to identify minority businesses that can perform public building projects and to implement outreach efforts to encourage minority business participation in these projects to include education, recruitment, and interaction between minority businesses and nonminority businesses.
- b. Attend the scheduled prebid conference.
- c. At least 10 days prior to the scheduled day of bid opening, notify minority businesses that have requested notices from the public entity for public construction or repair work and minority businesses that otherwise indicated to the Office of Historically Underutilized Businesses an interest in the type of work being bid or the potential contracting opportunities listed in the proposal. The notification shall include the following:
 - (1) A description of the work for which the bid is being solicited.
 - (2) The date, time, and location where bids are to be submitted.
 - (3) The name of the individual within the public entity who will be available to answer questions about the project.
 - (4) Where bid documents may be reviewed.
 - (5) Any special requirements that may exist.
- d. Utilize other media, as appropriate, likely to inform potential minority businesses of the bid being sought.

3. Designer

Under the single-prime bidding, separate prime bidding, construction manager at risk, or alternative contracting method, the Designer will:

- a. Attend the scheduled prebid conference to assist in explaining minority business requirements to the prospective bidders.
- b. Assist the Owner to identify and notify prospective minority business prime and subcontractors of potential contracting opportunities.
- c. Maintain documentation of any contacts, correspondence, or conversation with minority business firms made in an attempt to meet the goals.

- d. Review jointly with the Owner, all requirements of G.S. §143-128.2(c) and G.S. § 143-128.2(f) - (i.e. bidders' proposals for identification of the minority businesses that will be utilized with corresponding total dollar value of the bid and affidavit listing Good Faith Efforts, or affidavit of self-performance of work, if the contractor will perform work under contract by its own workforce) - prior to recommendation of award.
 - e. During construction phase of the project, review "MBE Documentation for Contract Payment" - (Appendix E) for compliance with minority business utilization commitments. Submit Appendix E form with monthly pay applications to the Owner.
 - f. Make documentation showing evidence of implementation of Designer's responsibilities available for review by the Owner and State officials upon request.
4. Prime Contractor(s), CM at Risk, and Its First-Tier Subcontractors
Under the single-prime bidding, the separate-prime bidding, construction manager at risk and alternative contracting methods, contractor(s) will:
- a. Attend the scheduled prebid conference.
 - b. Identify or determine those work areas of a subcontract where minority businesses may have an interest in performing subcontract work.
 - c. At least ten (10) days prior to the scheduled day of bid opening, notify minority businesses of potential subcontracting opportunities listed in the proposal. The notification will include the following:
 - (1) A description of the work for which the subbid is being solicited.
 - (2) The date, time and location where subbids are to be submitted.
 - (3) The name of the individual within the company who will be available to answer questions about the project.
 - (4) Where bid documents may be reviewed.
 - (5) Any special requirements that may exist, such as insurance, licenses, bonds and financial arrangements.
- If there are more than three (3) minority businesses in the general locality of the project who offer similar contracting or subcontracting services in the specific trade, the contractor(s) shall notify three (3), but may contact more, if the contractor(s) so desires.
- d. During the bidding process, comply with the contractor(s) requirements listed in the proposal for minority participation.
 - e. Identify on the bid the minority businesses that will be utilized on the project with corresponding total dollar value of the bid and affidavit listing Good Faith Efforts as required by G.S. §143-128.2(c) and G.S. §143-128.2(f).
 - f. Make documentation showing evidence of implementation of PM, CM-at-Risk and First-Tier Subcontractor responsibilities available for review by the Owner and State officials upon request.
 - g. Upon being named the apparent low bidder, the bidder shall provide one of the following:
 - (1) an affidavit (Affidavit C) that includes a description of the portion of work to be executed by minority businesses, expressed as a percentage of the total contract price, which is equal to or more than the applicable goal; (2) if the percentage is not equal to the applicable goal, then documentation of all Good Faith Efforts taken to meet the goal. Failure to comply with these requirements is grounds for rejection of the bid and award to the next lowest responsible and responsive bidder.
 - h. The contractor(s) shall identify the name(s) of minority business subcontractor(s) and

corresponding dollar amount of work on the schedule of values. The schedule of values shall be provided as required in the General Conditions of the Contract to facilitate payments to the subcontractors.

- i. The contractor(s) shall submit with each monthly pay request(s) and final payment(s), "MBE Documentation for Contract Payment" - (Appendix E), for Designer's review.
- j. During the construction of a project, at any time, if it becomes necessary to replace a minority business subcontractor, immediately advise the Owner of the circumstances involved. The prime contractor shall make a good faith effort to replace a minority business subcontractor with another minority business subcontractor.
- k. If during the construction of a project additional subcontracting opportunities become available, make a Good Faith Effort to solicit subbids from minority businesses.
- l. It is intended that these requirements apply to all contractors performing as prime contractor and first tier subcontractor under construction manager at risk on County projects.

5. Minority Business Responsibilities

While minority businesses are not required to become certified in order to participate in County construction projects, it is recommended that they become certified and should take advantage of the appropriate technical assistance that is made available. In addition, minority businesses who are contacted by owners or bidders must respond promptly whether or not they wish to submit a bid.

SECTION D: DISPUTE PROCEDURES

It is the policy of this State that disputes that involve a person's rights, duties or privileges should be settled through informal procedures. To that end, minority business disputes arising under these Guidelines should be resolved as governed under G.S. §143-128(g).

SECTION E: ADDITIONAL INFORMATION

Listings of certified woman-owned and minority-owned businesses can be found at the following Web site:

NC Vendor Link - www.ips.state.nc.us/ips/vendor/vndpubmain.asp

MINORITY BUSINESS CONSTRUCTION CONTRACT PROVISIONS

APPLICATION:

The **Guidelines for Recruitment and Selection of Minority Businesses for Participation in ROWAN COUNTY Construction Contracts** are hereby made a part of these contract documents.

MINORITY BUSINESS SUBCONTRACT GOALS:

The goals for participation by minority firms as subcontractors on this project have been set at 10%.

The bidder must identify on its bid the minority businesses that will be utilized on the project with corresponding total dollar value of the bid and affidavit (Affidavit A) listing good faith efforts **or** affidavit (Affidavit B) of self-performance of work, if the bidder will perform work under contract by its own workforce, as required by G.S. §143-128.2(c) and G.S. 143-128.2(f).

The lowest responsible, responsive bidder must provide Affidavit C that includes a description of the portion of work to be executed by minority businesses, expressed as a percentage of the total contract price, which is equal to or more than the applicable goal.

OR

Provide Affidavit C that includes a description of the portion of work to be executed by minority businesses, expressed as a percentage of the total contract price, **with documentation of Good Faith Effort and Affidavit D if the percentage is not equal to the applicable goal.**

OR

Provide Affidavit B, which includes sufficient information for the Owner to determine that the bidder does not customarily subcontract work on this type project.

The above information must be provided as required. Failure to submit these documents is grounds for rejection of the bid.

MINIMUM COMPLIANCE REQUIREMENTS:

All written statements, affidavits or intentions made by the bidder shall become a part of the agreement between the Contractor and the Owner for performance of this contract. Failure to comply with any of these statements, affidavits or intentions, or with the minority business Guidelines shall constitute a breach of the contract. A finding by the Owner that any information submitted either prior to award of the contract or during the performance of the contract is inaccurate, false or incomplete, shall also constitute a breach of the contract. Any such breach may result in termination of the contract in accordance with the termination provisions contained in the contract. It shall be solely at the option of the Owner whether to terminate the contract for breach.

In determining whether a contractor has made Good Faith Efforts, the Owner will evaluate all efforts made by the Contractor and will determine compliance in regard to quantity, intensity, and results of these efforts. Good Faith Efforts include:

- (1) Contacting minority businesses that reasonably could have been expected to submit a quote and that were known to the Contractor or available on State or local government maintained lists at least 10 days before the bid or proposal date and notifying them of the nature and scope of the work to be performed.
- (2) Making the construction plans, specifications and requirements available for review by prospective minority businesses, or providing these documents to them at least 10 days before the bid or proposals are due.
- (3) Breaking down or combining elements of work into economically feasible units to facilitate minority participation.
- (4) Working with minority trade, community, or contractor organizations identified by the Office for Historically Underutilized Businesses and included in the bid documents that provide assistance in recruitment of minority businesses.
- (5) Attending any prebid meetings scheduled by the public Owner.
- (6) Providing assistance in getting required bonding or insurance or providing alternatives to bonding or insurance for subcontractors.
- (7) Negotiating in good faith with interested minority businesses and not rejecting them as unqualified without sound reasons based on their capabilities. Any rejection of a minority business based on lack of qualification should have the reasons documented in writing.
- (8) Providing assistance to an otherwise qualified minority business in need of equipment, loan capital, lines of credit, or joint pay agreements to secure loans, supplies, or letters of credit, including waiving credit that is ordinarily required. Assisting minority businesses in obtaining the same unit pricing with the bidder's suppliers in order to help minority businesses in establishing credit.
- (9) Negotiating joint venture and partnership arrangements with minority businesses in order to

increase opportunities for minority business participation on a public construction or repair project when possible.

- (10) Providing quick pay agreements and policies to enable minority contractors and suppliers to meet cash-flow demands.

APPENDIX E

MBE DOCUMENTATION FOR CONTRACT PAYMENTS

Prime Contractor/Architect: _____

Address & Phone: _____

Project Name: _____

Pay Application #: _____ Period: _____

The following is a list of payments made to Minority Business Enterprises on this project for the above-mentioned period.

MBE FIRM NAME	* INDICATE TYPE OF MBE	AMOUNT TO BE PAID	TOTAL PAYMENTS TO DATE	TOTAL AMOUNT COMMITTED

*Minority categories: Black, African American (B), Hispanic (H), Asian American (A), American Indian (I), Female (F), Social and Economically Disadvantage (D)

Date: _____ Approved/Certified By: _____
Name

Title

Signature

SUBMIT WITH EACH PAY REQUEST & FINAL PAYMENT

do hereby certify that on this project, we will use the following minority business enterprises as construction subcontractors, vendors, suppliers or providers of professional services.

*Minority categories: Black, African American (**B**), Hispanic (**H**), Asian American (**A**) American Indian (**I**), Female (**F**) Socially and Economically Disadvantaged (**D**)

MBForms 2002-Revised
March, 2005

State of North Carolina AFFIDAVIT A – Listing of Good Faith Efforts

County of _____

(Name of Bidder)

Affidavit of _____

I have made a good faith effort to comply under the following areas checked:

Bidders must earn at least 50 points from the good faith efforts listed for their bid to be considered responsive. (1 NC Administrative Code 30 I.0101)

- ☐ **1 – (10 pts)** Contacted minority businesses that reasonably could have been expected to submit a quote and that were known to the contractor, or available on State or local government maintained lists, at least 10 days before the bid date and notified them of the nature and scope of the work to be performed.
- ☐ **2 --(10 pts)** Made the construction plans, specifications and requirements available for review by prospective minority businesses, or providing these documents to them at least 10 days before the bids are due.
- ☐ **3 – (15 pts)** Broken down or combined elements of work into economically feasible units to facilitate minority participation.
- ☐ **4 – (10 pts)** Worked with minority trade, community, or contractor organizations identified by the Office of Historically Underutilized Businesses and included in the bid documents that provide assistance in recruitment of minority businesses.
- ☐ **5 – (10 pts)** Attended prebid meetings scheduled by the public owner.
- ☐ **6 – (20 pts)** Provided assistance in getting required bonding or insurance or provided alternatives to bonding or insurance for subcontractors.
- ☐ **7 – (15 pts)** Negotiated in good faith with interested minority businesses and did not reject them as unqualified without sound reasons based on their capabilities. Any rejection of a minority business based on lack of qualification should have the reasons documented in writing.
- ☐ **8 – (25 pts)** Provided assistance to an otherwise qualified minority business in need of equipment, loan capital, lines of credit, or joint pay agreements to secure loans, supplies, or letters of credit, including waiving credit that is ordinarily required. Assisted minority businesses in obtaining the same unit pricing with the bidder's suppliers in order to help minority businesses in establishing credit.
- ☐ **9 – (20 pts)** Negotiated joint venture and partnership arrangements with minority businesses in order to increase opportunities for minority business participation on a public construction or repair project when possible.
- ☐ **10 - (20 pts)** Provided quick pay agreements and policies to enable minority contractors and suppliers to meet cash-flow demands.

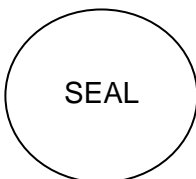
The undersigned, if apparent low bidder, will enter into a formal agreement with the firms listed in the Identification of Minority Business Participation schedule conditional upon scope of contract to be executed with the Owner. Substitution of contractors must be in accordance with GS143-128.2(d) Failure to abide by this statutory provision will constitute a breach of the contract.

The undersigned hereby certifies that he or she has read the terms of the minority business commitment and is authorized to bind the bidder to the commitment herein set forth.

Date: _____ Name of Authorized Officer: _____

Signature: _____

Title: _____



State of _____, County of _____

Subscribed and sworn to before me this _____ day of _____ 20____

Notary Public _____

My commission expires _____

State of North Carolina --AFFIDAVIT B-- Intent to Perform Contract with Own Workforce.

County of _____

Affidavit of _____
(Name of Bidder)

I hereby certify that it is our intent to perform 100% of the work required for the _____
_____ contract.
(Name of Project)

In making this certification, the Bidder states that the Bidder does not customarily subcontract elements of this type project, and normally performs and has the capability to perform and will perform all elements of the work on this project with his/her own current work forces; and

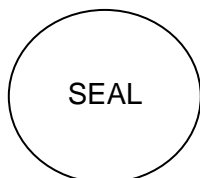
The Bidder agrees to provide any additional information or documentation requested by the owner in support of the above statement.

The undersigned hereby certifies that he or she has read this certification and is authorized to bind the Bidder to the commitments herein contained.

Date: _____ Name of Authorized Officer: _____

Signature: _____

Title: _____



State of _____, County of _____

Subscribed and sworn to before me this _____ day of _____ 20____

Notary Public _____

My commission expires _____

State of North Carolina - AFFIDAVIT C - Portion of the Work to be Performed by Minority Firms

County of _____

(Note this form is to be submitted only by the apparent lowest responsible, responsive bidder.)

If the portion of the work to be executed by minority businesses as defined in GS143-128.2(g) is equal to or greater than 10% of the bidders total contract price, then the bidder must complete this affidavit. This affidavit shall be provided by the apparent lowest responsible, responsive bidder within **72 hours** after notification of being low bidder.

Affidavit of _____ I do hereby certify that on the
(Name of Bidder)

(Project Name)
Project ID# _____ Amount of Bid \$ _____

I will expend a minimum of _____% of the total dollar amount of the contract with minority business enterprises. Minority businesses will be employed as construction subcontractors, vendors, suppliers or providers of professional services. Such work will be subcontracted to the following firms listed below. Attach additional sheets if required

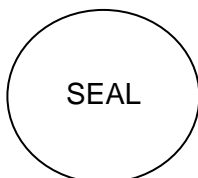
Name and Phone Number	*Minority Category	Work description	Dollar Value

*Minority categories: Black, African American (**B**), Hispanic (**H**), Asian American (**A**) American Indian (**I**), Female (**F**) Socially and Economically Disadvantaged (**D**)

Pursuant to GS143-128.2(d), the undersigned will enter into a formal agreement with Minority Firms for work listed in this schedule conditional upon execution of a contract with the Owner. Failure to fulfill this commitment may constitute a breach of the contract.

The undersigned hereby certifies that he or she has read the terms of this commitment and is authorized to bind the bidder to the commitment herein set forth.

Date: _____ Name of Authorized Officer: _____



Signature: _____

Title: _____

State of _____, County of _____

Subscribed and sworn to before me this _____ day of _____ 20____

Notary Public _____

My commission expires _____

State of North Carolina AFFIDAVIT D – Good Faith Efforts

County of _____

(Note this form is to be submitted only by the apparent lowest responsible, responsive bidder.)

If the goal of 10% participation by minority business **is not** achieved, the Bidder shall provide the following documentation to the Owner of his good faith efforts:

Affidavit of _____ I do hereby certify that on the
(Name of Bidder)

(Project Name)
Project ID# _____ Amount of Bid \$ _____

I will expend a minimum of _____% of the total dollar amount of the contract with minority business enterprises. Minority businesses will be employed as construction subcontractors, vendors, suppliers or providers of professional services. Such work will be subcontracted to the following firms listed below. (Attach additional sheets if required)

Name and Phone Number	*Minority Category	Work description	Dollar Value

*Minority categories: Black, African American (**B**), Hispanic (**H**), Asian American (**A**) American Indian (**I**), Female (**F**) Socially and Economically Disadvantaged (**D**)

Examples of documentation that may be required to demonstrate the Bidder's good faith efforts to meet the goals set forth in these provisions include, but are not necessarily limited to, the following:

- Copies of solicitations for quotes to at least three (3) minority business firms from the source list provided by the State for each subcontract to be let under this contract (if 3 or more firms are shown on the source list). Each solicitation shall contain a specific description of the work to be subcontracted, location where bid documents can be reviewed, representative of the Prime Bidder to contact, and location, date and time when quotes must be received.
- Copies of quotes or responses received from each firm responding to the solicitation.
- A telephone log of follow-up calls to each firm sent a solicitation.
- For subcontracts where a minority business firm is not considered the lowest responsible sub-bidder, copies of quotes received from all firms submitting quotes for that particular subcontract.
- Documentation of any contacts or correspondence to minority business, community, or contractor organizations in an attempt to meet the goal.
- Copy of pre-bid roster.
- Letter documenting efforts to provide assistance in obtaining required bonding or insurance for minority business.
- Letter detailing reasons for rejection of minority business due to lack of qualification.
- Letter documenting proposed assistance offered to minority business in need of equipment, loan capital, lines of credit, or joint pay agreements to secure loans, supplies, or letter of credit, including waiving credit that is ordinarily required.

Failure to provide the documentation as listed in these provisions may result in rejection of the bid and award to the next lowest responsible and responsive bidder.

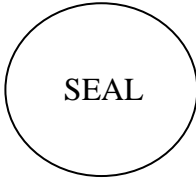
Pursuant to GS143-128.2(d), the undersigned will enter into a formal agreement with Minority Firms for work listed in this schedule conditional upon execution of a contract with the Owner. Failure to fulfill this commitment may constitute a breach of the contract.

The undersigned hereby certifies that he or she has read the terms of this commitment and is authorized to bind the bidder to the commitment herein set forth.

Date: _____ Name of Authorized Officer: _____

Signature: _____

Title: _____



State of _____, County of _____

Subscribed and sworn to before me this _____ day of _____ 20____

Notary Public _____

My commission expires _____

APPENDIX E

MBE DOCUMENTATION FOR CONTRACT PAYMENTS

Prime Contractor/Architect: _____

Address & Phone: _____

Project Name: _____

Pay Application #: _____ Period: _____

The following is a list of payments made to Minority Business Enterprises on this project for the above-mentioned period.

MBE FIRM NAME	* INDICATE TYPE OF MBE	AMOUNT PAID THIS MONTH	TOTAL PAYMENTS TO DATE	TOTAL AMOUNT COMMITTED

*Minority categories: Black, African American (B), Hispanic (H), Asian American (A), American Indian (I), Female (F), Social and Economically Disadvantage (D)

Date: _____ Approved/Certified By: _____

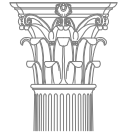
Name

Title

Signature

SUBMIT WITH EACH PAY REQUEST & FINAL PAYMENT

OFFICE STANDARD RATE SHEET



January 2015

For additional architectural services above basic fees for projects, change orders, expert witnessing, special circumstance problem solving or projects without a clearly-defined scope, we provide services at the following hourly rates:

Principal \$ 180 per hour

The Partner in responsible charge of each project. The Principal has controlling authority to obligate the Firm in all contractual areas of design, production and finance.

Project Architect \$ 120 per hour

The Architect responsible for overall project management. Oversees all design, construction consultations, site evaluations and preliminary studies, the preparation of plans, specifications and contract documents, administration of construction contracts and related services.

Intern Architect \$ 75 per hour

Graduate of an accredited School of Design working in the Intern Development Program towards partial satisfaction of the architectural licensing and certification requirements.

Technical Draftsperson \$ 70 per hour

Design and production personnel qualified in the preparation of plans, specifications and construction documents.

Administration \$ 50 per hour

All clerical, accounting and office management personnel.

Professional Consultants Cost plus 20%

Additional structural, mechanical and electrical engineering or other specialized consultant services.

Travel Time

Travel time is billed at 1/2 the hourly rate if more than 3 hours total travel time is required for any trip.

Reimbursables

Expenses of reproduction	Cost plus 20%
Expenses of postage and handling of drawings, specifications, and other documents	Cost plus 20%
Expenses of renderings, models, and mock-ups	Cost plus 20%
Expense of any additional insurance coverage or limits including professional liability insurance requested by the owner in excess of that normally carried.	At Cost
Living expenses in connection with out-of-town travel.	At Cost
Long distance communications	At Cost
Fees paid for securing approval of authorities having jurisdiction over the Project.	At Cost
Transportation in connection with Project	.575 cents/mile

SUPPLEMENTARY CONDITIONS

The following supplements modify, change, delete from or add to the "General Conditions of the Contract for Construction," AIA Document A201, Edition, 2007. Where any Article of the General Conditions is modified or any Paragraph, Subparagraph or Clause thereof is modified or deleted by these Supplementary Conditions, the unaltered provisions of that Article, Paragraph, Subparagraph or Clause shall remain in effect.

ARTICLE 1; GENERAL PROVISIONS

1.2 Correlations and Intent of the Contract Documents

Add the following Clauses 1.2.1.1 through 1.2.1.3 to Subparagraph 1.2.1:

1.2.1.1 In the event of ambiguity or conflict of statement or directive, the contract documents shall be interpreted in this order:

1. (highest) The General Conditions (edition as issued with the project specifications)
2. The Owner-Contractor Agreement
3. The Supplementary Conditions
4. Written Dimensions on the Drawings
5. Large Scale Details on the Drawings
6. Detailed Specifications
7. Small Scale Details on the Drawings

1.2.1.2 Should the above subparagraph fail to solve the ambiguity or conflict of statement or directive, the Contractor shall have included in the contract price the better quality and/or quantity of work or materials shown or listed.

1.2.1.3 Items shown on smaller plans and details that are not shown on larger plans and details **ARE STILL PART OF THE WORK**. Only information **IN CONFLICT** between small and large details follows the "Larger plans and details rule" that larger plans and details dictate work.

ARTICLE 2; OWNER

Delete Subparagraph 2.2.5 and substitute the following subparagraph 2.2.5 (including Clauses 2.2.5.1 through 2.2.5.5):

2.2.5 The Contractor(s), without cost of copies, will be supplied the following numbers of Contract Documents:

2.2.5.1 All Contract Documents-- 1 each (General Contractors bid set)

2.2.5.2 Construction Drawings - 4 complete sets for each of the following:

General Contractor
Plumbing Contractor
HVAC Contractor
Electrical Contractor

2.2.5.3 Specifications - 4 complete set for each of the following:

General Contractor
Plumbing Contractor
HVAC Contractor
Electrical Contractor

2.2.5.4 Miscellaneous Supplemental Detail Drawings, Addenda, Etc. used in the bid process - 4 copies each item.

General Contractor
Plumbing Contractor
HVAC Contractor
Electrical Contractor

2.2.5.5 In the case of a single Prime Contractor, all copies listed in these Clauses will be made available to the Prime Contractor for distribution. Neither the Architect nor Owner shall be responsible for further distribution or the final numbers, which the Prime Contractor distributes to each subcontractor.

2.4 Owner's Right to Carry out the Work

Add the following Subparagraph 2.4.2 and Clauses 2.4.2.1 through 2.4.2.7 to Paragraph 2.4:

2.4.2 The Owner may declare the Contractor in default for any one or more of the following reasons:

- 2.4.2.1** failure to complete the Work within the Contract Time or any extension thereof;
- 2.4.2.2** failure or refusal to comply with an order of the Architect within a reasonable time;
- 2.4.2.3** failure or refusal to remove rejected materials within 30 days;
- 2.4.2.4** failure or refusal to perform anew any defective or unacceptable Work;
- 2.4.2.5** failure to provide a qualified superintendent, competent workers or subcontractors to carry on the Work in an acceptable manner;
- 2.4.2.6** failure to promptly pay subcontractors and material suppliers in a timely manner; or
- 2.4.2.7** if the Contractor abandons the Project for 15 or more days;

ARTICLE 3; CONTRACTOR

3.2 Review of Contract Documents and Field Conditions by Contractor.

Add the following Clauses 3.2.1.1 and 3.2.1.2 and 3.2.1.3 to Subparagraph 3.2.1

3.2.1.1 Should detailed information be lacking, Contractor before proceeding with work and if possible before bidding will refer the matter in writing to the Architect for his decision and/or interpretation. If the Engineer's name appears on drawings in question, the contractor shall refer the matter in writing directly to the Engineer. The Contractor and Engineer shall keep the Architect informed with copies of all communications. Final decisions shall be by the Architect. **Should errors or conflicts occur which are not clarified by the Architect, the Contractor is held to have included in the contract price the better quality and/or quantity of work or materials involved.**

3.2.1.2 Before ordering any materials or doing any work, the contractor shall verify all measurements, grades, levels, and lines at the site and shall be responsible for the correctness of same before starting work. Any differences shall be submitted by written notice to the architect for consideration before continuing the work. No extra changes will be allowed at completion on account of differences between actual dimensions and those indicated on the drawings.

3.2.1.3 The contractor will not be allowed any extra compensation by reason of lack of familiarity concerning site conditions which site inspection might have disclosed had Contractor fully informed himself prior to bidding.

3.2.1.4 If in the Contractor's opinion, any work is indicated in the drawings, or is specified in such a manner as will make it impossible to produce first class work, or discrepancy appear between Drawings and Specifications, Contractor shall refer to Architect for interpretation before proceeding with work. Architect will respond with addenda, bulletin drawings, or construction directives as required.

3.2.1.5 No work shall be installed that obviously will not work, fit or function in the manner intended. Failure to consult with architect/engineer prior to installing such work will not result in the Owner participating in the cost to have the adjusted such that it will work fit or function properly.

Add the following Clause 3.2.2.1 to Subparagraph 3.2.2:

3.2.2.1 The Contractor shall assume full responsibility for accuracy of measurements obtained at the site. No extra compensation will be allowed because of differences between actual measurements and dimensions indicated on the Drawings, nor for Contractor's failure to coordinate work with actual field measurements.

3.3 Supervision and Construction Procedures

Add the following Clause 3.3.2.1 to Subparagraph 3.3.2:

3.3.2.1 Successful completion of the project depends upon the integrity, ability, and interest of the several tradesmen in producing a superior job. The Architect expects Contractor, each subcontractor, and/or craftsman to produce quality results in his own field within the scope of the work outlined by the drawings and specifications that cannot practically cover each construction operation and detail routinely employed by a conscientious craftsman in the normal process of executing his work.

3.4 Labor and Material

Add the following Subparagraphs 3.4.4 through 3.4.7 to Paragraph 3.4:

3.4.4 During Architect's site visits, Contractor shall furnish necessary incidental mechanics, labor, tools, etc. to assist Architect in observing progress of the work.

3.4.5 During inspections (Preliminary Final and Final Inspections) Contractor shall furnish necessary mechanics, labor, tools, etc. for thorough inspection of project.

3.4.6 The Contractor shall provide, maintain, and make available to other contractors, subcontractors and craftsmen, while in place for his own use, scaffolding, temporary stairs, ladders, ramps, runways, hoists, chutes, etc., as required for proper execution of work by all trades, and remove same at completion of job.

3.4.7 The Contractor shall be responsible for inspection of portions of work already performed under this contract by the Contractor and/or his subcontractors to determine that such portions are in proper condition to receive subsequent work."

3.5 Warranty

Add the following Subparagraphs 3.5.1.

3.5.1 The warranty period shall be defined as being **one (1) year** after the date of Substantial Completion.

3.6 Taxes

Add the following to Subparagraph 3.6.1 to Paragraph 3.6:

3.6.1 Pursuant to North Carolina General Statutes, Section 105-164.14, the Owner is eligible for sales and use tax refund on all materials that become a permanent part of the construction. Since the Owner will desires to receive and keep all sales tax refunds the contractor must include these same sales tax charges in his bid price. **NO REFUND OF SALES TAX WILL BE FORWARDED TO THE CONTRACTOR!** The Contractor agrees to provide the Owner documentation that meets the requirements of Sales and Use Tax Regulations 42 regarding requests for refund of sales and use taxes. Those requirements are outlined below:

- (g) All refund claims must be substantiated by proper documentary proof and only those taxes actually paid by the claimant during the fiscal year covered by the refund claim may be included in the claim.

Any local sales or use taxes included in the claim must be separately stated in the claim for refund. In cases where more than one county's sales and use tax has been paid, a break down must be attached to the claim for refund showing the amount of each county's local tax separately.

To substantiate a refund claim for sales and use taxes paid on purchase of building materials, supplies, fixtures, and equipment by its Contractor, the claimant must secure from such Contractor certified statements setting forth the cost of the property purchases from each vendor and the amount of state and local sales and/or use taxes paid thereon. Such statement must also include the cost of any tangible personal property withdrawn from the Contractor's warehouse stock and the amount of state and local sales or use tax paid thereon by the Contractor. Similar certified statements by his subcontractors must be obtained by the General contractor and furnished to the claimant (Owner). Any local sales or use taxes included in the Contractor's statements must be shown separately from the State sales or use taxes. The Contractor's statements must be shown separately from the State sales or use taxes. The Contractor's statements must not contain sales or use taxes paid on purchase of tangible personal property purchased by such Contractors for use in performing the contract which does not annex to, affix to or in some manner become a part of the building or structure being erected, altered or repaired for the governmental entities as defined by G.S. 105-164.14(c). Examples of property on which sales and use tax has been paid by the Contractor and which should not be included in the Contractor's statement are scaffolding, forms for concrete, fuel for the operation of machinery and equipment, tools, equipment repair parts and equipment rentals, blueprints, etc.

The Contractor shall submit notarized sales tax certificates that meet the requirements detailed above with each Application for Payment. Payment will not be made until the sales tax certificate(s) have been submitted to the Owner."

3.9 Superintendent

Add the following Subparagraph 3.9.2 to Paragraph 3.9:

3.9.2 Should the superintendent be changed for the convenience of the Contractor without the Architect's approval, the Contractor agrees to compensate the Architect for the time required to acquaint the new superintendent with previous instructions. Compensation will be in accordance with the OFFICE STANDARD RATE SHEET. A copy of which is attached and incorporated herein by reference.

3.10 Contractor' Construction Schedules

Add the following Clause 3.10.1.1 to Subparagraph 3.10.1:

3.10.1.1 No application for payment will be approved until the Construction Progress Schedule has been received and approved by the Architect."

3.14 Cutting and Patching

Add the following Subparagraphs 3.14.1 through 3.14.3 to Paragraph 3.14:

3.14.1 The General Contractor shall typically provide openings and lintels for other prime contractors and/or subcontractors' work as building construction progresses. The General Contractor shall coordinate with these contractor's and/or subcontractors their requirements prior to beginning construction. **Should**

another prime or subcontractor in need of the opening fail to coordinate the required opening with the General Contractor and there is no evidence on the drawing that an opening is required, the prime or subcontractor involved shall bear the financial responsibility for having the General Contractor provide the required opening in previously constructed work.

3.14.2 The General Contractor shall provide all chases, vertical openings, structural framing around same, etc. of proper size as required by subcontractors whether specifically shown or not. Verify locations with Architect prior to constructing same or routing work toward same.

3.14.3 Openings required in existing walls, floor and roof structure shall be made by the prime contractor whose work requires the passage, unless the opening is specifically called out as General construction work. Openings shall be reasonably sized, made in a clean cut manner, and be supported with a lintel appropriate for the span.

ARTICLE 4; ADMINISTRATION OF THE CONTRACT

4.2 Architects Administration or the Contract

Add the following Clauses 4.2.4.1 and 4.2.4.2 to Subparagraph 4.2.4:

4.2.4.1 Should the Contractor perform work directed by the Owner, without the knowledge and approval of the Architect, including but not limited to work relating to artistic effect, code compliance, structures, building plumbing- mechanical- electrical systems performance, and "life safety", **the cost of necessary corrective measures will be borne by the Contractor executing such work.**

4.2.4.2 The Contractor shall copy Architect on all communications directly with the Owner.

4.2.4.3 Failure on the part of the Architect to condemn or detect defective material or workmanship shall not relieve the Contractor from liability to make good should it be discovered later or cause damage to the building.

ARTICLE 5; SUBCONTRACTORS

Add new Paragraph 5.5 (including Subparagraphs 5.5.1 through 5.5.4) to ARTICLE 5:

5.5 Mutual Responsibility

5.5.1 The contractor and subcontractors shall check and verify data contained in drawings, specifications, and work for which they are responsible, as well as the drawings, specifications, and work of other related contractor, subcontractors and/or trades before bidding if possible and again before construction to avoid bidding and/or installation conflicts. **The division of these specifications into sections is not intended to control the Contractor in dividing the work among subcontractors or to limit the scope of work performed by any trade under a given section.** The Architect will not undertake to settle any differences between the Contractor and his Subcontractors as to inclusion of work or materials items. It shall be the Contractor's entire responsibility for the proper coordination and completion of all the work described in these Specifications whether performed by the Contractor or Subcontractors, if any.

5.5.2 Defects in work by others affecting proper application and/or installation of work, materials, devices, fixtures, and/or appliances, unless reported in writing to Architect and the General Contractor for their action, shall be the responsibility of the contractor or subcontractor failing to make report and corrected at his expense.

5.5.3 Installation of materials, devices, fixtures, and/or appliances by the contractor or subcontractors is tantamount to his unqualified acceptance and check or related work by others.

5.5.4 Each Subcontractor shall as a portion of his contract, anticipate and include normal cutting, patching, and digging required for the successful completion of his contract which may not practically be accomplished by the General Contractor as outlined in paragraph 3.14 Cutting and Patching.

ARTICLE 7; CHANGES IN THE WORK

7.3. Construction Change Directives

Add the following Clause 7.3.6.6 to Subparagraph 7.3.6:

7.3.6.6 The maximum allowance for overhead and profit combined shall not exceed fifteen percent (15%) of net cost for work not sublet by General Contractor; for work sublet, five percent (5%); for work by other Prime Contractors, if applicable, no percent (0%).

ARTICLE 8; TIME

8.1 Definitions

Add the following Clauses 8.1.1.1 and 8.1.1.2 to Subparagraph 8.1.1:

8.1.1.1 The contractors shall commence work to be performed under this agreement on a date to be specified in written order from the architect (or from the date of the Owner-Contractor Agreement if no such notice is given.) and shall fully complete all work hereunder by:

TOTAL 10 Months – See Form of Proposal

Contract time listed includes normal average number of bad weather days. It shall be Contractor's responsibility to keep accurate records and substantiate Climatic Center records for any possible extension he might later request.

Liquidated Damages shall be assessed and levied against the General Contractor (Single Prime) not attaining substantial completion in the amount of time indicated above. See Liquidated Damage Provision in Specification section 01011 "Summary of the Work".

8.1.1.2 Normal bad weather days are defined as those days on which precipitation is 0.10 of an inch, or greater; or any 24 hour daylight period the temperature fails to exceed an average of 40 degrees F. **The normal bad weather days and any time extension will be based on the Local Climatological Data Sheets compiled and published by weatherbase.com for the nearest city (Salisbury, NC).** If the total accumulated number of working days lost due to bad weather, from the start of work until the project is completed, exceeds the "historical" average of bad weather days, the time for completion will be extended by the difference.

The Contractor's claims, if any, for extension of time must be made in writing to the Architect not more than five working days after the Contractor has notice of the delay. Thereafter, the Contractor must provide full details and supporting documentation with regard to the cause of the delay within 15 working days of the initial notice of the delay to the Architect. If either the initial notice or the supporting documentation are not filed with the Architect in writing within the time periods specified, the claim for delay shall be waived. If the cause for the delay is a continuing one then only one claim is necessary. The Contractor's supporting documentation to the Architect shall include and estimate of the probable effects of the delay on the progress of the Work and the Project Schedule.

Notwithstanding any other provisions of the Contract, Contractor agrees as between and among itself and the Owner, Architect, the General Contractor, and any other AE Representative that the Contractor's right

to receive an extension of time pursuant to the provisions of this Paragraph shall be the Contractor's sole and exclusive remedy with regard to any Work and The Contractor hereby waives and releases claims for monetary damages arising out of or related to any such delay or interference, including but not limited to, claims for delay damages, interference damages, impact damages, acceleration damages and any other form of the time-related damages against the Owner and the Design Professional.

ARTICLE 9; PAYMENTS AND COMPLETION

9.3 Applications for Payment

Add the following Clause 9.3.1.3 to Subparagraph 9.3.1:

9.3.1.3 Prior to reaching a maximum retainage of two and one half percent (2.5%) of the total contract amount, the Owner will pay ninety five percent of the amount due on the Contractor's monthly application for payment. Thereafter the owner will pay one hundred percent (100%) of the Contractor's monthly application for payment amount, holding the 2.5% maximum retainage as a fixed amount until substantial completion is certified. Provisions of NC General Statutes 143-134.1 (b1) through (e) will be followed.

The following conditions must be met to qualify for contractual retainage reduction:

1. The project be on or ahead of schedule, and
2. Written permission from the Contractor's bonding company must be submitted.

9.8 Substantial Completion

Add the following Subparagraph 9.8.6 to Paragraph 9.8:

9.8.6 Should more than **two** substantial completion inspections be necessary, **the cost of the additional inspections shall be borne by the Contractor**. Compensation will be made for each authorized Owner's representatives involved in these inspections at the rate of \$100.00 per hour or fraction thereof. Compensation to the Architect and his consultants will be accordance with the OFFICE STANDARD RATE SHEET, a copy of which is attached and incorporated herein by reference.

ARTICLE 11; INSURANCE AND BONDS

Contractor's Liability Insurance

Add the following Clause 11.1.2.1 to Subparagraph 11.1.2:

11.1.2.1 The insurance required by Subparagraph 11.1.1 shall be written for not less than the following, or greater if required by law.

1. Workers' Compensation:

- | | |
|---------------------------|---------------|
| (a) State: | Statutory |
| (b) Applicable Federal: | Statutory |
| (c) Employer's Liability: | \$ 500,000.00 |

2. Comprehensive General Liability (including Premises-Operations; Independent Contractors' Protective; Products and Completed Operations; Broad Form Property Damage):

- | | |
|--|--------------------------------------|
| (a) Bodily Injury - including Personal injuries: | |
| \$ 2,000,000.00 | Each Occurrence and Annual Aggregate |
| (b) Property Damage: | |

\$ 2,000,000.00 Each Occurrence and Annual Aggregate

(c) Products and Completed Operations to be maintained
for twelve months (12) after final payment.

3. Contractual Liability:

(a) Bodily Injury:
\$ 2,000,000.00 Each Occurrence and Annual Aggregate

(b) Property Damage:
\$ 2,000,000.00 Each Occurrence and Annual Aggregate

4. Personal Injury, with Employment Exclusion deleted:

\$ 2,000,000.00 Annual Aggregate

5. Comprehensive Automobile Liability:

(a) Bodily Injury:
\$ 2,000,000.00 Each Person
\$ 2,000,000.00 Each Occurrence

(b) Property Damage:
\$ 2,000,000.00 Each Occurrence

Add the following Subparagraph 11.1.4 and 11.1.5 to Paragraph 11.1:

11.1.4 The Contractor shall furnish to the Owner copies of any endorsements that are subsequently issued amending coverage of limits.

11.1.5 Provide either in the body of the policy or by appropriate endorsement (rider) to the policy, a clause prohibiting cancellation or amendment of policy until thirty (30) days prior written notice has been sent to both the Architect and Owner of such alterations or cancellation.

11.3. Property Insurance

Amend clause 11.3.1.1 to include the purchase of Property Insurance by each prime contractor as part of their contract requirements. Provide Builder's Risk Insurance for amount of project over and above contractor's liability coverage. The insured amount each contractor shall provide shall be as follows:

General Contractor: "all risk" - minimum of General contract amount.**11.4 Performance Bond and Payment Bond**

Delete Subparagraph 11.4.1 and substitute the following:

11.4.1 Performance Bond and Labor and Material Payment Bond are required by Owner. Both bonds shall be in an amount equal to 100 percent of the contract sum and the cost shall be part of the contract price.

Add the following Subparagraphs 11.4.3 and 11.4.4 to Paragraph 11.4:

11.4.3 The bonds shall be written on the standard AIA forms A311 or form A312; and shall guarantee faithful performance of the contract and shall guarantee payment of all bills for labor and materials when said bills are due, as provided by Article 3 of Chapter 44A of the North Carolina General Statutes.

11.4.4 The bonds shall remain in full force and effect for at least twelve months after completion of the work and Architect's final Certificate is approved for payment to the Owner.

ARTICLE 13; MISCELLANEOUS

13.1 Governing Law

Delete paragraph 13.1 and substitute the following:

13.1 This agreement shall be construed and enforced in accordance with the laws of the State of North Carolina. The parties to this agreement confer exclusive jurisdiction of all disputes arising hereunder upon the **General Courts of Justice of Rowan County, North Carolina.**

13.5 Tests and Inspections

Add the following Subparagraph 13.5.7 to Paragraph 13.5:

13.5.7 Mechanical devices, machinery, apparatus, or equipment supplied under contract may be tested by trial usage for a reasonable period as determined by the Architect before final acceptance. Such usage shall not be construed as evidence of acceptance, and no claim for damages, injury, or breakage shall be made if caused by weakness, inaccuracy of structural parts, defective materials or workmanship.

13.6 Interest

Delete paragraph 13.6 and substitute the following:

13.6 Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at six percent (6%), annually, compounded monthly or the maximum allowed by law **whichever is less.**

ARTICLE 14; TERMINATION OR SUSPENSION OF THE CONTRACT

14.4 – Termination by the Owner for Convenience

Delete Subparagraph 14.4.3 and replace with the following Subparagraphs 14.4.3 and 14.4.4:

14.4.3 Upon such termination, the Contractor shall recover as its sole remedy payment for Work properly performed in connection with the terminated portion of the Work prior to the effective date of termination and for items properly and timely fabricated off the Project site, delivered and stored in accordance with the Owner's instructions. The Contractor hereby waives and forfeits all other claims for payment and damages, including, without limitation, anticipated profits.

14.4.4 The Owner shall be credited for: (1) payments previously made to the Contractor for the terminated portions of the Work; (2) claims which the Owner has against the Contractor under the Contract Documents; and (3) the value of the materials, supplies, equipment or other items that are to be disposed of by the Contractor that are part of the Contract Sum.

15.4 Arbitration

Delete Paragraph 15.4.

NOTE: Further, any reference throughout the General Conditions to ARBITRATION or Paragraph 15.4 shall be deemed deleted and of no effect.

ADD THE FOLLOWING NEW ARTICLE

ARTICLE 16; EQUAL OPPORTUNITY

16.1 Equal Opportunity

16.1.1 In connection with the performance of work under this contract or purchase order, the Contractor or supplier agrees as follows:

16.1.1.1 The Contractor will not discriminate against any employee or applicant for employment because of race, creed, color, or national origin. The Contractor will take affirmative action to insure that applicants are employed, and that employees are treated during employment without regard to their race, creed, color, or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer, recruitment advertising, layoff or termination, rates of pay, or other forms of compensation, and selection for training, including apprenticeship.

16.1.1.2 The Contractor will, in all solicitation or advertisements for employees placed by or on behalf of the contractor, state that all applicants will receive consideration for employment without regard to race, creed, color, or national origin.

End of SUPPLEMENTARY CONDITIONS

SECTION 01011 - SUMMARY OF THE WORK

PART 1 - GENERAL

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PROJECT/WORK IDENTIFICATION:

General: Project name is **ABC Store & Warehouse** located at 1428 S. Jake Alexander Blvd., Salisbury, North Carolina as shown on Contract Documents prepared by RAMSAY BURGIN SMITH ARCHITECTS, INC. Drawings and Specifications dated DECEMBER 2016.

Prime Contracts, in the context used in this Section, are separate contracts that represent significant elements of work that are performed concurrently with and in close coordination with work performed on the project under other prime contracts. Prime contracts for this project include the following:

Contract for General Work including the work associated with Site Civil, Architectural, Structural, Plumbing, Heating, Ventilating and Air Conditioning and Electrical work as required to complete the building for its intended use and function.

Contract Documents indicate the work of Contract and related requirements and conditions that have an impact on the project. Related requirements and conditions that are indicated on the Contract Documents include, but are not necessarily limited to the following:

Existing site conditions and restrictions on use of the site and adjacent site.

Construction of new retail and warehouse facility.

Work to be performed subsequent to work under the prime contract.

Items to be installed by prime contractor(s) that will be furnished by the Owner.

Work associated with accepted Alternates.

Unit Prices that may be applicable to conditions found during construction.

Allowances.

PROJECT COMPLETION: Prime Contractor shall deliver to the Owner from the notice to proceed, a completed building with related plumbing, HVAC, electrical systems functioning, as designed and specified for its intended use as an educational facility.

Construction Duration: 10 Months.

LIQUIDATED DAMAGES shall be assessed and levied against each Prime Contractor not attaining substantial completion of the contractual work in the amount of time indicated above. The damage amount applicable to each Contractor shall be as listed below and shall begin the day following the

scheduled date of substantial completion above (plus any written, approved extensions) and continue until final acceptance is obtained.

Each day following the intended substantial completion date for work not found substantially complete will be subject to damage assessment at the following rate:

GENERAL WORK ----- \$ 500.00 per calendar day

Submittal of proposals constitutes acknowledgement by the General Contractor that time is of the essence to the Owner and of material value equal to the damage amounts listed above. These amounts are pre-established equitable values required to recover the losses incurred by the Owner for failure to have complete use of the new facility by the required completion date.

Each Subcontractor shall be responsible for reviewing the General Contractor's initial construction schedule and report any unacceptable scheduling. Failure by a subprime contractor to report objections within 30 days to the General Contractor (with copy to Architect) after issuance of initial schedule constitutes acceptance of the schedule.

The General Contractor shall accept clerical responsibility for reporting any delays due to extremes in weather or other uncontrollable events which create deviations from the established construction schedule that unduly exposes the contractor to liquidated damages. These reports are required to be submitted to the Architect on a monthly basis coinciding with the Contractor's monthly application for payments. Failure to report delays constitutes agreement by the General Contractor, that no time extension is forthcoming for each applicable month at the end of the project completion date.

NOTE: Reporting of delays does not guarantee Owner or Architect agreement that delays are acceptable or justified.

The completion date includes normal bad weather days. See Supplementary Conditions for definition of a bad weather day and the allowance for numbers of bad weather days included as "normal" within the contract base bid.

Change Orders will not automatically mean additional time. If events beyond the Prime Contractor's(s') control or if additional work adds time to the project's "critical path", a change order may then include an appropriate extensions to the contract completion date.

GENERAL WORK includes work that is primarily architectural, structural and civil in nature plus work traditionally recognized as general construction, including demolition of existing where required, and new construction. It also includes both administrative and coordination responsibilities.

Pay for all permits required, including all government and utility fees; sales, consumer and use taxes for the proper execution of the work.

File and Pay for Water & Sewer Tap fees - Contractors shall be responsible for hooking to meters and providing & installing all other piping – including providing and installing RPZ(s).

File & Pay for all Building & Permit fees.

Project coordination work.

Temporary facilities related to General work as specified in the "Temporary Facilities" section of these specifications.

Typically, work described on drawing Sheets C – Cover Sheet, A1, C-1 thru C-8, , A2, A3, A4, A5, A6, L1, S0.10, S0.20, S1.10, S1.20 and specifications including Invitation to Bids, Instructions to bidders, General Conditions, Supplementary General Conditions, Specification Divisions 1 thru 14, and MBE requirements represents General Work.

Complete drawings and specifications are included in bid package to assist General Contractor in including coordination costs of his work as it relates to other prime contracts (or major subcontracts) and to assist General Contractor in determining how other prime contractor(s) (or major subcontractors) work effects General Work construction. Only specifically noted work by General Contractor on P1.1, P2.1, M1.1, M2.1, E0.1, E1.1, E2.1, E3.1 and E4.1 is part of General Work.

PLUMBING WORK includes the work required to provide complete domestic water and sewer piping systems in the new building including, but not limited to the following:

- Water service connection,
- Sewer service connection,
- Building potable water supply system (hot and cold water piping),
- Pipe insulation,
- Building sewer system,
- Vent piping system,
- Plumbing fixtures and equipment, and
- Temporary facilities related to plumbing work as specified in the "Temporary Facilities" section of these specifications.

Typically, work described on drawings P1.1, P2.1, Invitation to Bids, Instructions to bidders, General Conditions, Supplementary General Conditions and Specification Division 1, Division 15, and MBE requirements represent bases of Plumbing Work.

Complete drawings and specifications are included in bid package to assist Plumbing Contractor in including coordination costs of his work as it relates to other prime contracts (or major subcontracts) and to assist Plumbing Contractor in determining how other prime contractor(s) (or major subcontractor work) work effects Plumbing Work construction. Only specifically noted work by Plumbing Contractor on Sheets C – Cover Sheet, A1, C-1 thru C-8, , A2, A3, A4, A5, A6, L1, S0.10, S0.20, S1.10, S1.20 and M1.1, M2.1, E0.1, E1.1, E2.1, E3.1 and E4.1 and specifications Division 2 thru 14 is part of Plumbing Work.

HEATING, VENTILATING AND AIR CONDITIONING (MECHANICAL) WORK includes the work required to provide a complete heating, ventilating and air conditioning system in the new building including, but not limited to the following:

- HVAC System Refrigerant piping,
- Air handlers,
- Heat Pumps,
- Condensate drain piping,
- Control system,
- Piping insulation,
- Ducted (air) or sheet metal portion of the heating, ventilating and air conditioning system,
- Fans/blowers, power ventilators and exhaust systems,
- Motor starters for HVAC equipment motors,
- Air filters,
- Air diffusers, grilles and registers, and
- HVAC test-adjust-balance requirements.
- Temporary facilities related to heating, ventilating and air-conditioning work as specified in the "Temporary Facilities" section of these specifications.

Typically, work described on drawings M1.1, M2.1 and Invitation to Bids, Instructions to bidders, General Conditions, Supplementary General Conditions and Specification Division 1, Division 15,

and MBE requirements represent bases of Heating, Ventilating and Air Conditioning Work (Mechanical Work).

Complete drawings and specifications are included in bid package to assist Mechanical Contractor in including coordination costs of his work as it relates to other prime contracts (or major subcontracts) and to assist Mechanical Contractor in determining how other prime contractor(s) (or major subcontractor work) work effects Mechanical Work construction. Only specifically noted work by Mechanical Contractor on Sheets C – Cover Sheet, A1, C-1 thru C-8, , A2, A3, A4, A5, A6, L1, S0.10, S0.20, S1.10, S1.20 and P1.1, P2.1,, E0.1, E1.1, E2.1, E3.1 and E4.1 and specifications Division 2 thru 14 and Division 16 is part of Mechanical Work.

ELECTRICAL WORK includes the work required to provide a complete electrical power distribution and lighting system in the new building including but not necessarily limited to the following:

- Power transmission and service extension,
- Power distribution (panel boards) including disconnect switches at major units of other work requiring power (except as noted otherwise),
- Electrical lighting,
- Emergency lighting,
- Grounding,
- Fire alarm and equipment and systems, data systems, and
- Raceways, outlets, etc. for power, lights, security, telephone, data processing, and other special systems.
- Temporary facilities related to electrical work as specified in the "Temporary Facilities" section of these specifications.

Typically, described on drawings E0.1, E1.1, E2.1, E3.1 and E4.1 and Invitation to Bids, Instructions to bidders, General Conditions, Supplementary General Conditions and Specification Division 1 and MBE requirements represent bases of Electrical Work.

Complete drawings and specifications are included in bid package to assist Electrical Contractor in including coordination costs of his work as it relates to other prime contracts (or major subcontracts) and to assist Electrical Contractor in determining how other Prime Contractor(s) (or major subcontractor work) work effects Electrical Work construction. Only specifically noted work by Electrical Contractor on Sheets C – Cover Sheet, A1, C-1 thru C-8, , A2, A3, A4, A5, A6, L1, S0.10, S0.20, S1.10, S1.20 and P1.1, P2.1, M1.1, M2.1 and and specifications Division 2 thru 15 is part of Electrical Work.

DEFINITION OF THE EXTENT OF PRIME CONTRACT WORK: The extent of the work of the Prime Contract is indicated in/on the Contract Documents. General names and terminology on the drawings and in the specifications may be used to control which subcontract(s) includes a specific element of required work, **but the final extent and demarcation of subcontract work is the sole responsibility of the Prime Contractor.**

Summary by References: Work of the major subcontract(s) can be summarized by reference to the major subcontract(s) drawing sheets, General Conditions, Supplementary Conditions, Specification sections, Addenda and Modifications to Contract Documents issued subsequent to the initial printing of this Project Manual, and including but not necessarily limited to printed material reference by any of these. It is recognized that the work of the Contract(s) is unavoidably affected or influenced by governing regulations, natural phenomenon, including weather conditions, and other forces outside the contract documents.

CONTRACTORS USE OF PREMISES:

General: During the entire construction period all contractors and subcontractors jointly shall have the use of the premises for construction operations, including full use of the site within limits described.

Grading and site work on adjacent property shall be prohibited unless specifically note otherwise.

The site is defined as the property shown on drawings by property lines.

Specific work activities as drawn and/or specified are allowed as required beyond the site lines; however, limit time to minimum required to perform work.

Use of the Site: Confine operations at the site to the areas permitted under the Contract. Portions of the site beyond areas on which work is required are not to be disturbed. Conform to site rules and regulations affecting the work while engaged in project construction.

Do not unreasonably encumber the site with materials of equipment. Confine stockpiling of materials and location of storage sheds to minimum areas.

Lock automotive type vehicles such as passenger cars and trucks and other types of mechanized and motorized construction equipment, when parked and unattended, so as to prevent unauthorized use.

Do not leave such vehicles or equipment unattended with the motor running or the ignition key in place.

Smoking or open fires will not be permitted within the building enclosure or on the premises as further specified in Division 2 work.

BUILDING USAGE AND SECURITY:

General: The Contract for General Work includes maintaining security and occupant safety during the construction process; however, all Prime Contractors are accountable for conducting their work in a safe, responsible manner that will provide a safe environment for all workers.

ALTERATIONS AND COORDINATION:

General: The Contract for General Work includes coordination of the entire work of the project, acting as the "Project Expeditor" including preparation of general coordination drawings, diagrams and schedules and control of site utilization from the beginning of construction activity through project closeout and warranty period.

MISCELLANEOUS PROVISIONS: Electrical Requirements: Except as otherwise indicated, comply with applicable provisions of the National Electric Code (NEC) and standards by the National Electrical Manufacturer's Association (NEMA) for electrical components of general work. Provide Underwriter's Laboratories listed and labeled products where applicable.

PART 2 - PRODUCTS (Not Applicable).

SCHEDULE OF DRAWINGS

Dated DECEMBER 2016 - unless noted otherwise

Architectural

- C COVER SHEET – LIFE SAFETY PLAN, BUILDING CODE SUMMARY
& INDEX OF DRAWINGS
- A1 SITE PLAN - EXISTING CONDITIONS & SITE DETAILS

Civil

- C-1 STANDARD NOTES
- C-2 EXISTING SITE AND DEMO PLAN
- C-3 PROPOSED SITE AND UTILITY PLAN
- C-4 GRADING, DRAINAGE & EROSION CONTROL
- C-5 PAVING & PARKING PLAN
- C-6 SPOT ELEVATIONS
- C-7 BIO-CELL SITE PLAN & DETAILS
- C-8 STANDARD & EROSION CONTROL DETAILS

- A2 FLOOR PLANS –RFS & WALL TYPES & TOILET PLANS & MISC DETAILS
- A3 BUILDING ELEVATIONS
- A4 WALLS SECTIONS
- A5 WALL SECTIONS - CANOPY
- A6 DOORS & WINDOWS
- L1 LANDSCAPE PLAN & DETAILS

Structural

- S0.10 GENERAL NOTES & ABBREVIATIONS
- S0.20 TYPICAL DETAILS
- S1.10 FOUNDATION PLAN & DETAILS
- S1.20 ROOF FRAMING PLAN & DETAILS

Plumbing & Mechanical

- P1.1 PLUMBING WASTE & WATER PLANS & SCHEDULES
- P2.1 PLUMBING DETAILS
- M1.1 MECHANICAL - HVAC PLAN, GAS PIPING SCHEMATIC, SCHEDULES & DETAILS
- M2.1 MECHANICAL - DETAILS

Electrical

- E0.1 ELECTRICAL SCHEDULES
- E1.1 ELECTRICAL SITE PLAN
- E2.1 ELECTRICAL POWER PLAN
- E3.1 ELECTRICAL LIGHTING PLAN
- E4.1 ELECTRICAL RISER & PANEL SCHEDULES

End of SECTION 01011

SECTION 01020 - ALLOWANCES

PART 1 - GENERAL

RELATED DOCUMENTS

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

SUMMARY

This Section specifies administrative and procedural requirements governing handling and processing allowances.

Selected materials and equipment, and in some cases, their installation are shown and specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. Additional requirements, if necessary, will be issued by Change Order.

Types of allowances required include the following:

- Lump sum allowances.
- Unit-cost allowances.
- Contingency allowance.
- Inspection and testing allowances.

Procedures for submitting and handling Change Orders are included in Section "Change Order Procedures."

Use of allowances for inspection and testing agencies is included in Section "Quality Control Services."

SELECTION AND PURCHASE

At the earliest feasible date after Contract award, advise the Architect of the date when the final selection and purchase of each product or system described by an allowance must be completed in order to avoid delay in performance of the Work.

When requested by the Architect, obtain proposals for each allowance for use in making final selections; include recommendations that are relevant to performance of the Work.

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

SUBMITTALS

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

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

CONTINGENCY ALLOWANCES

Use the contingency allowance only as directed for the Owner's purposes, and only by Change Orders which designate amounts to be charged to the allowance.

The Contractor's related costs for products or equipment ordered by the Owner under the contingency allowance, including delivery, installation, taxes, insurance, equipment rental, and similar costs are not part of the Contract Sum.

Change Orders authorizing use of funds from the contingency allowance will include the Contractor's related costs and reasonable overhead and profit margins (see Supplementary General Conditions).

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

INSPECTION AND TESTING ALLOWANCES

Inspection and testing allowance includes the cost of engaging the inspection or testing agencies and cost for reporting the results of unanticipated below grade soil conditions only. General Contractor shall include in his regular job costs, the testing required for soil compaction, concrete mix and steel connections as specified in those sections of these specifications.

At Project closeout, credit unused amounts remaining in the inspection and testing allowance to Owner by Change Order.

UNUSED MATERIALS

Return unused materials to the manufacturer or supplier for credit to the Owner, after installation has been completed and accepted.

Where it is not economically feasible to return unused material for credit and when requested by the Architect, prepare unused material for the Owner's storage, and deliver to the Owner's storage space as directed. Otherwise, disposal of excess material is the Contractor's responsibility.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

INSPECTION

Inspect products covered by an allowance promptly upon delivery for damage or defects.

PREPARATION

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

SCHEDULE OF ALLOWANCES:

NOTE: ALL ALLOWANCES LISTED BELOW SHALL BE INCLUDED IN THE BASE BID.

GENERAL CONTRACT:

Contingency Allowance **\$ 28,000.00**

Signage Allowance (ABC letters on Canopy) **\$ 4,000.00**

Note, this allowance pertains to the ABC letters on the Canopy only. The Yard Sign (Div 10000) must be included in Base Bid.

Undercut and Compacted Structural Fill Allowance **3000 cubic yards
of undercut and fill**

NOTE: See Form of Proposal for unit pricing (Unit Price #1) to be used to compute this allowance value.

Testing Allowance **\$ 15,000.00**

This Allowance to be used by Contractor to pay for all required testing - reference Section 01400.

End of SECTION 01020

SECTION 01026 - UNIT PRICES

PART 1 - GENERAL

RELATED DOCUMENTS

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

SUMMARY

This Section specifies administrative and procedural requirements for unit prices.

A unit price is an amount proposed by Bidders and stated on the Bid Form as a price per unit of measurement for materials or services that will be added to or deducted from the Contract Sum by Change Order in the event the estimated quantities of Work required by the Contract Documents are increased or decreased.

Unit prices include all necessary material, overhead, profit and applicable taxes.

Refer to individual Specification Sections for construction activities requiring the establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.

Schedule: A "Unit Price" section is included as part of the "Form of Proposal" and as applicable to each prime contract **must be completed as part of the bid**. Specification Sections referenced in the Schedule contain requirements for materials and methods described under each unit price.

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 by an independent surveyor acceptable to the Contractor at the Owner's expense.

PART 3 - EXECUTION (NOT APPLICABLE).

UNIT PRICE SCHEDULE

Unit prices are for complete work and no profit or overhead shall be added or deducted when applying unit prices. No work described on the drawings or specifications is to be bid as a unit price. Unit price costs will be used only for additional work the owner may want to include in the work by change order.

UNIT COST #1 - Undercut including compacted structural quality soil refill, per cubic yard.

This unit price must also include cost of hauling AND LEGALLY DISPOSING OF undercut soil from site, hauling in structural quality soil to site and compacting structural quality soil refill. Testing costs of soil material characteristics and appropriateness of its use as structural fill shall be part of unit cost or otherwise part of general contractor's base bid.

NOTE: Testing services for undercut and compacted refill for unit price work shall be paid for by Owner out of Testing Allowance.

Unit price shall be paid on the basis of the actual size hole required to be filled after undercut has been removed. Unit price above must account for any "shrinkage" from compaction. **Fill will not be paid per truck load volume.**

See Allowances for unit amount to be included in Base Bid.

"Legal disposal" includes meeting all requirements from NCDENR.

UNIT COST #2 - Undercut including compacted ABC stone refill, per cubic yard.

This unit price must also include cost of hauling AND LEGALLY DISPOSING OF undercut soil from site, hauling in ABC stone to site and compacting ABC stone refill. Testing costs of ABC stone characteristics and appropriateness of its use as structural fill shall be part of unit cost or otherwise part of general contractor's base bid.

NOTES: Testing services for undercut and compacted refill for unit price work shall be paid for by Owner out of Testing Allowance.

Unit price shall be paid on the basis of the actual size hole required to be filled after undercut has been removed. Unit price above must account for any "shrinkage" from compaction. **Fill will not be paid per truck load volume.**

"Legal disposal" includes meeting all requirements from NCDENR.

End of SECTION 01026

SECTION 01027 - APPLICATIONS FOR PAYMENT

PART 1 - GENERAL

RELATED DOCUMENTS

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

SUMMARY

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

This Section specifies administrative and procedural requirements governing each Prime Contractor's Applications for Payment.

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

The Construction Schedule and Submittal Schedule are included in Section "Submittals".

SCHEDULE OF VALUES

Coordinate preparation of the Schedule of Values with preparation of the Construction Schedule.

Each Prime Contractor shall coordinate preparation of its Schedule of Values for its part of the Work with preparation of the Construction Schedule.

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

- General Contractor's construction schedule (as approved by all Prime Contractors).
- Application for Payment form.
- List of subcontractors.
- Schedule of allowances.
- List of products.
- List of principal suppliers and fabricators.

Submit the Schedule of Values to the Architect at the earliest feasible date, but in no case later than 7 days before the date scheduled for submittal of the initial Application for Payment.

Format and Content: Use the Project Manual Table of Contents as a guide to establish the format for the Schedule of Values.

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

- Project name and location.
- Name of the Architect.
- Prime Contractor's name and address.
- Date of submittal.

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

Generic name.
Related Specification Section.
Dollar value.
Percentage of Contract Sum to the nearest one-tenth percent, adjusted to total 100 percent.

Provide a breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. Break principal subcontract amounts down into several line items including cost of major equipment and labor costs.

Round amounts off to the nearest whole dollar; the total shall equal the Contract Sum.

Margins of Cost: Temporary facilities and other major cost items that are not direct cost of actual work-in-place shall be shown as separate line items in the Schedule of Values as general overhead expense.

APPLICATIONS FOR PAYMENT

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

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

Payment Application Times (Unless listed otherwise in the Owner-Contractor Agreement): The date for each progress payment is the 15th day of each month. The period of construction Work covered by each Application for Payment is the period ending 15 days prior to the date for each progress payment and starting the day following the end of the preceding period.

Payment Application Forms: Use AIA Document G 702 and Continuation Sheets G 703 as the form for Application for Payment.

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

Entries shall match data on the Schedule of Values and Construction Schedule. Use updated schedules if revisions have been made.

Include amounts of Change Orders and Construction Change Directives issued prior to the last day of the construction period covered by the application.

Each monthly payment application shall include an attachment listing of all sales tax paid on materials that are billed on the application. (**See SALES TAX REPORT attached at the end of this Section 01027.**) Listing shall breakdown, per vendor, the tax amount paid to each state and each county.

Payments requested for stored materials or major pieces of equipment will be paid from invoice costs documented with applications. Submit "Amendment to Protect Stored Materials" (**sample attached at the end of this Section 01027**) on Bonding Company letterhead with application for payment.

Transmittal: Submit 4 executed copies of each Application for Payment to the Architect by means ensuring receipt within 24 hours; all copies shall be complete.

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

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

Waiver Forms: Submit waivers of lien on forms, and executed in a manner, acceptable to Owner.

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

- List of subcontractors,
- List of principal suppliers and fabricators,
- Schedule of Values,
- General Contractor's Construction Schedule (preliminary if not final),
- List of Prime Contractor's(s') staff assignments,
- Initial progress report,
- Copies of authorizations and licenses from governing authorities for performance of the Work,
- Certificates of insurance and insurance policies (Part of Owner-Contractor Agreement documents),
- Performance and payment bonds (Part of Owner-Contractor Agreement documents), and
- Data needed to acquire Owner's insurance (Part of Owner-Contractor Agreement documents).

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

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

- Occupancy permits and similar approvals,
- Warranties (guarantees) and maintenance agreements,
- Test/adjust/balance records,
- Maintenance instructions,
- Start-up performance reports,
- Changeover information related to Owner's occupancy, use, operation and maintenance,
- Final cleaning,
- Application for reduction of retainage, and consent of surety,
- Advice on shifting insurance coverages,
- List of incomplete Work, recognized as exceptions to Architect's Certificate of Substantial Completion,
- Change of door locks to Owner's access, and
- Issue final keys to Owner with door numbers marked on each key.

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

- Completion of Project closeout requirements,
- Completion of items specified for completion after Substantial Completion,
- Submit signed off completed Punch List items to the Architect
- Assurance that unsettled claims will be settled,
- Assurance that Work not complete and accepted will be completed without undue delay,
- Transmittal of required Project construction records to Owner,
- Proof that taxes, fees and similar obligations have been paid,
- Removal of temporary facilities and services, and
- Removal of surplus materials, rubbish and similar elements.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

End of SECTION 01027

AMENDMENT TO PROTECT STORED MATERIALS

Below is the outline form letter noted in Division 1 of the specifications required by the Architect prior to recommending to the Owner payments for materials stored off site.

COMPANY LETTER HEAD

CURRENT DATE

Ramsay, Burgin, Smith, Architects, Inc.
225 North Main Street, Suite 501
Salisbury, North Carolina 28144

Subject: Rowan/Kannapolis ABC Store & Warehouse
Salisbury, NC

Dear Sirs:

This letter represents consent from **LIST NAME OF BONDING COMPANY** allowing Ramsay, Burgin, Smith, Architects, Inc. to release payment to **LIST NAME OF CONTRACTOR** all materials claimed on applications for payment as stored materials for Rowan/Kannapolis ABC STORE & WAREHOUSE, Salisbury, NC. This applies to materials whether stored on or off site.

The bonding company does not require the Owner or Architect to inventory or monitor inventory for said stored materials.

The bonding company also acknowledge that in the event of contractor default, bond coverage includes all costs and expenses for recovery or repurchase of these paid stored materials as well as all normal bond obligations and responsibilities applicable toward project completion.

Very truly yours,

AUTHORIZED SIGNATURE

SIGNEE'S TITLE

SIGNEE'S COMPANY NAME

XXX/xx

APPLICABLE OR DESIRED COPIES

Attachment: Power of Attorney statement

XXX/xx

Sheet # _____
To _____

Sales Taxes Paid from _____ To _____

Payment Application # _____

[illegible]

BY: _____

TITLE

SECTION 01030 - ALTERNATES

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings, General Conditions and Supplementary General Conditions and other Division-1 Specification Sections, apply to this Section.

SUMMARY

This Section specifies administrative and procedural requirements for Alternates.

Definition: An Alternate is an amount proposed by Bidders and stated on the Bid Form for certain construction activities defined in the Bidding Requirements that may be added to or deducted from Base Bid amount if the Owner decides to accept a corresponding change in either the amount of construction to be completed, or in the products, materials, equipment, systems or installation methods described in Contract Documents.

Coordination: Coordinate related Work and modify or adjust adjacent Work as necessary to ensure that Work affected by each accepted Alternate is complete and fully integrated into the project.

Notification: Immediately following the award of the Contract, prepare and distribute to each party involved, notification of the status of each Alternate. Indicate whether Alternates have been accepted, rejected or deferred for consideration at a later date. Include a complete description of negotiated modifications to Alternates.

Schedule: A "Schedule of Alternates" is included at the end of this Section. Specification Sections referenced in the Schedule contain requirements for materials and methods necessary to achieve the Work described under each Alternate.

Include as part of each Alternate, miscellaneous devices, accessory objects and similar items incidental to or required for a complete installation whether or not mentioned as part of the Alternate.

PART 2 - PRODUCTS

PART 3 - EXECUTION

SCHEDULE OF ALTERNATES:

~~NOTE: PRICES FOR ALL ALTERNATES LISTED BELOW ARE TO BE INCLUDED ON THE CONTRACTOR'S FORM OF PROPOSAL.~~

~~Each alternate price listing in this proposal shall cover all costs required for this particular part of the work, complete and in place, including all changes, alterations or modifications to surrounding work required to accommodate the substitution, addition, deletion or other change.~~

~~The Architect reserves the right to recommend to the Owner the acceptance or rejection of any or all alternates. The Owner reserves the right to accept or reject any or all such recommendations. The Owner further reserves the right to accept or reject alternates in any order they preferred without regard to whether or not their selected order effects bid outcome.~~

~~Should any of the alternates as described in the specifications be accepted, the amount written on the "Form of Proposal" shall be the amount to "add to" or "deduct from" the Base Bid. Signify the option intended by the words "add" or "deduct" in front of the written figures and the like "plus" or "minus" signs in front of the numerals.~~

NO ALTERNATES

END OF SECTION 01030

SECTION 01041 - PROJECT COORDINATION - SINGLE PRIME CONTRACTS

PART 1 - GENERAL

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification sections, apply to work of this section.

DESCRIPTION OF WORK:

Maximum administrative and supervisory requirements necessary for coordination of work on the project to be fulfilled collectively by the prime contractors include but are not necessarily limited to the following:

- Coordination and meetings,
- Administrative and supervisory personnel,
- Surveys and records or reports,
- Special reports,
- General installation provisions,
- Cleaning and protection, and
- Conservation and salvage.

These coordination requirements must be participated in by the General Contractor and each major subcontractor (plumbing, HVAC, electrical), where applicable, even though certain items of work may be assigned to a specific prime contractor, and even though the Contractor for General Work may be assigned certain general work for overall coordination purposes.

COORDINATION AND MEETINGS:

Coordination Drawings: Each subcontractor shall prepare their related coordination drawings where work by separate entities requires fabrication off-site of products and materials that must accurately interface. Coordination drawings shall indicate how work shown by separate shop drawings will interface and shall indicate installation sequence. Comply with all requirements of the "Submittals" section.

Monthly Coordination Meetings: The Contractor for General Work shall schedule and hold monthly general project coordination meetings at regularly scheduled times that are convenient for the attendance of other major subcontractors and other parties involved. Required attendance includes the General Contractor and each subcontractor and every other entity identified by any contractor or subcontractor as being currently involved in the coordination or planning for the work of the entire project. Conduct meetings in a manner that resolve coordination problems. The Contractor for General Work shall preside at each meeting, and shall record meeting results. The Contractor for General Work shall distribute copies of the meeting result to everyone in attendance and to others affected by the decisions and actions resulting from each meeting.

ADMINISTRATIVE/SUPERVISORY PERSONNEL:

General: In addition to a General Superintendent and other administrative and supervisory personnel required for performance of the work, each major subcontractor shall provide specific coordinating personnel as reasonably required for interfacing work with other work of total project.

Project Coordinator: The Contractor for General Work shall provide a Project Coordinator, who is experienced in administration and supervision of building construction, including plumbing, mechanical, electrical, and sprinkler work. This Project Coordinator is hereby authorized to act as the general coordinator of interfaces between the work. For the purpose of this provision, "interface" is defined to include scheduling and sequencing of work, sharing of access to work spaces, installations, protection of each other's work, cutting and patching, tolerances, cleaning, selections for compatibility, preparation of coordination drawings, inspection, tests and temporary facilities and services.

Submittals of Staff Names, Duties: Within 15 days of Notice to Proceed the General Contractor and each major subcontractor shall submit a listing of Contractor's principal staff assignments and consultants, naming persons and listing their addresses and telephone numbers.

SURVEYS AND RECORDS/REPORTS:

General: Working from lines and levels established by the property survey, the Contractor for General Work shall establish and maintain bench marks and other dependable markers. These bench marks and markers are established to set lines and levels for work at each story of construction and elsewhere as needed to properly locate each element of the project. Each major subcontractor shall calculate and measure required dimensions as shown, within recognized tolerances. Drawings shall not be scaled to determine dimensions. Advise entities performing work, of marked lines and levels provided for their use.

Survey Procedures: Before proceeding with the layout of actual work, each major subcontractor shall verify the layout information shown on the drawings, in relation to the property area and existing bench marks. As the work proceeds, check every major element for line, level and plumb. Each contractor and subcontractor shall report (to the General Contractor and Architect) and record deviations which are accepted and/or not corrected, on record drawings.

LIMITATIONS ON USE OF THE SITE:

General: Limitations on site usage as well as specific requirements that impact utilization are indicated on the drawings and by other contract documents. In addition to these limitations and requirements, the Contractor for General Work shall administer allocation of available space equitably among the subcontractors and other entities needing access and space, so as to produce the best overall efficiency in performance of the total work of the project. Each contractor and subcontractor shall schedule deliveries so as to minimize space and time requirements for storage of materials and equipment on site.

SPECIAL REPORTS:

General: Submit special reports directly to the Architect and other entities affected by the occurrence.

Reporting Unusual Events: When an event of an unusual and significant nature occurs at the site, the Contractor for General Work shall prepare and submit a special report. The report shall list chain of events, persons participating, the response by the contractor's personnel and by the personnel of the other subcontractors, an evaluation of the results or effects, and similar pertinent information. It is the responsibility of each contractor and subcontractor to advise the Architect in advance date, when such events are known or predictable.

Reporting Accident: Each contractor and subcontractor shall prepare and submit reports of significant accidents, at site and anywhere else work is in progress. Record and document data and actions. For this purpose, a significant accident is defined to include events where personal injury is sustained, or property loss of substance is sustained, or where the event posed a significant threat of loss or personal injury.

PART 3 - EXECUTION

GENERAL INSTALLATION PROVISIONS:

Installer's Inspection of Conditions: The contractor (General and/or Subcontractor) involved require the Installer of each major unit of work to inspect the substrate to receive the work and the conditions under which the work is to be performed. The Installer shall report all unsatisfactory conditions in writing to the General Contractor and Architect. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

Manufacturer's Instructions: Where installations include manufactured products, comply with the manufacturer's applicable instructions and recommendations for installation, to the extent that these instructions and recommendations are more explicit or more stringent than requirements indicated in the contract documents.

Inspect each item of materials or equipment immediately prior to installation. Reject damaged and defective items.

Provide attachment and connection devices and methods for securing work properly. Secure work true to line and level, and within recognized tolerances. Allow expansion and building movement. Provide uniform joint width in exposed work. Arrange joints in exposed work to obtain the best visual effect. Refer questionable visual-effect choices to the Architect/Engineer for final decision.

Recheck measurements and dimensions of the work, as an integral step of starting each installation.

Install each unit of work during weather conditions and project status which will ensure the best possible results in coordination with the entire work. Isolate each unit of work from incompatible work as necessary to prevent deterioration.

Enclosure of the Work: Each prime contractor shall coordinate the closing-in of the work with required inspections and tests, so as to minimize the necessity of uncovering work for that purpose.

Mounting Heights: Where mounting heights are not indicated, mount individual units of work at industry recognized standard mounting heights for the particular application indicated. Refer questionable mounting height choices to the Architect/Engineer for final decision.

CLEANING AND PROTECTION:

General: During handling and installation of work at the project site, each prime contractor shall clean and protect work in progress and adjoining work in the basis of continuous maintenance. Apply protective covering on installed work where it is required to ensure freedom from damage or deterioration at the time of substantial completion.

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

Limiting Exposure of Work: To the extent possible through reasonable control and protection methods, each prime contractor shall supervise performance of the work in such a manner and by such means which will ensure that none of the work, whether completed or in progress, will be subjected to harmful, dangerous, damaging or otherwise deleterious exposure during the construction period.

End of SECTION 01041

SECTION 01045 - CUTTING AND PATCHING

PART 1 - GENERAL

RELATED DOCUMENTS

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

SUMMARY

This Section specifies administrative and procedural requirements for cutting and patching.

Refer to other Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

Requirements of this Section apply to mechanical and electrical installations. Refer to Division-15 and Division-16 Sections for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.

QUALITY ASSURANCE

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

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

- Foundation construction.
- Bearing and retaining walls.
- Structural concrete.
- Structural steel.
- Lintels.
- Structural decking.
- Miscellaneous structural metals.
- Equipment supports.
- Piping, ductwork, vessels and equipment.

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

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, or result in visual evidence of cutting and patching. Remove and replace Work cut and patched in a visually unsatisfactory manner.

If possible retain the original installer or fabricator to cut and patch the following categories of exposed Work, or if it is not possible to engage the original installer or fabricator, engage another recognized experienced and specialized firm:

- Roofing and Roof Flashing
- HVAC enclosures, cabinets or covers.
- Electrical panels and motor controls

PART 2 - PRODUCTS

MATERIALS

Use materials that are identical to existing materials.

PART 3 - EXECUTION

INSPECTION

Before cutting existing surfaces, examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed. Take corrective action before proceeding, if unsafe or unsatisfactory conditions are encountered.

Before proceeding, meet at the 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.

PREPARATION

Temporary Support: Provide temporary support of Work to be cut.

PERFORMANCE

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

Cut existing construction to provide for installation of other components or performance of other construction activities and the subsequent fitting and patching required to restore surfaces to their original condition.

In general, where cutting is required use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots neatly to size required with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.

Cut through concrete and masonry using a cutting machine such as a carborundum saw or diamond core drill.

Comply with requirements of applicable Sections of Division-2 where cutting and patching requires excavating and backfilling.

By-pass utility services such as pipe or conduit, before cutting, where services are shown or required to be removed, relocated or abandoned. 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.

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

Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

CLEANING

Thoroughly clean areas and spaces where cutting and patching is performed or used as access. Remove completely paint, mortar, oils, putty and items of similar nature. Thoroughly clean piping, conduit and similar features before painting or other finishing is applied. Restore damaged pipe covering to its original condition.

End of SECTION 01045

SECTION 01050 - FIELD ENGINEERING

PART 1 - GENERAL

RELATED DOCUMENTS

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

SUMMARY

General: This Section specifies administrative and procedural requirements for field engineering services required as part of the **General Work**, including, but not necessarily limited to, the following:

Survey and Building Layout Work.

Post Construction Survey Work.

SUBMITTALS

Certificates: Submit a certificate signed by the Land Surveyor certifying that the location and elevation of improvements comply with the Contract Documents.

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

QUALITY ASSURANCE

Surveyor: Engage a Registered Land Surveyor registered in the State where the project is located, to perform land surveying services required.

Pre Construction Property and Topographic Map survey for the project Site plan was provided by:

Ramsay Burgin Smith Architects – proposed site plan

as well as - Survey by Josiah A. Webb, III

Post Construction Survey: Prepare, provide and submit Final Project Site Survey including all as built structures, utilities, storm sewer improvements including storm basin grate tops, inlet and outlet elevations to the City of Salisbury as part of the close-out documents required for project completion.

Original surveyor may be contacted to provide final Project Survey.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

EXAMINATION

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

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.

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

PERFORMANCE

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

Advise entities engaged in construction activities, of marked lines and levels provided for their use.

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

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.

Site Improvements: Locate and lay out site improvements, including pavements, stakes for grading, fill and topsoil placement, utility slopes and invert elevations by instrumentation and similar appropriate means.

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.

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

End of SECTION 01050

SECTION 01095 - REFERENCE STANDARDS AND DEFINITIONS

PART 1 - GENERAL

RELATED DOCUMENTS

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

DEFINITIONS

General: Basic Contract definitions are included in the General Conditions.

Indicated: The term "indicated" refers to graphic representations, notes, or schedules on the Drawings, other paragraphs or schedules in the Specifications, and similar requirements in the Contract Documents. Where terms such as "shown," "noted," "scheduled," and "specified" are used, it is to help the reader locate the reference; no limitation on location is intended.

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

Approve: The term "approved," where 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 General and Supplementary Conditions.

Regulation: 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.

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

Install: The term "install" is used to describe operations at project site including the actual "unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations."

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

Installer: An "Installer" is the Contractor or an entity engaged by the Contractor, either as an employee, subcontractor, or sub-subcontractor, for performance of a particular construction activity, including installation, erection, application, and similar operations. Installers are required to be experienced in the operations they are engaged to perform.

The term "experienced" when used with the term "Installer" means having a minimum of 5 previous Projects similar in size and scope to this Project, being familiar with the precautions required, and having complied with requirements of the authority having jurisdiction.

Assignment of Specialists: Certain Sections of the Specifications require that specific construction activities shall be performed by specialists who are recognized experts in the operations to be performed. The specialists must be engaged for those activities, and assignments are requirements over which the Contractor has no choice or option. Nevertheless, the ultimate responsibility for fulfilling Contract requirements remains with the Contractor.

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

Testing Laboratories: A "testing laboratory" 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.

SPECIFICATION FORMAT AND CONTENT EXPLANATION

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

Specification Content: This Specification uses certain conventions in the use of language and the intended meaning of certain terms, words, and phrases when used in particular situations or circumstances. These conventions are explained as follows:

Abbreviated Language: Language used in Specifications and other Contract Documents is the abbreviated type. Implied words and meanings will be appropriately interpreted. Singular words will be interpreted as plural and plural words interpreted as singular where applicable and the full context of the Contract Documents so indicates.

Imperative and streamlined language is used generally in the Specifications. Requirements expressed in the imperative mood are to be performed by the Contractor. At certain locations in the text, for clarity, subjective language is used to describe responsibilities that must be fulfilled indirectly by the Contractor, or by others when so noted.

INDUSTRY STANDARDS

Applicability of Standards: Except where 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. Such standards are made a part of the Contract Documents by reference.

Publication Dates: Where the date of issue of a referenced standard is not specified, comply with the standard in effect as of date of Contract Documents.

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

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. In complying 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.

Copies of Standards: Each entity engaged in construction on the Project is required to be familiar with industry standards applicable to that entity's construction activity. Copies of applicable standards are not bound with the Contract Documents.

Where copies of standards are needed for performance of a required construction activity, the Contractor shall obtain copies directly from the publication source.

Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. Where such acronyms or abbreviations are used in the Specifications or other Contract Documents, they mean the recognized name of the trade association, standards generating organization, authority having jurisdiction, or other entity applicable to the context of the text provision. Refer to the "Encyclopedia of Associations," published by Gale Research Co., available in most libraries.

GOVERNING REGULATIONS/AUTHORITIES

The Architect has contacted authorities having jurisdiction where necessary to obtain information necessary for preparation of Contract Documents; that information may or may not be of significance to the Contractor. Contact authorities having jurisdiction directly for information and decisions having a bearing on the Work.

SUBMITTALS

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, and similar documents, correspondence, and records established in conjunction with compliance with standards and regulations bearing upon performance of the Work.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

End of SECTION 01095

SECTION 01200 - PROJECT MEETINGS

PART 1 - GENERAL

RELATED DOCUMENTS

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

SUMMARY

This Section specifies administrative and procedural requirements for project meetings including but not limited to:

- Pre-Construction Conference.
- Coordination Meetings.
- Progress Meetings.

Construction schedules are specified in another Division-1 Section.

PRE-CONSTRUCTION CONFERENCE

Schedule a pre-construction conference and organizational meeting at the Project site or other convenient location no later than 15 days after execution of the Agreement and prior to commencement of construction activities. Conduct the meeting to review responsibilities and personnel assignments.

Attendees: The Owner, Architect and their consultants, the Prime Contractor(s) and their superintendent(s), major subcontractors, manufacturers, suppliers and other concerned parties shall each be represented at the conference by persons familiar with and authorized to conclude matters relating to the Work.

Agenda: Discuss items of significance that could affect progress including such topics as:

- Tentative construction schedule,
- Critical Work sequencing,
- Designation of responsible personnel,
- Procedures for processing field decisions and Change Orders,
- Procedures for processing Applications for Payment,
- Submittal of Shop Drawings, Product Data and Samples,
- Preparation of record documents,
- Use of the premises,
- Office, Work and storage areas,
- Equipment deliveries and priorities,
- Safety procedures,
- First aid,
- Security,
- Housekeeping, and
- Working hours.

COORDINATION MEETINGS

Conduct Project coordination meetings at regularly scheduled times convenient for all parties involved. Project coordination meetings are in addition to specific meetings held for other purposes, such as regular progress meetings and special pre-installation meetings.

Request representation at each meeting by every party currently involved in coordination or planning for the construction activities involved.

Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

PROGRESS MEETINGS

Conduct progress meetings at the Project site at regularly scheduled intervals. Notify the Owner and Architect of scheduled meeting dates. Coordinate dates of meetings with preparation of the payment request.

Attendees: In addition to representatives of the Owner, Architect, and Prime Contractor(s), each subcontractor, supplier or other entity concerned with current progress or involved in planning, coordination or performance of future activities shall be represented at these meetings by persons familiar with the Project and authorized to conclude matters relating to progress.

Agenda: Review and correct or approve minutes of the previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the current status of the Project.

Contractor's Construction Schedule: Review progress since the last meeting. Determine where each activity is in relation to the Contractor's Construction Schedule, whether on time or ahead or behind schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

Review the present and future needs of each entity present, including such items as:

- Interface requirements,
- Time,
- Sequences,
- Deliveries,
- Off-site fabrication problems,
- Access,
- Site utilization,
- Temporary facilities and services,
- Hours of Work,
- Hazards and risks,
- Housekeeping,
- Quality and Work standards,
- Change Orders, and
- Documentation of information for payment requests.

Reporting: No later than 3 days after each progress meeting date, distribute copies of minutes of the meeting to each party present and to other parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.

Schedule Updating: Revise the construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue the revised schedule concurrently with the report of each meeting.

End of SECTION 01200

SECTION 01300 - SUBMITTALS

PART 1 - GENERAL

RELATED DOCUMENTS

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

SUMMARY

This Section specifies administrative and procedural requirements for submittals required for performance of the Work, including:

- Contractor's construction schedule.

- Shop Drawings.

- Note: Contractors/Subs shall not assume CAD files will be released from Architect or Engineers for Shop Drawing production. PDF ONLY will be available for this use.*

- Product Data.

- Samples.

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:

- Permits.

- Applications for payment.

- Performance and payment bonds.

- Insurance certificates.

- List of Subcontractors.

The Schedule of Values submittal is included in Section "Applications for Payment."

Inspection and test reports are included in Section "Quality Control Services."

SUBMITTAL PROCEDURES

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.

Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals and related activities that require sequential activity.

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.

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

Processing: Allow sufficient review time so that installation will not be delayed as a result of the time required to process submittals, including time for resubmittals.

Allow two weeks for initial review. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. The Architect will promptly advise the Contractor when a submittal being processed must be delayed for coordination.

If an intermediate submittal is necessary, process the same as the initial submittal.

Allow two weeks for reprocessing each submittal.

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.

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.

Provide a space approximately 4" x 5" on the label or beside the title block on Shop Drawings to record the Contractor's review and approval markings and the action taken.

Include the following information on the label for processing and recording action taken.

Project name.
Date.
Name and address of Contractor.
Name and address of subcontractor.
Name and address of supplier.
Name of manufacturer.
Drawing number and detail references, as appropriate.

Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from Contractor to Architect using a transmittal form. Submittals received from sources other than the Contractor will be returned without action.

On the transmittal Record relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including minor variations and limitations. Include Contractor's certification that information complies with Contract Document requirements.

CONTRACTOR'S CONSTRUCTION SCHEDULE

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

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."

SHOP DRAWINGS

Submit newly prepared information, drawn to accurate scale.

Highlight, encircle, and otherwise indicate deviations from the Contract Documents. ALSO SEE GENERAL CONDITIONS REQUIREMENTS FOR SUBMITTAL – ARTICLE 3, paragraph 3.12, and all related subparagraphs.

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 considered Shop Drawings.

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

Dimensions.

Identification of **specific products, model #'s and/or materials** included.

Compliance with specified standards.

Notation of coordination requirements.

Notation of dimensions established by field measurement.

Sheet Size: Except for templates, patterns and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2" x 11" but no larger than 30" x 42".

Paper - Initial Submittal: Submit two prints for the Architect's review; one print will be returned.

Electronic - PDF Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number.

Please Note: If possible, **electronic submittals are preferred** method of submittal / review.

However, CONTRACTOR must then print all electronic submittals and provide FINAL stamped/approved PAPER COPIES on the Job Site -in the Job Trailer.

Paper - Final Submittal: Submit 5 blue-line prints, 2 prints will be retained; the remainder will be returned.

NOTE: Do not use Shop Drawings without an appropriate final stamp indicating action taken in connection with construction.

Coordination drawings are a special type of Shop Drawing that show the relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in the space provided or function as intended.

PRODUCT DATA

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. Where Product Data must be specially prepared because standard printed data is not suitable for use, submit as "Shop Drawings."

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

Manufacturer's printed recommendations.

Compliance with recognized trade association standards.

Compliance with recognized testing agency standards.

Application of testing agency labels and seals.

Notation of dimensions verified by field measurement.

Notation of coordination requirements.

Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.

Preliminary Submittal: Submit a preliminary single-copy of Product Data where selection of options is required.

Submittals: Submit 5 copies of each required submittal. The Architect will retain two, and will return the others marked with action taken and corrections or modifications required.

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

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.

Do not proceed with installation until an applicable copy of Product Data applicable is in the installer's possession.

Do not permit use of unmarked copies of Product Data in connection with construction.

SAMPLES

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.

Mount, display, or package Samples in the manner specified to facilitate review of qualities indicated. Prepare Samples to match the Architect's Sample. Include the following:

- Generic description of the Sample.
- Sample source.
- Product name or name of manufacturer.
- Compliance with recognized standards.
- Availability and delivery time.

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

Where variation in color, pattern, texture or other characteristics are inherent in the material or product represented, submit multiple units (not less than 3), that show approximate limits of the variations.

Refer to other Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation and similar construction characteristics.

Preliminary submittals: Where Samples are for selection of color, pattern, texture or similar characteristics from a range of standard choices, submit a full set of choices for the material or product.

Preliminary submittals will be reviewed and returned with the Architect's mark indicating selection and other action.

Note that the Architect must see a full selection of all samples of products that require a color selection together at one time. No decision can be made on any one color product without first seeing the full range of all color choices that must be made. No Delay may be claimed for Satisfying that requirement.

Submittals: Except for Samples illustrating assembly details, workmanship, fabrication techniques, connections, operation and similar characteristics, submit four sets; two will be returned marked with the action taken.

Maintain sets of Samples, as returned, at the Project site, for quality comparisons throughout the course of construction.

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

Sample sets may be used to obtain final acceptance of the construction associated with each set.

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.

Field Samples specified in individual Sections are special types of Samples. Field Samples are full-size examples erected on site to illustrate finishes, coatings, or finish materials and to establish the standard by which the Work will be judged.

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

ARCHITECT'S ACTION

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

Compliance with specified characteristics is the Contractor's responsibility.

Action Stamp: The Architect will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked, as follows, to indicate the action taken:

Final Unrestricted Release: Where submittals are marked "Approved," that part of the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents; final acceptance will depend upon that compliance.

Final-But-Restricted Release: When submittals are marked "Approved as Noted," that part of 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 acceptance will depend on that compliance.

Returned for Resubmittal: When submittal is marked "Not Approved, Revise and Resubmit," do not proceed with that part of the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the notations; resubmit without delay. Repeat if necessary to obtain a different action mark.

NOTE: Do not permit submittals marked "Not Approved, Revise and Resubmit" to be used at the Project site, or elsewhere where Work is in progress.

PART 2 - PRODUCTS (Not Applicable).

PART 3 - EXECUTION (Not Applicable).

End of SECTION 01300

SECTION 01400 - QUALITY CONTROL SERVICES

PART 1 - GENERAL

RELATED DOCUMENTS

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

SUMMARY

This Section specifies administrative and procedural requirements for quality control services.

Special Inspections required by NC Building Code Chapter 17 shall be performed under a separate contract between the Owner and the inspections firm.

Statement of Special Inspections is ATTACHED at the end of this Section.

Quality control services include inspections and tests and related actions including reports, performed by independent agencies, governing authorities, and the Contractor. They do not include Contract enforcement activities performed by the Architect.

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

Requirements of this Section relate to customized fabrication and installation procedures, not production of standard products.

Specific quality control requirements for individual construction activities are specified in the Sections that specify those activities. Those requirements, including inspections and tests, cover production of standard products as well as customized fabrication and installation procedures.

Inspections, test and related actions specified are not intended to limit the Contractor's quality control procedures that facilitate compliance with Contract Document requirements.

Requirements for the Contractor to provide quality control services required by the Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

RESPONSIBILITIES

Contractor Responsibilities: The Contractor shall employ a Testing Agency (approved by the Owner) to perform all inspections, tests and similar quality control services, specified in individual Specification Sections and required by governing authorities. Costs for these services shall be paid via the Owner's Testing Allowance. Contractors are warned not to abuse this right but to be responsible with agency's time and the Owner's Testing Allowance Funds.

The Owner will engage the services of an independent agency to perform inspections and tests specified as the Owner's responsibilities – specifically, the Special Inspections Requirements.

Retesting: The Contractor is responsible for retesting where results of required inspections, tests or similar services prove unsatisfactory and do not indicate compliance with Contract Document requirements, regardless of whether the original test was the Contractor's responsibility.

Cost of retesting construction revised or replaced by the Contractor is the Contractor's responsibility, where required tests were performed on original construction.

Associated Services: The Contractor shall cooperate with agencies performing required inspections, tests and similar services and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include but are not limited to:

Providing access to the Work and furnishing incidental labor and facilities necessary to facilitate inspections and tests.

Taking adequate quantities of representative samples of materials that require testing or assisting the agency in taking samples.

Providing facilities for storage and curing of test samples, and delivery of samples to testing laboratories.

Providing the agency with a preliminary design mix proposed for use for materials mixes that require control by the testing agency.

Security and protection of samples and test equipment at the Project site.

Duties of the Testing Agency: The independent testing agency engaged to perform inspections, sampling and testing of materials and construction specified in individual Specification Sections shall cooperate with the Architect and Contractor in performance of its duties, and shall provide qualified personnel to perform required inspections and tests.

The agency shall notify the Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.

The testing agency is not authorized to release, revoke, alter or enlarge requirements of the Contract Documents, or approve or accept any portion of the Work.

The agency shall not perform any duties of the Contractor.

Coordination: The Contractor and each agency engaged to perform inspections, tests and similar services shall coordinate the sequence of activities to accommodate required services with a minimum of delay. In addition to Contractor and each agency shall coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.

The Contractor is responsible for scheduling times for inspections, tests, taking samples and similar activities.

SUBMITTALS

The independent testing agency shall submit a certified written report of each inspection, test or similar service, to the Architect, in duplicate, unless the Contractor is responsible for the service. If the Contractor is responsible for the service, submit a certified written report of each inspection, test or similar service through the Contractor, in duplicate.

Submit additional copies of each written report directly to the governing authority, when the authority so directs.

Report Data: Written reports of each inspection, test or similar service shall include, but not be limited to:

Date of issue,
Project title and number,
Name, address and telephone number of testing agency,
Dates and locations of samples and tests or inspections,
Names of individuals making the inspection or test,
Designation of the Work and test method,
Identification of product and Specification Section,
Complete inspection or test data,
Test results and an interpretation of test results,
Ambient conditions at the time of sample-taking and testing,
Comments or professional opinion as to whether inspected or tested Work complies with
Contract Document requirements,
Name and signature of laboratory inspector, and
Recommendations on retesting.

QUALITY ASSURANCE

Qualification for Service Agencies: Engage inspection and testing service agencies, including independent testing laboratories, which are prequalified as complying with "Recommended Requirements for Independent Laboratory Qualification" by the American Council of Independent Laboratories, and which specialize in the types of inspections and tests to be performed.

Each independent inspection and testing agency engaged on the Project shall be authorized by authorities having jurisdiction to operate in the State in which the Project is located.

PART 2 - PRODUCTS (Not Applicable).

PART 3 - EXECUTION

REPAIR AND PROTECTION

General: Upon completion of inspection, testing, sample-taking and similar services, repair damaged construction and restore substrates and finishes to eliminate deficiencies, including deficiencies in visual qualities of exposed finishes. Comply with Contract Document requirements for "Cutting and Patching."

Protect construction exposed by or for quality control service activities, and protect repaired construction.

Repair and protection is the Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing or similar services.

End of SECTION 01400

(See attached Statement of Special Inspections)



Rowan County Building Code Enforcement

402 North Main Street Suite 207 Salisbury, N.C. 28144-4341

Office: 704-216-8619 Fax: 704-638-3130

Page 1 of 3

ROWAN COUNTY, NORTH CAROLINA Statement of Special Inspections

PROJECT: Rowan/Kannapolis ABC Store & Warehouse NCBC Edition: 2012

Address: 1428 S. Jake Alexander Blvd Occupancy: Mercantile
Salisbury, NC Construction Type: Type II B

Building Owner: Terry Osborne *Name* Rowan/Kannapolis ABC Board *Company*

Owner's Address: 510 N. Lee Street *Street* Salisbury *City* NC *State* 28144 *Zip Code*

Architect of Record: William R. Burgin, AIA #3510 *Name & License* Ramsay Burgin Smith Architects, Inc. *Company*

Structural Engineer of Record: Ashley R. Avery #27415 *Name & License* Applied Building Sciences, Inc. *Company*

Geotechnical Engineer of Record: Lee J. McGuinness, PE #028915 *Name & License* ECS Carolinas, LLP *Company*

Special Inspections Engineer of Record 1 : _____
Name & License *Company*

Special Inspections Engineer of Record 2: _____
Name & License *Company*

Special Inspections Engineer of Record 3: _____
Name & License *Company*

General Contractor: _____
Name & License *Company*

This Statement of Special Inspections is submitted as a condition for permit issuance in accordance with the North Carolina Statewide Building Code.

The Special Inspections Engineer of Record shall keep records of specified special inspections and testing and shall furnish copies of inspection and testing reports to the Rowan County Inspections Department and to the appropriate registered design professionals of record. Discrepancies from the approved plans and specifications and code violations observed during the conduct of special inspections services shall be brought to the immediate attention of the contractor for correction, to the attention of the Rowan County Inspections Department, and to the appropriate registered design professionals of record. A final report of special inspections documenting completion of specified special inspections and correction of any discrepancies and observed code violations noted in the inspection and testing reports shall be submitted to the Rowan County Inspections Department prior to the request for final building inspection and building inspection approval by County staff.

Prepared by Registered Design Professional in Responsible Charge:

(Type or print) Name *Signature & Date*

Building Owner's Authorization: _____
Signature & Date

Building Official's Acceptance: _____
Signature & Date



Rowan County Building Code Enforcement

402 North Main Street Suite 207 Salisbury, N.C. 28144-4341

Office: 704-216-8619 Fax: 704-638-3130

Page 2 of 3 PROJECT:	STATEMENT OF SPECIAL INSPECTIONS	Date: _____ Prepared By: _____
ACTIVITY/SYSTEMS	Y/N	AGENT *
Steel Construction, Fabrication & Seismic Resistance	Y	
Concrete Construction, Fabrication & Seismic Resistance	Y	
Masonry Construction, Fabrication & Seismic Resistance	Y	
Wood Construction, Fabrication & Seismic Resistance	N	
Soils	Y	
Pile Foundations & Fabricators	N	
Pier Foundations	Y	
Earth Retention Systems	Y	
Sprayed Fire Resistance Materials	N	
Mastic & Intumescent fire-resistant coatings	N	
EIFS	N	
Smoke Control	N	
Seismic Resistance Architectural, Components	N	
Seismic Resistance Mechanical Components	N	
Seismic Resistance Electrical Components	N	
Structural Observations required in Occupancy Category III or IV per Table 1604.5	N	<i>SER</i>
Special Cases	N	
Continuous or Periodic Inspection ref. below NC Building Code 1704.2, 1704.3, 1707, 1708.3, 1708.4 NC Building Code 1704.2, 1704.4, 1708.2 NC Building Code 1704.2, 1704.5 NC Building Code 1704.2, 1704.6, 1707.3 NC Building Code 1704.7 NC Building Code 1704.2, 1704.8, 1808, 1809, 1810 NC Building Code 1704.9, 1704.10, 1704.11, 1810 NC Building Code 1807.2.4, 1807.2.5 NC Building Code 1704.12 NC Building Code 1704.13 NC Building Code 1704.14 NC Building Code 1704.16 NC Building Code 1705.3.4, & 1707.6 NC Building Code 1705.3.1, 1705.3.3, 1705.3.5, 1707.7, 1707.8, 1707.9, & 1708.4 NC Building Code 1705.3.1, 1705.3.3, 1705.3.5, 1707.7, 1707.8, 1707.9, & 1708.4 NC Building Code 1702 & 1710 To be conducted by the Structural Engineer of Record NC Building Code 1704.15		
* INSPECTION AGENTS		
	Name,	Company,
Address		
1. Special Inspections Engineer of Record 1: _____		
2. Inspection and Testing Agency 1 A: _____		
3. Special Inspections Engineer of Record 2: _____		
4. Inspection and Testing Agency 2 A: _____		
5. Special Inspections Engineer of Record 3: _____		
6. Inspection and Testing Agency 3 A: _____		

Note: The inspectors and testing agencies shall be engaged by the Owner or the Owner's Agent, and not by the Contractor or Subcontractor whose work is to be inspected or tested. Any conflict of interest must be disclosed to the Building Official, prior to commencing work.

[illegible]



Rowan County Building Code Enforcement

402 North Main Street Suite 207 Salisbury, N.C. 28144-4341

Office: 704-216-8619 Fax: 704-638-3130

Contractor's Statement of Responsibility

Each contractor responsible for the construction or fabrication of a system or component described in the Statement of Special Inspections must submit a Statement of Responsibility.

Project:

Contractor's Name:

Address:

License No.:

Description of designated building systems and components included in the Statement of Responsibility:

Contractor's Acknowledgment of Special Requirements

I hereby acknowledge that control will be exercised to obtain conformance with the construction documents approved by the Building Official.

Signature

Date

Contractor's Provisions for Quality Control

Procedures for exercising control within the contractor's organization, the method and frequency of reporting and the distribution of reports is attached to this Statement.

Identification and qualifications of the person(s) exercising such control and their position(s) in the organization are attached to this Statement.

SECTION 01501 - TEMPORARY FACILITIES, SINGLE PRIME CONTRACTS

PART 1 - GENERAL

RELATED DOCUMENTS:

Drawings and general provisions of each prime Contract, including General and Supplementary Conditions and other Division-1 Specification sections, apply to work of this section.

DESCRIPTION OF REQUIREMENTS:

This section specifies administrative and procedural requirements for temporary services and facilities, including such items as temporary utility services, temporary construction and support facilities, and project security, protection and temporary storage shed.

Division of Responsibilities:

General: Each Prime Contractor and/or subcontractor is specifically assigned certain responsibilities for temporary services and facilities to be used by other contractors, and other entities at the site. **The Contractor for General Work is responsible for providing all temporary services and facilities that are not related to other Prime Contracts or other subcontractors' normal work and are not specifically assigned otherwise by these specifications.**

Work of each Prime contractor and/or subcontractor: Except as otherwise indicated, each Prime Contractor and subcontractor is responsible for the following:

Installation, operation, maintenance and removal of each temporary service or facility usually recognized as related to its own normal scope of work, and the costs and use charges associated with each service or facility.

Plug-in electric power cords and extension cords, and supplementary plug-in task lighting and special lighting necessary exclusively for its own work.

Storage and fabrication sheds necessary for its own work.

Specialized or unusual hoisting requirements.

Collection and disposal of its own hazardous, dangerous, unsanitary or otherwise harmful waste material.

Construction aids and miscellaneous services and facilities necessary for its own work.

The Contractor for General Work is responsible for the following:

Temporary telephone, superintendent cellphone (smart phone), and jobsite **fax or internet** service.

Temporary storm piping, dewatering and drainage.

Temporary Field Office – Job Trailer.

Temporary roads and paving.

Temporary toilets, including disposable supplies.

Temporary enclosure of the building.

Temporary heat.

Minimum emergency fire protection.

Project identification and temporary signs.

General collection and disposal of wastes.

Barricades, warning signs.

Environmental protection.

Rodent and Pest Control.

General project Construction Aids and Miscellaneous Services and Facilities.

Project Sign (See sign layout at the end of the Section)

The Subcontractor for Plumbing Work is responsible for the following:

Piped temporary water service.

The Subcontractor for Mechanical Work is responsible for the following:

NONE

The Subcontractor for Electrical Work is responsible for the following:

Temporary electric power service and distribution.
Temporary lighting.

Use Charges:

Cost or usage charges for temporary services or facilities are not chargeable to the Owner or Architect. General Contractor's cost or use charges for temporary services or facilities will not be accepted as a basis of claims for a change-order extra. These charges must be part of base bid costs.

Water Service Use Charges: The Contractor for the General work shall pay water service use charges, whether metered or otherwise, for water used by all entities authorized to be at or to perform work at the project site. This contractor may exercise reasonable control over water use in an effort to conserve water.

Electric Power Service Use Charges: The Contractor for the General Work shall pay electric power service use charges, whether metered or otherwise, for electricity used by all entities authorized to be at or to perform work at the project site. This contractor may exercise reasonable control over power use in an effort to conserve energy.

Telephone Charges: The Contractor for the General Work shall pay basic and local phone charges; however, each other Prime Contractor(s) and subcontractor(s) will be responsible for any long distance charges relating to their work and made by their employees (or sub-subcontractors). Contractor of the General Work will be responsible for invoicing these costs to other contractors.

Internet Charges: The contractor for the General Contractor shall pay for internet usage charges for online electronic service available at the jobsite for communications.

Other entities using temporary services and facilities may include, but are not limited to the following:

Other Prime Contractor(s) if multi-prime,
Other nonprime contractors,
The Owner's work forces,
Occupants of the Project,
The Architect/Engineer,
Testing agencies, and
Personnel of governing agencies.

QUALITY ASSURANCE:

Regulations: Prime Contractor shall comply with local laws and regulations governing construction and local industry standards, in the installation and maintenance of temporary services and facilities, including but not limited to the following:

Building Codes, including local requirements for permits, testing and inspection,

Health and safety regulations, (OSHA)
Utility company regulations and recommendations governing temporary utility services,
Fire Department rules and recommendations,
Police and Rescue Squad recommendations, and
Environmental protection regulations governing use of water and energy, and control of dust, noise
and other nuisances. (DENR)

JOB CONDITIONS:

General: Contractor for the General work shall provide each temporary service and facility ready for use at each location, when first needed to avoid delays in performance of work. Maintain, expand as required, and modify as needed throughout the progress of the work. Do not remove until services or facilities are no longer needed, or are replaced by the authorized use of completed permanent facilities.

Heat and Humidity control: The General Contractor must be aware that the unconditioned/exposed atmosphere inside the building produces extremely wet conditions in warm damp weather which causes condensation to form on cool interior surfaces. Temperature and humidity controls will be required to maintain newly installed finishes.

Mold control: The General Contractor will be required to protect construction in progress from the development of conditions that will be favorable for the development of mold. Means of removing moisture from within building enclosure shall be the responsibility of the General Contractor as required to inhibit mold development within the project.

Conditions of Use: Operate temporary services and facilities in a safe and efficient manner. Do not overload, and do not permit temporary services and facilities to interfere with the progress of work. Do not allow unsanitary conditions, public nuisances or hazardous conditions to develop or persist on the site.

Temporary Utilities: Do not permit freezing of pipes, flooding or the contamination of water sources.

Temporary Construction and Support Facilities: Maintain temporary facilities in a manner to prevent discomfort to users. Take necessary fire prevention measures. Maintain temporary facilities in a sanitary manner so as to avoid health problems.

Security and Protection: Maintain site security and protection facilities in a safe, lawful, publicly acceptable manner. Take measures necessary to prevent site erosion.

PART 2 - PRODUCTS

MATERIALS AND EQUIPMENT:

General: Contractor for the General work shall provide new materials and equipment for temporary services and facilities; used materials and equipment that are substantially undamaged and in serviceable condition may be used, if acceptable to the Architect/Engineer. Provide only materials and equipment that are suitable for their intended use.

Temporary Utilities: Where the local utility company provides only a portion of the temporary utility, provide the remainder with matching, compatible materials and equipment. Comply with utility company recommendations.

Electrical Service: Comply with applicable NEMA, NECA and UL standards and governing regulations for materials and layout of temporary electric service, including requirements included in Division-16 sections.

Voltage Differences: Provide identification warning signs at power outlets other than 110-120 volt power. Provide polarized outlets for plug-in type outlets, to prevent insertion of 110-120 volt plugs into higher voltage outlets.

Ground-Fault Protection: Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button and pilot light, for plug-in connection of power tools and equipment.

Electrical Power Cords: Use only grounded extension cords; use "hard-service" cords where exposed to abrasion and traffic. Use single lengths or waterproof connectors to connect separate lengths, if single lengths will not reach work areas.

Lamps and Light Fixtures: Provide general service incandescent lamps of wattage indicated or required for adequate illumination. Provide exterior fixtures where fixtures are exposed to weather or moisture.

Temporary Construction and Support Facilities: Provide facilities that can be maintained properly throughout the course of use at the project site.

Heating Units: Provide temporary heating units that have been tested and labeled by UL, FM or another recognized trade association related to the fuel being consumed.

Temporary Offices and Similar Construction: For temporary offices, fabrication shops, storage sheds and similar construction, provide standard prefabricated or mobile units. Provide insulated, weathertight units, that are heated and air-conditioned, with lockable entrances, operable windows, roofing, foundations adequate for normal loading, including wind loads, serviceable finishes, and mechanical and electrical equipment necessary to achieve ambient conditions indicated.

Self-Contained Toilet Units: Provide single-occupant self-contained toilet units of the chemical, aerated recirculation, or combustion type, properly vented and fully enclosed with glass fiber reinforced polyester shell or similar non-absorbent material.

First Aid Supplies: Comply with governing regulations and recognized recommendations within the construction industry.

Drinking Water: Provide potable water complying with local health authority requirements.

Sign Materials: For signs and directory boards, provide exterior type, Grade B-B High Density Concrete Form Overlay Plywood conforming to PS-1, of sizes and thicknesses indicated. Provide exterior grade acrylic-latex-base enamel for painting sign panels and applying graphics.

Security and Protection Facilities:

Fire Extinguishers: Provide type "A" fire extinguishers for temporary offices and similar spaces where there is minimal danger of electrical fires or grease-oil-flammable liquid fires. In other locations provide either type "ABC" dry chemical extinguishers, or a combination of several extinguishers of NFPA recommended types for the exposures in each case.

PART 3 - EXECUTION

INSTALLATION - GENERAL:

General: Use qualified tradesmen for installation of temporary services and facilities. Locate temporary services and facilities where they will serve the entire project adequately and result in minimum interference with performance of the Work.

Relocate, modify and extend services and facilities as required during the course of work so as to accommodate the entire work of the project.

TEMPORARY UTILITY INSTALLATION:

General: Engage the local utility company to install temporary service to the project, or to make connections to existing service. Arrange with the companies and existing users for an acceptable time when service can be interrupted, where necessary, to make connections for temporary services.

Water Service:

General: Install water service and distribution piping of sizes and pressures adequate for temporary construction purposes during the construction period and until permanent service is in use, including but not limited to the following uses:

- Construction processes,
- Drinking water,
- Sanitary facilities, and
- Cleaning.

- Obtain metered water service.

Temporary Electric Power Service:

General: Provide a weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics to accommodate performance of work during the construction period. Whenever an overhead floor or roof deck has been installed, install temporary lighting adequate to provide sufficient illumination for safe work and traffic conditions in every work area.

Temporary Service: Install service and grounding in compliance with the National Electric Code (NFPA 70). Include necessary meters, transformers, overload protection disconnect and main distribution switch gear.

- Install electric power service overhead except where underground service must be used to avoid construction conflicts or to comply with governing regulations.

- Connect temporary service to the local electric power company main in the manner directed by company officials.

- Provide temporary service with an automatic ground-fault interrupter feature, activated from the circuits of the system.

Power Distribution System: Provide circuits of adequate size and proper characteristics for each use.

Provide overload-protected disconnect switch for each temporary power circuit and each temporary lighting circuit, located at the power distribution center.

For power hand tools and task lighting, provide temporary 4-gang outlets at each floor level, spaced so that a 100 foot extension cord can reach each work area. Provide separate 110-120 Volt, 20 Amp circuit for each 4-gang outlet (4 outlets per circuit).

Temporary Lighting:

- Provide not less than one 200-watt incandescent lamp per 1000 sq. ft. of floor area, uniformly distributed, for general construction lighting, or illumination of a similar nature. In corridors and similar traffic areas provide one 100-watt incandescent lamp every 50 feet. In stairways and at ladder runs, provide one lamp every story, located to illuminate each landing and flight.

- Install and operate temporary lighting to fulfill security and protection requirements, without the necessity of operating the entire system.

Temporary Telephones:

General: Arrange for the local telephone company to install temporary service to the project. Provide service of the type and capacity indicated in other Division-1 sections.

TEMPORARY CONSTRUCTION AND SUPPORT FACILITIES INSTALLATION:

General: Provide a neat and uniform appearance in temporary construction and support facilities acceptable to the Architect/Engineer and the Owner.

Locate field offices, storage and fabrication sheds and other facilities for easy access to the work. Position offices so that windows give the best possible view of construction activities.

Maintain field offices, storage and fabrication sheds, temporary sanitary facilities, waste collection and disposal system, and project identification and temporary signs until near substantial completion. Immediately prior to substantial completion remove these facilities. Personnel remaining at the site beyond substantial completion will be permitted to use certain permanent facilities, under restricted use conditions acceptable to the Owner.

Temporary Heat:

General: Provide temporary heat where indicated or needed for proper performance of the Work, curing or drying of recently installed work or protection of work in place from adverse effects of low temperatures or high humidity. Select facilities known to be safe and without deleterious effect upon work in place or being installed. Coordinate with ventilation requirements to produce indicated ambient condition required and to minimize consumption of fuel or energy.

Maintain a minimum temperature of 45 deg.F (7 deg.C) in permanently enclosed portions of the building and areas where finished work has been installed.

Heating Facilities: Except where conditions make it necessary to use another system, and where use of permanent heating system is available and authorized, provide properly vented self-contained LP gas or fuel oil heaters with individual space thermostatic control for temporary heat.

Do not use open burning or salamander type temporary heating units where prohibited by governing regulations, or when combustible materials are located in or near the space being heated, or when work installed or being installed includes work exposed to view in the completed project.

Field Offices:

General: The Contractor for the General Work shall provide a **temporary field office** of sufficient size to accommodate required office personnel of all subcontractors at the project site.

Provide a vented space heater, capable of maintaining uniform indoor temperature of 68 deg.F (20 deg.C), and an air-conditioning unit capable of maintaining a maximum indoor temperature of 72 deg.F (24 deg.C).

Furnish with not less than a desk and chair, a 4-drawer file cabinet, plan table and plan rack and seated meeting space for 8 people minimum.

Storage and Fabrication Sheds: Install storage and fabrication sheds, properly sized, furnished and equipped, as required to accommodate work. Comply with applicable provisions specified elsewhere for distribution and use of temporary utilities. Sheds may be open shelters or fully enclosed spaces, within the building construction area or elsewhere on the project site.

Temporary Roads and Paving:

General: To the fullest extent possible, locate temporary roads and paving for storage areas and temporary parking, in the same locations as permanent facilities for similar uses. To incorporate temporary paving provisions, review significant modifications of permanent paving requirements with the Architect for acceptance of the proposed improvements.

Coordinate development of temporary roads and paved areas with grading and the compaction of the subgrade, installation and stabilization of the subbase and installation of the base and finish courses of

permanent paving. Coordinate development in a manner that will minimize exposure of incomplete work to deterioration and the need to rework installations, that will provide adequate temporary roads and paving during the course of the work, and that will result in completion of permanent roads and paved areas in a manner that will be new in appearance and without damage or deterioration at the time of the Owner's occupancy.

Delay installation of the final course of permanent asphalt concrete paving in areas exposed to temporary use, until immediately before substantial completion. Coordinate with normal weather conditions to avoid unsatisfactory results.

Extend temporary roads and/or paving in and around the site construction area as necessary to accommodate the following:

- Delivery and storage of materials,
- Fabrication operations,
- Use of equipment, including truck cranes,
- Mock-ups,
- Testing operations,
- Administration and supervision, and
- Safety and protection activities.

Sanitary Facilities:

General: Sanitary facilities include temporary toilets, wash facilities and drinking water fixtures. Comply with governing regulations including safety and health codes for the type, number, location, operation and maintenance of fixtures and facilities; provide not less than specified requirements. Install in locations which will best service the project's needs.

Supply and maintain toilet tissue, paper towels, paper cups and other disposable materials as appropriate for each facility. Provide covered waste containers for used material.

Toilets: Install self-contained toilet units or water and sewer connected temporary toilet facilities, to the extent permitted by governing regulations. Use of pit-type privies will not be permitted. Provide a minimum of three units.

Wash Facilities: Install potable-water-supplied wash facilities at locations convenient to construction personnel involved in handling compounds and materials where wash-up is necessary to maintain a healthy, sanitary condition.

Responsibilities: The Contractor for General Work is responsible for temporary sanitary facilities and their maintenance, including disposable supplies.

Temporary Enclosure:

General: At the earliest practical time provide temporary enclosure of materials, equipment, work in progress and completed portions of work to provide protection to the Work and employees from effects of exposure, foul weather, other construction operations, and similar activities on the site.

Provide temporary enclosures where temporary heat is needed and permanent building enclosure is not yet completed, and there is no other provision for containment of temporary heat. Coordinate enclosures with ventilating and material drying or curing requirements to avoid dangerous conditions and adverse effects.

Enclosure: Install tarpaulins or equivalent materials securely, using a minimum of wood framing and combustible materials. Individual openings of 25 sq. ft. or less may be closed with plywood or similar materials.

Close openings through the floor or roof decks and other horizontal surfaces with substantial load-bearing wood-framed or similar construction.

Project Identification and Temporary Signs:

General: Prepare project identification and other temporary signs of the size and with graphic content indicated; install where indicated. Support on posts or framing of treated wood or steel. Maintain signs

to properly inform the public and persons seeking entrance to the project. Do not permit installation of unauthorized signs that are visible outside the site.

Project Identification Signs: Engage an experienced sign painter to apply graphics in a neat professional manner. Comply with details and notations indicated on sketch of sign inserted after end of this section.

Collection and Disposal of Wastes:

General: Establish a system for daily collection and disposal of waste materials from construction areas and elsewhere on the site. Enforce requirements strictly. Do not hold collected materials at the site more than 7 days during normal weather or 3 days when the daily temperature is expected to rise above 80 deg.F (27 deg.C). Handle hazardous, dangerous, or unsanitary waste materials separately from other inert waste by containerizing appropriately. Dispose of waste material in a lawful manner.

Burying or burning of waste materials on the site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.

Construction Aids and Miscellaneous Services and Facilities:

General: Design, construct, and maintain construction aids and miscellaneous services and facilities as needed to accommodate performance of work. Construction aids and miscellaneous services and facilities include, but are not limited to the following:

Temporary stairs and ladders,
Guardrails and barriers, and
Walkways.

Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate for performance of work. Cover finished permanent stairs exposed to occupants' use, with a durable protective covering of plywood or similar material so that finishes will undamaged at the time of acceptance.

Walkways: Install and maintain temporary walkways around construction work and to field offices, toilets and similar places. Construct walkways of washed, well graded gravel 6" deep by 36" wide, or duckboard units 20" wide.

Responsibility: General construction aids and miscellaneous facilities required by the Contractor for General Work as well as other subcontractors are the responsibility of the Contractor for General Work. Construction aids and miscellaneous facilities required exclusively for each subcontractor are the responsibility of that subcontractor.

SECURITY AND PROTECTION FACILITIES INSTALLATION:

General: Provide a neat and uniform appearance in security and protection facilities acceptable to the Architect/Engineer and the Owner.

Barricades, Warning Signs:

General: Comply with recognized standards and code requirements for erection of substantial, structurally adequate barricades where needed to prevent accidents and losses. Paint with appropriate colors, graphics and warning signs to inform personnel at the site and the public, of the hazard being protected against. Provide lighting where appropriate and needed for recognition of the facility, including flashing red lights where appropriate.

Storage: Where materials and equipment must be temporarily stored, prior to and during construction, and are of substantial value or are attractive for possible theft, provide a secure lockup. Enforce strict discipline in connection with the timing of installation and release of materials, so that the opportunity for theft and vandalism is minimized.

OPERATION, TERMINATION AND REMOVAL:

Supervision: Enforce strict discipline in the use of temporary services and facilities at the site. Limit availability of temporary services and facilities to essential and intended uses to minimize waste and

abuse. Do not permit temporary installations to be abused or endangered. Do not allow hazardous, dangerous or unsanitary conditions to develop or persist on the site.

Maintenance: Operate and maintain temporary services and facilities in good operating condition throughout the time of use and until removal is authorized. Protect from damage by freezing temperatures and similar elements.

Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation and similar facilities on a 24-hour day basis where required to achieve indicated results in the work and avoid the possibility of damage to work or the temporary facilities.

Protection: Prevent water filled piping from freezing, by use of ground covers, insulation, by keeping drained or by temporary heating. Maintain distinct markers for underground lines. Protect from damage during excavation operations.

Termination and Removal: Unless the Architect/Engineer requests that it be maintained for a longer period of time, remove each temporary service and facility promptly when the need for it has ended, or when it has been replaced by authorized use of a permanent facility, or no later than the time of substantial completion. Complete or, if necessary, restore permanent work which may have been delayed because of interference with the temporary service or facility. Repair damaged work, clean exposed surfaces and replace work which cannot be satisfactorily repaired.

Materials and facilities that constitute temporary services and facilities are and remain the property of each Prime Contractor.

At substantial completion, clean and renovate permanent services and facilities that have been used to provide temporary services and facilities during the construction period, including but not limited to the following:

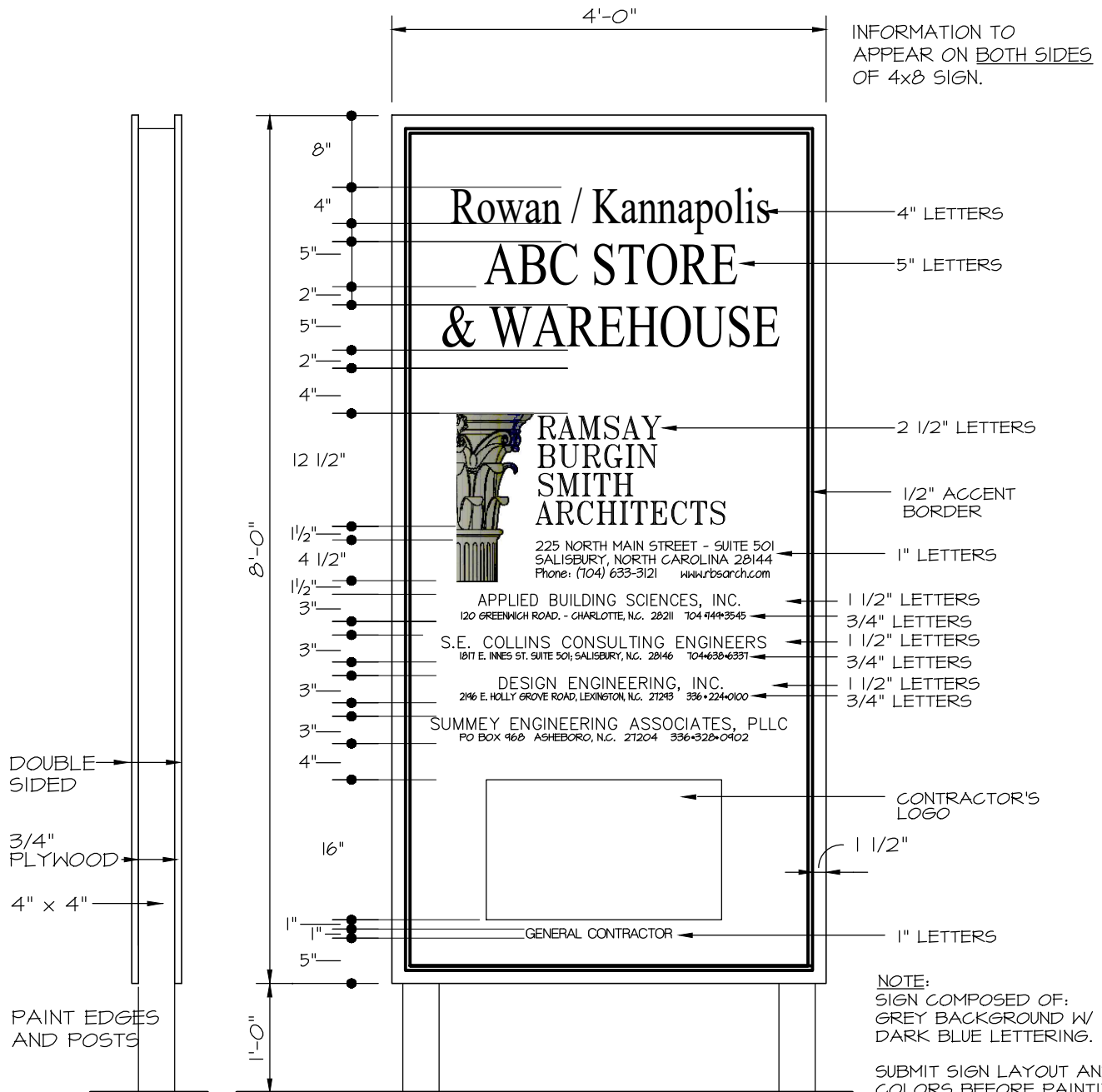
- Replace air filters and clean the inside of ductwork and housings.

- Replace significantly worn parts and parts that have been subject to unusual operating conditions.

- Replace lamps in the lighting system that are burned out or dimmed by substantial hours of use.

END OF SECTION 01501

(SEE PROJECT SIGN ATTACHED BEYOND THIS PAGE)



PROJECT SIGN

NOTE:
SIGN COMPOSED OF:
GREY BACKGROUND W/
DARK BLUE LETTERING.

SUBMIT SIGN LAYOUT AND
COLORS BEFORE PAINTING
OR CALL ARCHITECT FOR
INSPECTION OF SIGN IN
SHOP BEFORE FINISHING.

SECTION 01600 - MATERIALS AND EQUIPMENT

PART 1 - GENERAL

RELATED DOCUMENTS

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

SUMMARY

This Section specifies administrative and procedural requirements governing the Prime Contractor's(s') selection of products for use in the Project.

Prime Contracts: Provisions of this Section apply to the construction activities of each Prime Contractor.

The Prime Contractor's(s') Construction Schedule and the Schedule of Submittals are included under Section "Submittals."

Standards: Refer to Section "Definitions and Standards" for applicability of industry standards to products specified.

Administrative procedures for handling requests for substitutions made after award of the Contract are included under Section "Product Substitutions."

DEFINITIONS

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 such are self-explanatory and have well recognized meanings in the construction industry.

"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.

"Named Products" are items identified by manufacturer's product name, including make or model designation, indicated in the manufacturer's published product literature, that is current as of the date of the Contract Documents.

"Materials" are products that are substantially shaped, cut, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form a part of the Work.

"Equipment", is a product with operational parts, whether motorized or manually operated, that requires service connections such as wiring or piping.

QUALITY ASSURANCE

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

Compatibility of Options: When the Prime Contractor(s) is given the option of selecting between two 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.

Each Prime Contractor (or subcontractor) is responsible for providing products and construction methods that are compatible with products and construction methods of prime or other separate subcontractors.

If a dispute arises between Prime Contractors or subcontractors over concurrently selectable, but incompatible products, the Architect will determine which products shall be retained and which are incompatible and must be replaced.

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 which will be exposed to view in occupied spaces or on the exterior.

Labels: Locate required product labels and stamps on a concealed surface or, where required for observation after installation, on an accessible surface that is not conspicuous.

Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on an easily accessible surface which is inconspicuous in occupied spaces. The nameplate shall contain the essential operating data and equipment characteristics.

PRODUCT DELIVERY, STORAGE, AND HANDLING

Deliver, store and handle products in accordance with the manufacturer's recommendations, using means and methods that will prevent damage, deterioration and loss, including theft.

Schedule delivery to minimize long-term storage at the site and to prevent overcrowding of construction spaces.

Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft and other losses.

Deliver products to the site in the manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting and installing.

Inspect products upon delivery to ensure compliance with the Contract Documents, and to ensure that products are undamaged and properly protected.

Store products at the site in a manner that will facilitate inspection and measurement of quantity or counting of units.

Store heavy materials away from the Project structure in a manner that will not endanger the supporting construction.

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

PRODUCT SELECTION

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

Provide products complete with all accessories, trim, finish, safety guards and other devices and details needed for a complete installation and for the intended use and effect.

Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.

Product Selection Procedures: Product selection is governed by the Contract Documents and governing regulations, not by previous Project experience. Procedures governing product selection include the following:

Proprietary Specification Requirements: Where only a single product or manufacturer is named, provide the product indicated. No substitutions will be permitted.

Semi-proprietary Specification Requirements: Where two or more products or manufacturers are named, provide one of the products indicated. No substitutions will be permitted.

Where products or manufacturers are specified 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.

Non-Proprietary Specifications: When the Specifications list products or manufacturers that are available and may be incorporated in the Work, but do not restrict the Prime Contractor(s) to use of these products only, the Prime Contractor(s) 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.

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.

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. General overall performance of a product is implied where the product is specified for a specific application.

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

Compliance with Standards, Codes and Regulations: Where the Specifications only require compliance with an imposed code, standard or regulation, select a product that complies with the standards, codes or regulations specified.

Visual Matching: Where Specifications require matching an established Sample, the Architect's decision will be final on whether a proposed product matches satisfactorily.

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

Visual Selection: Where specified product requirements include the phrase "...as selected from manufacturer's standard colors, patterns, textures

Allowances: Refer to individual Specification Sections and "Allowance" provisions in Division-1 for allowances that control product selection, and for procedures required for processing such selections.

PART 3 - EXECUTION

INSTALLATION OF PRODUCTS

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.

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

End of SECTION 01600

SECTION 01631 - PRODUCT SUBSTITUTIONS

PART 1 - GENERAL

RELATED DOCUMENTS

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

SUMMARY

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

Prime Contracts: Provisions of this Section apply to the construction activities of each Prime Contractor.

The Prime Contractor's(s') Construction Schedule and the Schedule of Submittals are included under Section "Submittals."

Standards: Refer to Section "Definitions and Standards" for applicability of industry standards to products specified.

Procedural requirements governing the Prime Contractor's(s) selection of products and product options are included under Section "Materials and Equipment."

DEFINITIONS

Definitions used in this Article are not intended to change or modify the meaning of other terms used in the Contract Documents.

Substitutions: Requests for changes in products, materials, equipment, and methods of construction required by Contract Documents proposed by the Prime Contractor(s) after award of the Contract are considered requests for "substitutions." The following are not considered substitutions:

Substitutions requested by Bidders during the bidding period, and incorporated in a project addendum prior to award of Contract, are considered as included in the Contract Documents and are not subject to requirements specified in this Section for substitutions.

Revisions to Contract Documents requested by the Owner or Architect.

Specified options of products and construction methods included in Contract Documents.

SUBMITTALS

Substitution Request Submittal: Requests for substitution will be considered if received within 60 days after commencement of the Work. Requests received more than 60 days after commencement of the Work may be considered or rejected at the discretion of the Architect.

Submit 3 copies of each request for substitution for consideration. Submit requests in the form and in accordance with procedures required for Change Order proposals.

Identify the product, or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers. Provide complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate:

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

Samples, where applicable or requested.

A detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements such as size, weight, durability, performance and visual effect.

Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate Prime Contractors, that will become necessary to accommodate the proposed substitution.

A statement indicating the substitution's effect on the Construction Schedule compared to the schedule without approval of the substitution.

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

Certification by the Prime Contractor(s) that the substitution proposed is equal-to or better in every significant respect to that required by the Contract Documents, and that it will perform adequately in the application indicated. Include the Prime Contractor's(s') waiver of rights to additional payment or time, that may subsequently become necessary because of the failure of the substitution to perform adequately.

Architect's Action: Within one week of receipt of the request for substitution, the Architect will request additional information or documentation necessary for evaluation of the request. Within 2 weeks of receipt of the request, or one week of receipt of the additional information or documentation, whichever is later, the Architect will notify the Prime Contractor(s) of acceptance or rejection of the proposed substitution. If a decision on use of a proposed substitute cannot be made or obtained within the time allocated, use the product specified by name. Acceptance will be in the form of a Change Order.

PART 2 - PRODUCTS

SUBSTITUTIONS

Conditions: The Prime Contractor's(s') substitution request will be received and considered by the Architect when one or more of the following conditions are satisfied, as determined by the Architect; otherwise requests will be returned without action except to record noncompliance with these requirements.

Extensive revisions to Contract Documents are not required.

Proposed changes are in keeping with the general intent of Contract Documents.

The request is timely, fully documented and properly submitted.

The request is directly related to an "or equal" clause or similar language in the Contract Documents.

The specified product or method of construction cannot be provided within the Contract Time. The request will not be considered if the product or method cannot be provided as a result of failure to pursue the Work promptly or coordinate activities properly.

The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.

A substantial advantage is offered the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities the Owner may be required to bear. Additional responsibilities for the Owner may include additional compensation to the Architect for redesign and evaluation services, increased cost of other construction by the Owner or separate Prime Contractors, and similar considerations.

The specified product or method of construction cannot be provided in a manner that is compatible with other materials, and where the Prime Contractor(s) certifies that the substitution will overcome the incompatibility.

The specified product or method of construction cannot be coordinated with other materials, and where the Prime Contractor(s) certifies that the proposed substitution can be coordinated.

The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Prime Contractor(s) certifies that the proposed substitution provide the required warranty.

Where a proposed substitution involves more than one Prime Contractor, each Contractor shall cooperate with the other Contractors involved to coordinate the Work, provide uniformity and consistency, and to assure compatibility of products.

The Prime Contractor's(s') submittal and Architect's acceptance of Shop Drawings, Product Data or Samples that relate to construction activities not complying with the Contract Documents does not constitute an acceptable or valid request for substitution, nor does it constitute approval.

PART 3 - EXECUTION (Not Applicable).

End of SECTION 01631

SECTION 01700 - PROJECT CLOSEOUT

PART 1 - GENERAL

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification sections, apply to work of this section.

DESCRIPTION OF REQUIREMENTS:

Definitions: 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 Prime Contractor(s) and the normal termination of the Contract.

Specific requirements for individual units of work are included in the appropriate sections in Divisions 2 through 16.

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 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.

PREREQUISITES TO SUBSTANTIAL COMPLETION:

General: Complete the following before requesting the Architect's inspection for certification of substantial completion, either for the entire Work or for portions of the Work. List known exceptions in the request.

In the progress payment request that coincides with, or is the first request following, the date substantial completion is claimed, show either 100% completion for the portion of the Work claimed as "substantially complete", or list incomplete items, the value of incomplete work, and reasons for the Work being incomplete.

Include supporting documentation for completion as indicated in these contract documents.

Submit a statement showing an accounting of changes to the Contract Sum.

Advise Owner of pending insurance change-over requirements.

Submit specific warranties, workmanship/maintenance bonds, maintenance agreements, final certifications and similar documents.

Obtain and submit releases enabling Owner's full, unrestricted use of the Work and access to services and utilities. Where required, include occupancy permits, operating certificates and similar releases.

Submit record drawings, maintenance manuals, damage or settlement survey, and similar final record information.

Deliver tools, spare parts, extra stocks of material and similar physical items to the Owner.

Make the final change-over of locks and transmit the keys to the Owner. Advise the Owner's personnel of the change-over in security provisions.

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, mock-ups, and similar elements.

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

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

Inspection Procedures: Upon receipt of Prime Contractor's(s') request for inspection, the Architect will either proceed with inspection or advise Prime Contractor(s) of unfulfilled prerequisites.

Following the initial inspection, the Architect will either prepare the certificate of substantial completion, or will advise Prime Contractor(s) of work which must be performed before the certificate will be issued. The Architect will repeat the inspection when requested and when assured that the Work has been substantially completed.

Note requirements of General Conditions, Article 9 and Supplementary Conditions, Article 9 clause 9.8.6.

Results of the completed inspection will form the initial "punch-list" for final acceptance.

Punch lists must be completed by the contractor within 30 days of receipt. Unless items on the list are specifically excluded by the Architect, Liquidated damages will be reassessed for work not completed in the 30 days indicated above.

PREREQUISITES TO FINAL ACCEPTANCE:

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

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.

Submit an updated final statement, accounting for final additional changes to the Contract Sum.

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

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

Submit consent of surety, Prime Contractor's(s') Affidavit of Payment of Debts and Claims; Release of Liens (from each major subcontractor and material supplier.)

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

Re-inspection Procedure: The Architect will re-inspect the Work upon receipt of the Prime Contractor's(s') notice that the work, including punch-list items resulting from earlier inspections, has

been completed, except for these items whose completion has been delayed because of circumstances that are acceptable to the Architect.

Upon completion of re-inspection, the Architect will either prepare a certificate of final acceptance, or will advise the Prime Contractor(s) of work that is incomplete or of obligations that have not been fulfilled, but are required for final acceptance.

If necessary, the re-inspection procedure will be repeated.

Note requirements of General Conditions, Article 9 and Supplementary Conditions, Article 9 clause 9.8.6.

RECORD DOCUMENT SUBMITTALS:

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

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 reference during normal working hours.

Record Drawings: Maintain a record set of black line white-prints of contract drawings and shop drawings in a clean, undamaged condition. Mark-up the set of record documents to show the actual installation where the installed 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 mark-up, 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.

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

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.

Note related change-order number where applicable.

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

Record Project Survey: Submit three copies of the project property survey provided by a licensed surveyor that shows within the project boundaries, the new and existing structures, site improvements, utilities, storm drainage components including basin top, inlet and outlet elevations, and other data required by the local municipality.

Record Specifications: Maintain one complete copy of the Project Manual, including specifications and addenda, and one copy of other written construction documents such as change orders and similar modifications issued in printed form during construction. Mark these documents to show substantial variations in the actual work performed in comparison with the text of the specifications and modifications as issued. Give particular attention to substitutions, selection of options and similar information on work where it is concealed or cannot otherwise be readily discerned at a later date by direct observation. Note related record drawing information and product data, where applicable.

Upon completion of the Work, submit record specifications to the Architect for the Owner's records.

Miscellaneous Record Submittals: Refer to other sections of these specifications for requirements of miscellaneous record-keeping and submittals in connection with the actual performance of the Work. Immediately prior to the date or dates of substantial completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for continued use and reference. Submit to the Architect for the Owner's records.

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

Include the following types of information in operation and maintenance manuals:

- List of Prime Contractor(s) and major subcontractors names, addresses and phone numbers and contact person.
- Project Warranties
- Subcontractor Warranties
- Emergency instructions,
- Spare parts listing,
- Copies of color schedules, hardware schedules,
- Wiring diagrams,
- Recommended "turn-around" cycles,
- Inspection procedures,
- Shop drawings and product data, and
- Floor or wall finish cleaning instructions from manufacturers.
- Asbestos Certification for Project

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

CLOSEOUT PROCEDURES:

General Operating 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 Owners personnel to provide necessary basic instruction in the proper operation and maintenance of the entire Work. Where installers are not experienced in the required procedures, include instruction by the manufacturer's representatives.

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

- Maintenance manuals,
- Record documents,
- Spare parts and materials,
- Tools,
- Lubricants,
- Fuels,
- Identification systems,
- Control sequences,
- Hazards,
- Cleaning, and
- Warranties, bonds, maintenance agreements and similar continuing commitments.

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

Start-up,
Shut-down,
Emergency operations,
Noise and vibration adjustments,
Safety procedures,
Economy and efficiency adjustments, and
Effective and energy utilization.

FINAL CLEANING:

General: Special cleaning requirements for specific units of Work are included in the appropriate sections of Divisions 2 through 16. General Cleaning during the regular progress of the Work is required by the General Conditions and is included under section "Temporary Facilities".

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 the manufacturer's instructions for operations.

Complete the following cleaning operations before requesting the Architect's inspection for certification of substantial completion.

Remove labels that are not required as permanent labels.

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

Clean exposed exterior and interim hard-surfaced finishes to a dust-free condition, 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.

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.

Clean the project site, including landscape development areas, of rubbish, litter and 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.

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

Compliances: 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 systems. Remove waste materials from the site and dispose of in a lawful manner.

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

End of SECTION 01700

SECTION 01740 - WARRANTIES AND BONDS

PART 1 - GENERAL

RELATED DOCUMENTS

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

The warranty period for this project is one (1) year unless more is indicated in the individual sections of this specification. Nothing implied by this warranty period exempts the Owner from other warranty and legal rights that he may apply to work quality issues.

SUMMARY

This Section specifies general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturers standard warranties on products and special warranties.

Refer to the General Conditions for terms of the Prime Contractor's(s) special warranty of workmanship and materials.

General closeout requirements are included in Section "Project Closeout."

Specific requirements for warranties for the Work and products and installation that are specified to be warranted, are included in the individual Sections of Divisions-2 through -16.

Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.

Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Prime Contractor(s) of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Prime Contractor.

Separate Prime Contracts: Each Prime Contractor is responsible for warranties related to its own Contract.

DEFINITIONS

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

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.

WARRANTY REQUIREMENTS

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

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.

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 Contract Documents. The Prime Contractor(s) 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.

Owner's Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, right and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.

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

SUBMITTALS

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.

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

When a special warranty is required to be executed by the Prime Contractor(s), or the Prime Contractor(s) and a subcontractor(s), supplier(s) or manufacturer(s), 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.

Refer to individual Sections of Divisions-2 through -16 for specific content requirements, and particular requirements for submittal of special warranties.

PART 2 - PRODUCTS (not applicable).

PART 3 - EXECUTION

Additional requirements for warranties and bonds on products and installation are found in their applicable sections of the specifications.

End of SECTION 01740

CONTRACTOR'S GENERAL WARRANTY/CERTIFICATION

(Name of Project)

(Address)

(Name of Contract)

The undersigned Contractor hereby warrants, in accordance with the applicable provisions and terms set forth in the Contract Documents, all materials and workmanship incorporated in the (name of contract) contract for (name of project) located in (project address) against any and all defects due to faulty materials or workmanship or negligence for a period of 12 months, or such longer periods as set forth in the Contract Documents, from the effective date of this warranty.

This Warranty shall be binding where defects occur due to normal usage conditions and does not cover willful or malicious damage, damage caused by acts of God or other casualty beyond the control of the Contractor.

This Warranty shall be in addition to other warranties and guarantees set forth in the Contract Documents, and shall not act to constitute a waiver of additional protection of the Owner afforded, where applicable, by consumer protection and product liability provisions of law, and these stipulations shall not constitute waiver of any additional rights or remedies available to the Owner under the law.

The undersigned Contractor also hereby certifies that to the best of his/her knowledge, information and belief, no asbestos, lead or other hazardous materials have been utilized in this project.

Signed: _____

(Corporate Seal)

Name: _____

Title: _____

Date: _____

Subscribed and sworn before me this

____ day of _____, 20__.

(Notary Public)

SECTION 02110 - SITE CLEARING

PART 1 – GENERAL

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

Reference Drawing A1 – Existing Conditions & Site Details Sheet
Reference Civil Drawings for Demolition & Erosion Control Measures.

DESCRIPTION OF WORK:

Extent of site clearing is shown on drawings.

Site clearing includes, but is not limited to:

- Removal of trees and other vegetation.
- Removal of wood frame shed, fences, gravel, paving, etc. (See A1 and C-2)
- Topsoil (and gravel) stripping.
- Clearing and grubbing.
- Removing above-grade improvements.
- Removing below-grade improvements.

JOB CONDITIONS:

Traffic: Conduct site clearing operations to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets, walks or other occupied or used facilities without permission from authorities having jurisdiction.

See **Civil Drawing** for DOT Required Temporary Construction Entrance specifics.
Protect improvements on adjoining properties and on Owner's property.

Protection of Existing Site Features: Protect the following with barricades, fences, or other necessary measures to insure that they remain undisturbed:

- Existing street curb and guttering and storm drainage.
- Existing adjacent buildings and structures.

PART 2 - PRODUCTS (Not applicable to work of this section.)

PART 3 - EXECUTION

SITE CLEARING:

General: Remove trees, shrubs, grass and other vegetation, improvements, or obstructions interfering with installation of new construction. Remove such items elsewhere on site or premises as specifically indicated. **Removal includes digging out stumps and roots.**

REMOVAL OF STUMPS AND ROOTS IS BASE BID WORK.

Carefully and cleanly cut roots and branches of trees indicated to be left standing, where such roots and branches obstruct new construction.

Topsoil: Topsoil is defined as friable clay loam surface soil found in a depth of **not less than 6 inches.**
REMOVAL OF TOPSOIL IS BASE BID WORK.

Satisfactory topsoil is reasonably free of subsoil, clay lumps, stones, and other objects over 2" in diameter, and without weeds, roots, and other objectionable material.

Strip topsoil to whatever depths encountered in a manner to prevent intermingling with underlying subsoil or other objectionable material.

Remove heavy growths of grass from areas before stripping.

Where trees are indicated to be left standing, stop topsoil stripping a sufficient distance to prevent damage to main root system.

Stockpile topsoil in storage piles in areas shown, or where directed. Construct storage piles to freely drain surface water.

Dispose of unsuitable or excess topsoil same as waste material, herein specified.

Clearing and Grubbing: Clear site of trees, shrubs and other vegetation, except for those indicated to be left standing.

Completely remove stumps, roots, and other debris protruding through ground surface.

Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated.

Place fill material in horizontal layers not exceeding 6" loose depth, and thoroughly compact to a density equal to adjacent original ground.

Removal of Improvements: Remove existing above-grade and below-grade improvements necessary to permit construction, and other work as indicated (See other Division 1 section).

DISPOSAL OF WASTE MATERIALS:

Burning not permitted on Owner's Property:

Removal from Owner's Property: Remove waste materials and unsuitable and excess topsoil from Owner's property and dispose of off site in a legal manner. Follow all NCDENR requirements for off-site disposal of soils.

End of SECTION 02110

SECTION 02200 - EARTHWORK

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings, General Conditions and Supplementary General Conditions and other Division-1 Specification Sections, apply to this Section.

SEE SECTION 01020 – ALLOWANCES.

SEE SECTION 01026 – UNIT PRICES.

Earthwork Contractors shall include an Allowance for 3000 cubic yards of Undercut including compacted refill.

SUMMARY

This Section includes the following:

See also specifications on Civil and Structural drawings for additional requirements.

Providing suitable structural fill form off site or removing excess soil offsite as necessary to create level building pad as indicated on drawings.

Preparing of subgrade for building slabs, walks, and pavements.

Drainage fill course for support of building slabs is included as part of this work.

Excavating and backfilling of trenches within building lines for piping, foundations, footings, etc.

Excavating and Backfilling for Mechanical/Electrical Work: Refer to Divisions 15 and 16 sections for excavation and backfill required in conjunction with underground mechanical and electrical utilities and buried mechanical and electrical appurtenances.

Note that all backfilled utility trenches must be tested for soil compaction under buildings and paving.

Final Grading, together with placement and preparation of topsoil for lawns and planting, is specified in Division 2 Section, "Landscape Work."

Preparing of aggregate base for Concrete Paving is specified in a separate Div 2 section.

Preparing of aggregate base for asphalt paving is work required by Section 02513 "Asphalt Paving" and described in this section work type.

DEFINITIONS

Excavation consists of removal of material encountered to subgrade elevations indicated and subsequent disposal of materials removed.

Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be at Contractor's expense.

Under footings, foundation bases, or retaining walls, fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom, without altering required top elevation. Lean concrete fill may be used to bring elevations to proper position, when acceptable to Architect.

In locations other than those above, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by Architect.

Additional Excavation: When excavation has reached required subgrade elevations, notify Geotechnical Engineer, who will make an inspection of conditions. If Geotechnical Engineer determines that bearing materials at required subgrade elevations are unsuitable, continue excavation until suitable bearing materials are encountered and replace excavated material as directed by Geotechnical Engineer. **Notify the Architect immediately** of any additional excavation subject to additional cost to the Owner. Architect's Construction Administrator must review Geotechnical Engineer's recommendations prior to any excavation occurring. The Contract Sum may be adjusted by an appropriate Contract Modification.

Removal of unsuitable material and its replacement as directed will be paid on basis of Conditions of the Contract relative to changes in work.

Subgrade: The undisturbed earth or the compacted soil layer immediately below granular subbase and/or base, drainage fill, or topsoil materials.

Structure: Buildings, foundations, slabs, tanks, curbs, or other man-made stationary features occurring above or below ground surface.

SUBMITTALS

Test Reports: Submit the following reports directly to Architect from the testing services, with copy to Contractor:

Test reports on borrow material (**included in the contractor's base bid costs and/or fill unit price**).

Verification of suitability of each footing subgrade material, in accordance with specified requirements (**tests scheduled by contractor and paid for by Owner**).

Field reports of in-place soil density tests for fill required by the base bid contract (**tests scheduled by contractor and paid for by Owner**).

Test reports required for the removal of unsuitable material and additional verification of subgrade material below intended excavation lines. (**tests scheduled by contractor and paid for by Owner**).

QUALITY ASSURANCE

Codes and Standards: Perform excavation work in compliance with applicable requirements of authorities having jurisdiction.

Testing and Inspection Service: **The Owner** will employ and pay for a qualified independent geotechnical testing and inspection laboratory to perform soil testing and inspection service during earthwork operations. Contractor will coordinate scheduling of tests.

PROJECT CONDITIONS

Site Information: Data in subsurface investigation reports was used for the basis of the design and are available to the Contractor for information only. Conditions are not intended as representations or warranties of accuracy or continuity between soil borings. The Owner will not be responsible for interpretations or conclusions drawn from this data by Contractor.

The Report of Subsurface Exploration dated October 31, 2016

ECS CAROLINAS, LLP
1812 Center Park Drive Suite D
Charlotte, NC 28217
tel# 704.525.5152

-Full Reports are posted on line at www.rbsarch.com .

Contractor may perform, at his option, additional test borings and other exploratory operations; however, no change in the Contract Sum will be authorized for such additional exploration.

Existing Utilities: Locate existing underground utilities in areas of excavation work. If utilities are indicated to remain in place, provide adequate means of support and protection during earthwork operations.

Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.

Use of Explosives: Do not bring explosives onto site or use in work.

Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights.

Operate warning lights as recommended by authorities having jurisdiction.

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

Perform excavation by hand within dripline of large trees to remain. Protect root systems from damage or dryout to the greatest extent possible. Maintain moist condition for root system and cover exposed roots with moistened burlap.

PART 2 - PRODUCTS

SOIL MATERIALS

General: Provide borrow soil materials when sufficient satisfactory soil materials are not available due to quantities required by contour requirements.

Satisfactory soil materials are defined as those complying with ASTM D2487 soil classification groups that are clean subsoil free from debris, roots, topsoil, frozen material, and rock larger than 1/3 cu. ft. **that can be compacted to the densities herein specified, under the conditions defined.**

Unsatisfactory soil materials are defined as those complying with ASTM D2487 soil classification groups that are not capable of being compacted to the densities required or rock material larger than 1/3 cu. Ft. debris or consisting of debris or organic material.

Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at the time of compaction. However, soils with high moisture contents shall be remediated by means determined by the soils engineer to dry them until they attain a satisfactory moisture percentage.

Top soil: Fertile, friable, , natural soil of loamy character, free of clay clumps, stones in excess of 4" in greatest dimension, typical of project vicinity and containing no harmful chemicals or toxins harmful to plant growth.

Base Material: Naturally or artificially graded mixture of natural or crushed granite gravel, crushed stone, crushed slag, and natural or crushed sand.

Drainage Fill: Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, with 100 percent passing a 1-1/2 inch sieve and not more than 2 percent passing a No. 4 sieve.

Uses: Typical under floor slabs
 Typical around foundation drains
 Typical Backfill for retaining walls

Backfill and Fill Materials: Satisfactory soil materials free of clay, rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation and other deleterious matter. See drawing and subsurface investigation report for acceptable fill materials.

PART 3 - EXECUTION

EXCAVATION

Excavation Classifications: The following classifications of excavation will be made when rock is encountered:

Earth Excavation includes excavation of pavements and other obstructions visible on surface; underground structures, utilities, and other items indicated to be demolished and removed; together with earth and other materials encountered that are not classified as rock or unauthorized excavation.

Rock excavation for trenches and pits includes removal and disposal of materials and obstructions encountered that cannot be excavated with a track-mounted power excavator, equivalent to Caterpillar Model No. 215C LC, and rated at not less than 115 HP flywheel power and 32,000-pound drawbar pull and equipped with a short stick and a 42-inch wide, short tip radius rock bucket rated at 0.81 cubic yard (heaped) capacity. Trenches in excess of 10 feet in width and pits in excess of 30 feet in either length or width are classified as open excavation.

Rock excavation in open excavations includes removal and disposal of materials and obstructions encountered that cannot be dislodged and excavated with a modern, track-mounted, heavy-duty excavating equipment without drilling, blasting, or ripping. Rock excavation equipment is defined as Caterpillar Model No. 973 or equivalent track-mounted loader, rated at not less than 210 HP flywheel power and developing minimum of 45,000-pound breakout force (measured in accordance with SAE J732).

Typical of materials classified as rock are boulders 1/2 cu. yd. or more in volume, solid rock, rock in ledges, and rock-hard cementitious aggregate deposits.

Intermittent drilling, blasting, or ripping performed to increase production and not necessary to permit excavation of material encountered will be classified as earth excavation.

Do not perform rock excavation work until material to be excavated has been cross-sectioned and classified by geotechnical engineer. Such excavation will be paid on basis of Contract Conditions relative to changes in work and based on unit costs and volumes determined by geotechnical engineer and approved architect/owner.

Rock payment lines are limited to the following:

Two feet outside of concrete work for which forms are required, except footing.

One foot outside perimeter of footings.

In pipe trenches, 6 inches below invert elevation of pipe and 2 feet wider than inside diameter of pipe, but not less than 3 feet minimum trench width.

Outside dimensions of concrete work where no forms are required.

Under slabs on grade, 6 inches below bottom of concrete slab.

Additional Excavation: When excavation has reached required subgrade elevations, notify Architect/Engineer who will make an inspection of conditions.

If unsuitable bearing materials are encountered at required subgrade elevations, carry excavations deeper and replace excavated material as directed by Architect/Engineer.

Removal of unsuitable material and its replacement as directed will be paid on basis of contract conditions relative to changes in work.

Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.

Dispose of excess soil material and waste materials legally off site.

Excavation for Trenches: Dig trenches to the uniform width required for particular item to be installed, sufficiently wide to provide ample working room.

Except as otherwise indicated, excavate for exterior water bearing piping (water, steam, condensate, drainage) so top of piping is not less than 2'-6" below finished grade.

Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F.

STABILITY OF EXCAVATIONS

General: Comply with local codes, ordinances, and requirements of agencies having jurisdiction.

Slope sides of excavations to comply with local codes, ordinances, and requirements of agencies having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

Shoring and Bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers, and cross braces, in good serviceable condition. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Extend shoring and bracing as excavation progresses.

DEWATERING

Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.

Grade excavation top perimeter to prevent surface water run-off into excavation or to adjacent properties.

Protect sub-grades from softening, undermining, washout and damage by rain or water accumulation.

Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations.

Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavation as temporary drainage ditches.

Do not use excavated trenches as temporary drainage ditches.

Maintain the water level below the excavation sub-grade during excavation and construction.

Material disturbed below the foundation sub-grade due to improper dewatering shall be removed and replaced with stone bedding material at no expense to the Owner.

Dewatering by trench pumping will not be permitted if migration of fine grained natural material (running sand) from bottom, side walls, or bedding material will occur.

Dispose of water pumped from excavations into ditches or storm drains having the capacity to handle the volume of pumped water.

Contractor is responsible for acquiring all permits required to discharge the water and shall protect waterways from turbidity during the operation.

Prevent flooding of streets, roadways, or private property.

Provide noise attenuated engines when pumps will operate within 500 feet of a residence or commercial establishment.

STORAGE OF EXCAVATED MATERIALS

Stockpile excavated materials acceptable for backfill and fill where directed. Place, grade, and shape stockpiles for proper drainage.

Separate excavated materials in separate piles of suitable and unsuitable soils.

Locate and retain soil materials away from edge of excavations. Do not store within drip line of trees indicated to remain.

Dispose of excess excavated soil material and materials not acceptable for use as backfill or fill.

EXCAVATION FOR STRUCTURES

Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 foot.

Excavations for footings and foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed. Trim bottoms to required lines and grades to leave solid base to receive other work.

EXCAVATION FOR PAVEMENTS

Cut surface under pavements to comply with cross-sections, elevations and grades as indicated.

TRENCH EXCAVATION FOR PIPES AND CONDUIT

Excavate trenches to uniform width, sufficiently wide to provide ample working room and a minimum of 6 to 9 inches of clearance on both sides of pipe or conduit.

Excavate trenches and conduit to depth indicated or required to establish indicated slope and invert elevations and to support bottom of pipe or conduit on undisturbed soil.

COLD WEATHER PROTECTION

Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F.

BACKFILL AND FILL

General: Place soil material in layers to required subgrade elevations, for each area classification listed below, using materials specified in Part 2 of this Section.

Under grassed areas, use satisfactory excavated or borrow material.

Under walks and pavements, use base material, satisfactory excavated or borrow material, or a combination.

Under steps, use base material.

Under building slabs, use drainage fill material.

Under piping and conduit and equipment, use base materials where required over rock bearing surface and for correction of unauthorized excavation. Shape excavation bottom to fit bottom 90 degrees of cylinder.

Do not backfill trenches until tests and inspections have been made and Architect authorizes backfilling. Use care in backfilling to avoid damage or displacement of pipe systems.

Provide 4-inch-thick concrete base slab support for piping or conduit less than 2'-6" below surface of roadways. After installation and testing of piping or conduit, provide minimum 4-inch-thick encasement (sides and top) of concrete prior to backfilling or placement of roadway base.

Backfill excavations as promptly as work permits, but not until completion of the following:

Acceptance of construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.

Inspection, testing, approval, and recording locations of underground utilities have been performed and recorded.

Removal of concrete formwork.

Removal of trash and debris from excavation.

Removal of permanent or temporary horizontal bracing in place on horizontally supported walls.

PLACEMENT AND COMPACTION

Ground Surface Preparation: Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow strip, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface.

When existing ground surface has a density less than that specified under "Compaction" for particular area classification, break up ground surface, pulverize, moisture-condition to optimum moisture content, and compact to required depth and percentage of maximum density.

Place backfill and fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

Place backfill and fill materials evenly adjacent to structures, piping, or conduit to required elevations. Prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping, or conduit to approximately same elevation in each lift.

Control soil and fill compaction, providing minimum percentage of density specified for each area classification indicated below. Correct improperly compacted areas or lifts as directed by Architect if soil density tests indicate inadequate compaction.

Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of standard proctor maximum dry density, in accordance with ASTM D 698:

Under structures, building slabs and steps, and pavements, compact subgrade and each layer of backfill or fill material at 95 percent maximum density. Compact the upper 24 inches of subgrade to 100 percent maximum dry density.

Under lawn or unpaved areas, compact top 6 inches of subgrade and each layer of backfill or fill material at 92 percent maximum density.

Under walkways, compact top 6 inches of subgrade and each layer of backfill or fill material at 98 percent maximum density.

Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade or layer of soil material. Apply water in minimum quantity as necessary to prevent free water from appearing on surface during or subsequent to compaction operations.

Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.

Stockpile or spread soil material that has been removed because it is too wet to permit compaction. Assist drying by discing, harrowing, or pulverizing until moisture content is reduced to a satisfactory value.

GRADING

Grading Outside Building Lines: Grade areas adjacent to building lines to drain away from structures and to prevent ponding. Finish surfaces free from irregular surface changes and as follows:

Lawn or Unpaved Areas: Finish areas to receive topsoil to within not more than 0.10 foot above or below required subgrade elevations.

Walks: Shape surface of areas under walks to line, grade and cross-section, with finish surface not more than 0.10 foot above or below required subgrade elevation.

Pavements: Shape surface areas under pavement to line, grade, and cross-section, with finish surface not more than 1/2 inch above or below required subgrade elevation.

Grading Surface of Fill Under Building Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of 1/2 inch when tested with a 10-foot straightedge.

Compaction: After grading, compact subgrade surfaces to the depth and indicated percentage of maximum or relative density for each area classification.

PAVEMENT BASE COURSE

General: Base course consists of placing base material, in layers of specified thickness, over subgrade surface to support a pavement base and/or surface course.

Refer to other Division 2 sections for paving specifications.

Grade Control: During construction, maintain lines and grades including crown and cross-slope of base course.

Shoulders: Place shoulders along edges of base course to prevent lateral movement. Construct shoulders of acceptable soil materials, placed in such quantity to compact to thickness of each base course layer. Compact and roll at least a 12 inch width of shoulder simultaneous with the compaction and rolling of each layer of base course.

Placing: Place base course material on prepared subgrade in layers of uniform thickness, conforming to indicated cross-section and thickness. Maintain optimum moisture content for compacting base material during placement operations.

When a compacted base course is indicated to be 6 inches thick or less, place material in a single layer. When indicated to be more than 6 inches thick, place material in equal layers, except no single layer more than 6 inches or less than 3 inches in thickness when compacted.

Typical paved parking and general driveway area base course thickness shall be 6" under asphalt paving and if applicable, 8" under concrete dumpster pad, apron, and Heavy Duty Asphalt. See Architectural/Civil Drawings for locations.

BUILDING SLAB DRAINAGE COURSE

General: Drainage course consists of placement of drainage fill material, in 4" thick layers of indicated thickness, over subgrade surface to support concrete building and sidewalk slabs.

Placing: Place drainage fill material on prepared subgrade in layers of uniform thickness, conforming to indicated cross-section and thickness. Maintain optimum moisture content for compacting material during placement operations.

When a compacted drainage course is shown to be 6" thick or less, place material in a single layer. When shown to be more than 6" thick, place material in equal layers, except no single layer more than 6" or less than 3" in thickness when compacted.

FIELD QUALITY CONTROL

Quality Control Testing During Construction: **Contractor** (via the Owner's Testing Allowance) shall provide all soil testing necessary to insure that compacted soils and subgrades meets specified standards and in no case shall these tests be less than the following schedule. Allow testing service to inspect and approve each subgrade and fill layer before further backfill or construction work is performed.

Perform field density tests in accordance with ASTM D 1556 (sand cone method).

Footing Subgrade: **For each strata of soil** on which footings will be placed, **perform at least one test every 200 feet of perimeter but no less than three location tests** to verify required design bearing capacities. Subsequent verification and approval of each footing subgrade may be based on a visual comparison of each subgrade with related tested strata when acceptable to Architect/Soils Engineer.

Paved Areas and Building Slab Subgrade: Perform at least one field density test of subgrade for every 5,000 sq. ft. of paved area or every 3,000 sq. ft. of building slab, but in no case fewer than three tests. In each compacted fill layer, perform one field density test for every 3,000 sq. ft. of overlaying building slab or paved area, but in no case fewer than three tests.

Foundation wall Backfill: Take at least 2 field density tests, at locations and elevations directed.

If in opinion of Architect, based on testing service reports and inspection, subgrade or fills that have been placed are below specified density, perform additional compaction and testing until specified density is obtained, the cost of this retesting shall be paid as part of the contractor's project costs.

EROSION CONTROL

Provide erosion control methods in accordance with requirements of authorities having jurisdiction and requirements indicated in the drawings.

See Site Civil drawings for additional requirements.

MAINTENANCE

Protection of Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris.

Repair and reestablish grades in settled, eroded, and rutted areas to specified tolerances.

Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density prior to further construction.

Settling: Where settling is measurable or observable at excavated areas during general project warranty period, remove surface (pavement, lawn, or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

DISPOSAL OF EXCESS AND WASTE MATERIALS

Removal from Owner's Property: Remove waste materials, including unacceptable excavated material, trash, and debris, and dispose of it off Owner's property. **Follow all NCDENR requirements for off-site disposal of soils.**

End of SECTION 02200

SECTION 02361 - TERMITE CONTROL

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings, General Conditions and Supplementary General Conditions and other Division-1 Specification Sections, apply to this Section.

SUMMARY

This Section includes the following for termite control:

Soil treatment.

DEFINITIONS

EPA: Environmental Protection Agency.

PCO: Pest control operator.

SUBMITTALS

Product Data: Treatments and application instructions, including EPA-Registered Label.

Product Certificates: Signed by manufacturers of termite control products certifying that treatments furnished comply with requirements.

Qualification Data: For firms and persons specified in "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.

Warranties: Special warranties specified in this Section.

QUALITY ASSURANCE

Applicator Qualifications: A PCO who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment in jurisdiction where Project is located and who is experienced and has completed termite control treatment similar to that indicated for this Project and whose work has a record of successful in-service performance.

Regulatory Requirements: Formulate and apply termiticides, and label with a Federal registration number, to comply with EPA regulations and authorities having jurisdiction.

PROJECT CONDITIONS

Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with EPA-Registered Label requirements and requirements of authorities having jurisdiction.

COORDINATION

Coordinate soil treatment application with excavating, filling, and grading and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs, before construction.

WARRANTY

General Warranty: Special warranty 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.

Special Warranty: Written warranty (5 Years), signed by applicator and Contractor certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.

PART 2 - PRODUCTS

SOIL TREATMENT

Termiticide: Provide an EPA-registered termiticide complying with requirements of authorities having jurisdiction, in a soluble or emulsible, concentrated formulation that dilutes with water or foaming agent, and formulated to prevent termite infestation. Use only soil treatment solutions that are not harmful to plants. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to the product's EPA-Registered Label.

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:

AgrEvo Environmental Health, Inc.; a Company of Hoechst and Schering, Berlin.
American Cyanamid Co.; Agricultural Products Group; Specialty Products Department.
Bayer Corp.; Garden & Professional Care.
DowElanco.
FMC Corp.; Pest Control Specialties.
Zeneca Professional Products.

PART 3 - EXECUTION

EXAMINATION

Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of the soil, interfaces with earthwork, slab and foundation work, landscaping, and other conditions affecting performance of termite control. Proceed with application only after unsatisfactory conditions have been corrected.

PREPARATION

General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparing substrate. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil and around foundations.

Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated, except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended by termiticide manufacturer.

Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

APPLICATION, GENERAL

General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

APPLYING SOIL TREATMENT

Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute the treatment evenly.

Slabs-on-Grade and Basement Slabs: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.

Masonry: Treat voids.

Penetrations: At expansion joints, control joints, and areas where slabs will be penetrated.

Building perimeter: Treat entire perimeter upon building completion.

Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.

Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.

Post warning signs in areas of application.

Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

End of SECTION 02361

SECTION 02513 - ASPHALT CONCRETE PAVING

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

Reference all Civil & Architectural **Drawings**

DESCRIPTION OF WORK

Extent of asphalt concrete paving and base work is shown on drawings and includes resurfacing and new paving as detailed on drawings.

Prepared aggregate subbase (stone base) is specified as part of this section's work and its installation described per requirements of Section 02200 for stone base.

Automobile parking areas - 6" stone base after compaction TYPICAL.

Drive Aisles – 8" stone base after compaction.

SUBMITTALS

Material Certificates: Provide copies of materials certificates signed by material producer and Contractor, certifying that each material item complies with, or exceeds, specified requirements.

QUALITY ASSURANCE

Codes and Standards: Comply with North Carolina State highway department standard specifications, latest edition, and with local governing regulations if more stringent than herein specified.

Coordination: Close coordination of work schedules and schools operations are required before performing work of this contract. Prior to beginning work, contractor's are to notify (and must receive approval from) each school's Principal. Note that the existing lot must be repaved in "Phases" which allow 2/3 of the paved areas to remain in service at any time and allows 1/3 of paved areas to be out of service for paving work at any one time.

Weather Limitations: Apply prime and tack coats when ambient temperature is above 50 deg.F (10 deg.C), and when temperature has not been below 35 deg.F (1 deg.C) for 12 hours immediately prior to application. Do not apply when base is wet or contains an excess of moisture.

Construct asphalt concrete surface course when atmospheric temperature is above 40 deg.F (4 deg.C), and when base is dry. Base course may be placed when air temperature is above 30 deg. F (-1 deg.C) and rising.

Grade Control: Establish and maintain required lines and elevations.

PART 2 - PRODUCT

MATERIALS

General: Use locally available materials and gradations which exhibit a satisfactory record of previous installations.

Herbicide: "Roundup" by Monsanto or approved equivalent.

Base Course Aggregate: Sound, angular crushed stone, crushed gravel, or crushed slag, sand, stone or slag screenings.

Surface Course Aggregate: Crushed stone, crushed gravel, crushed slag, and sharp-edged natural sand.

Asphalt Cement: AASHTO M 226 (ASTM D 3381) for viscosity-graded material and AASHTO M 20 (ASTM D 946) for penetration-graded material.

Prime Coat: Cut-back asphalt type; AASHTO M 82 (ASTM D 2027) MC-30, MC-70 or MC-250.

Tack Coat: Emulsified asphalt, AASHTO M 140 (ASTM D 997) or M 208 (D 2397); SS-1, SS-1h, CSS-1 or CSS-1h, diluted with one part water to one part emulsified asphalt.

Lane Marking Paint: Chlorinated rubber-alkyd type, AASHTO M 248 (FS TT-P-115), Type III.

ASPHALT-AGGREGATE MIXTURE

Provide plant-mixed, hot-laid asphalt-aggregate mixture complying with standards of North Carolina State D.O.T. for Bituminous Concrete Surface Course, Type I-1.

PART 3 - EXECUTION

SURFACE PREPARATION - Paving:

Proof roll prepared subgrade and subbase surface to check for unstable areas and areas requiring additional compaction.

Notify Architect of unsatisfactory conditions. Do not begin subbase work until deficient subgrade areas have been corrected and considered acceptable for supporting base work. Do not begin paving work until deficient subbase areas have been corrected and are ready to receive base and/or paving.

SUBGRADE AND SUBBASE: See Division 2 for applicable specifications:

BASE: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, crushed slag, natural or crushed sand (D.O.T. "A, B, and C" stabilized aggregate stone base course material.)

SURFACE COURSE

Apply tack coat to contact surfaces of previously constructed asphalt or portland cement concrete and surfaces abutting or projecting into asphalt concrete pavement. Distribute at rate of 0.05 to 0.15 gal. per sq. yd. of surface. **(Reference CIVIL DWGS)**

LIGHT DUTY – Autotmobile Parking Areas

Place surface layer of **2" over 6" crushed aggregate base** (see drawings) (measured after compaction) asphalt concrete mixture NCDOT Asphalt Paving Type SF 9.5 A on prepared surface, spread and strike-off. Spread mixture at minimum temperature of 225 deg.F (107 deg.C). Place inaccessible and small areas by hand. Place course to required grade, cross-section, and compacted thickness.

HEAVY DUTY – Drive Aisles

Place surface layer of **1" over 2" binder course over 8" crushed aggregate base** (see drawings) (measured after compaction) asphalt concrete mixture NCDOT Asphalt Paving Type SF 9.5 A surface course / 2" Bitumnius 1 19.0 B Binder Course on prepared surface, spread and strike-off. Spread mixture at minimum temperature of 225 deg.F (107 deg.C). Place inaccessible and small areas by hand. Place course to required grade, cross-section, and compacted thickness.

JOINTS

Make joints between old and new pavements or between successive days' work, to ensure continuous bond between adjoining work. Construct joints to have same texture, density and smoothness as other sections of asphalt concrete course. Clean contact surfaces and apply tack coat.

ROLLING: (surface course Type I-1)

General: Begin rolling when mixture will bear roller weight without excessive displacement.

Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.

Breakdown Rolling: Accomplish breakdown or initial rolling immediately following rolling of joints and outside edge. Check surface after breakdown rolling, and repair displaced areas by loosening and filling, if required, with hot material.

Second Rolling: Follow breakdown rolling as soon as possible, while mixture is hot. Continue second rolling until mixture has been thoroughly compacted.

Finish Rolling: Perform finish rolling while mixture is still warm enough for removal of roller marks. Continue rolling until roller marks are eliminated and course has attained maximum density.

Patching: Remove and replace paving areas mixed with foreign materials and defective areas. Cut-out such areas and fill with fresh, hot asphalt concrete. Compact by rolling to maximum surface density and smoothness.

Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

TRAFFIC AND SPECIAL MARKINGS

Cleaning: Sweep and clean surface to eliminate loose material and dust.

Striping: Use chlorinated-rubber base traffic lane-marking paint, factory-mixed, quick-drying, and non-bleeding.

Color: White typical for special markings.

Color: White typical for parking and directional markings. Provide the following markings minimum:

An "in and out" direction arrow typically at each entry into property.

Parking space lines for as many spaces as shown on site plan.

Handicap parking spaces loading designations – one per handicap spaces.

Do not apply traffic and lane marking paint until layout and placement has been verified with Architect.

Apply paint with mechanical equipment to produce uniform straight edges.

FIELD QUALITY CONTROL

General: Test in-place asphalt concrete courses for compliance with requirements for thickness and surface smoothness. Repair or remove and replace unacceptable paving as directed by Architect.

Thickness: In-place compacted thickness will not be acceptable if exceeding following allowable variation from required thickness:

Base Course: 1/2", plus or minus.

Surface Course: 1/4", plus or minus.

Surface Smoothness: Test finished surface of each asphalt concrete course for smoothness, using 10' straightedge applied parallel with, and at right angles to centerline of paved area. Surfaces will not be acceptable if exceeding the following tolerances for smoothness.

Base Course Surface: 1/4".

Wearing Course Surface: 3/16".

Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template, 1/4".

Check surface areas at intervals as directed by Architect.

END OF SECTION 02513

SECTION 02514 - PORTLAND CEMENT CONCRETE PAVING

PART 1 - GENERAL

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work specified in this section.

DESCRIPTION OF WORK:

Extent of portland cement concrete paving is shown on drawings, including concrete curbs, steps, sidewalks and walkways.

Prepared subbase is specified in "Earthwork" section.

Concrete and related materials are specified in Division 3.

Joint fillers and sealers are specified in Division 7.

QUALITY ASSURANCE:

Codes and Standards: Comply with local governing regulations if more stringent than herein specified.

JOB CONDITIONS:

Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

Utilize flagmen, barricades, warning signs and warning lights as required.

PART 2 - PRODUCTS

MATERIALS:

Forms - General: Coat forms with a non-staining form release agent that will not discolor or deface surface of concrete.

Curbs: Steel of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects. (Note: wood forms for curbs are not allowed.)

Use flexible spring steel forms to form radius bends as required.

Shape: Standard profile for 6" tall curb with 12" gutter.

Sidewalks: Steel or wood of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects.

Truncated Dome Detectable Warning Pavers: Provide ADA compliant embedded tiles of 80 % recycled glass aggregate content with cast-in color. Product shall be equal to ECG Paver Tiles of Elizabeth City, NC.

Welded Wire Mesh: Welded plain cold-drawn steel wire fabric, ASTM A 185.

Reinforcing Bars: Deformed steel bars, ASTM A 615, Grade 40.

Cast Iron Sidewalk flumes: Provide 4" deep by top width required to cover storm pipe. Provide textured (checkered plate) exposed surface. See sidewalk storm drainage from canopy walkway covers.

Concrete Materials: Comply with requirements of applicable Division 3 sections for concrete materials, admixtures, bonding materials, curing materials, and others as required.

Expansion Joint Materials: Comply with requirements of applicable Division 7 sections for preformed expansion joint fillers and sealers.

Low VOC Liquid-Membrane Forming Curing Compound: Complying with ASTM C 309, Type I, Class A unless other type acceptable to Architect. Moisture loss not more than 0.55 gr./sq. cm. when applied at 200 sq. ft./gal.

Available Products: Subject to compliance with requirements, products, which may be incorporated in the work, include, but are not limited to, the following:

"Masterseal"; Master Builders.
"Ecocure"; Euclid Chemical Co.
"Clear Seal"; A.C. Horn.
"Sure Cure"; Kaufman Products Inc.
"Kure-N-Seal"; Sonneborn-Contech.
"Klearseal"; Seton Industries.

CONCRETE MIX, DESIGN AND TESTING:

Comply with requirements of applicable Division 3 sections for concrete mix design, sampling and testing, and quality control, and as herein specified.

Design mix to produce standard-weight concrete consisting of portland cement, aggregate, water-reducing or high-range water-reducing admixture (super-plasticizer), air-entraining admixture and water to produce the following properties:

Compressive Strength: 4000 psi for drive ways, 3000 for sidewalks ,minimum at 28 days, unless otherwise indicated.

Slump Range: 8" for concrete containing HRWR admixture (super-plasticizer); 3"-5" for other concrete.

Air Content: 5% to 8%.

PART 3 - EXECUTION

SURFACE PREPARATION:

Remove loose material from compacted subbase surface immediately before placing concrete.

FORM CONSTRUCTION:

Set forms to required grades and lines, rigidly braced and secured. Install sufficient quantity of forms to allow continuous progress of work and so that forms can remain in place at least 24 hours after concrete placement.

REINFORCEMENT:

Locate, place and support reinforcement as specified in Division 3 sections, unless otherwise indicated.

CONCRETE PLACEMENT:

General: Comply with requirements of ACI 330R for mixing and placing concrete, and as herein specified.

Do not place concrete until subbase and forms have been checked for line and grade. Moisten subbase if required to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

Place concrete using methods, which prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocation of reinforcing, dowels, and joint devices.

Use bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surface.

Deposit and spread concrete in a continuous operation between transverse joints, as far as possible. If interrupted for more than 1/2-hour, place a construction joint.

Curbs: Automatic machine may be used for curb placement at Contractor's option. If machine placement is to be used, submit revised mix design and laboratory test results, which meet or exceed minimums specified. Machine placement must produce curbs and gutters to require cross-section, lines, grades, finish, and jointing as specified for formed concrete.

JOINTS:

General: Construct expansion, weakened-plane (contraction), and construction joints true-to-line with face perpendicular to surface of concrete. Construct transverse joints at right angles to the centerline, unless otherwise indicated.

Weakened-Plane (Contraction) Joints: Provide weakened- plane (contraction) joints, sectioning concrete into areas as shown on drawings. Construct weakened-plane joints for a depth equal to at least 1/4 concrete thickness, as follows:

Tooled Joints: Form weakened-plane joints in fresh concrete by grooving top portion with a recommended cutting tool and finishing edges with a jointer.

Construction Joints: Place construction joints at end of placements and at locations where placement operations are stopped for a period of more than 1/2-hour, except where such pours terminate at expansion joints.

Construct joints as shown or, if not shown, use standard metal keyway-section forms.

Expansion Joints: Provide premolded joint filler for expansion joints abutting concrete curbs, catch basins, manholes, inlets, structures, walks and other fixed objects, unless otherwise indicated.

Locate expansion joints at 30' maximum for each walk and curb run, unless otherwise indicated.

Extend joint fillers full-width and depth of joint, and not less than 1/2" or more than 1" below finished surface. Fill within 1/8" of finish surface with joint sealer.

Fillers and Sealants: Comply with the requirements of applicable Division 7 sections for preparation of joints, materials, installation, and performance.

CONCRETE FINISHING:

After striking-off and consolidating concrete, smooth surface by screeding and floating. Use hand methods only where mechanical floating is not possible. Adjust floating to compact surface and produce uniform texture.

After floating, test surface for trueness with a 10' straightedge. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide a continuous smooth finish.

Work edges of slabs, gutters, back top edge of curb, and formed joints with an edging tool, and round to 1/2" radius, unless otherwise indicated. Eliminate tool marks on concrete surface.

After completion of floating and troweling when excess moisture or surface sheen has disappeared, complete surface finishing, as follows:

Broom finish, by drawing a fine-hair broom across concrete surface, perpendicular to line of traffic. Repeat operation if required to provide a fine line texture acceptable to Architect.

On inclined slab surfaces, provide a coarse, non-slip finish by scoring surface with a stiff-bristled broom, perpendicular to line of traffic.

Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point-up any minor honeycombed areas. Remove and replace areas or sections with major defects, as directed by Architect.

CURING:

Protect and cure finished concrete paving, complying with applicable requirements of Division 3 sections. Use membrane-forming curing and sealing compound or approved moist-curing methods.

REPAIRS AND PROTECTIONS:

Repair or replace broken or defective concrete, as directed by Architect.

Sweep concrete walks and wash free of stains, discolorations, dirt and other foreign material just prior to final inspection.

END OF SECTION 02514

SECTION 02720 – SANITARY SEWER CONSTRUCTION

RELATED DOCUMENTS:

Drawings, General Conditions and Supplementary General Conditions and other Division-1 Specification Sections, apply to this Section.

COORDINATE WITH CIVIL – UTILITY DRAWINGS.

MATERIAL SPECIFICATIONS FOR SANITARY SEWER CONSTRUCTION

Unless superseded or modified by a Special Provision, all material, apparatus, supplies, methods of manufacture, or construction shall conform to the specifications for same contained in this Section. National material Standards (ASTM, ANSI, etc.) referred to herein shall be considered to be the latest revisions only.

Vitrified Clay Pipe: Not allowed on this project.

Polyvinyl Chloride Pipe:

Polyvinyl Chloride Sewer Pipe: Plastic pipe for laterals, sizes 4" and 6", shall be solid wall extra strength (Schedule 40) pipe; pipe and fittings shall be PVC plastic conforming to the requirements of ASTM D2751-75. Pipe of all sizes shall be joined together by means of sleeve connectors chemically welded to the pipe ends. Fittings shall be as detailed in the manufacturer's catalog, or equal. Standard in-line wyes shall be used.

GRANULAR BEDDING MATERIAL: All bedding material shall be angular, clean washed stone graded in accordance with Size #67 in ASTM D448 for "Standard

Sizes of Coarse Aggregate".

100%	Passing 1"
90 - 100%	Passing 3/4"
20 - 55%	Passing 3/8"
0 - 10%	Passing #4
0 - 5%	Passing #8

Bedding material will be used only as instructed in the Specifications and/or as specifically directed by the Engineer.

STONE STABILIZATION MATERIAL: All stone stabilization material shall be angular, clean washed crushed stone graded in accordance with standard sizes #467 or #357 in ASTM D448.

Stabilization material will be used only as directed in the specifications and/or as specifically directed by the Engineer.

BACKFILL MATERIALS: All backfill materials shall be of a relatively non-plastic nature, free from roots, vegetative matter, waste, construction debris, or other objectionable material and shall be sufficiently close to optimum moisture content that specified compaction requirements can be met. Backfill material shall exhibit no tendency to flow or behave in a plastic manner under the blows of a mechanical tamp. Any material deemed unsuitable by the Engineer will be completely removed from the project site before backfill operations begin.

DETAILED SPECIFICATIONS FOR SANITARY SEWER CONSTRUCTION

HANDLING AND STORAGE OF MATERIALS: The Contractor shall be responsible for the safe storage of materials furnished by or to him, and accepted by him and intended for the work, until they have been incorporated in the completed project. The interior of the pipe, manholes and other accessories shall be kept free from dirt and foreign materials at all times.

Transportation of Materials and Equipment: The Contractor and his Suppliers are directed to contact the North Carolina Department of Transportation to verify axle load limits on State maintained roads and bridges which would be used for hauling of equipment and materials for this project. The Contractor and his Suppliers shall do all that is necessary to satisfy the Department of Transportation requirements and will be responsible for any damage to said roads which may be attributed to this project.

All materials furnished by the Contractor shall be delivered and distributed at the site by the Contractor.

Ductile iron pipe and cast iron accessories shall be loaded and un-loaded by lifting with hoists or skidding so as to avoid shock or damage. Concrete pipe, clay pipe, and precast manholes will be unloaded with hoists and/or as recommended by the respective manufacturers. Under no circumstances shall such materials be dropped. Pipe handled on skid ways shall not be skidded or rolled against pipe already on the ground.

Responsibility for Materials on Site: In distributing the material at the site of the work, each piece shall be unloaded opposite or near the place where it is to be laid in the trench. Pedestrian or vehicular traffic shall not be unduly inconvenienced in placing of material along the streets or right-of-way, as applicable.

Material and Equipment Storage: The Contractor will be responsible for locating and providing storage areas for construction materials and equipment. Any storage areas on property of the Owner shall be approved by the Owner. The Contractor shall be responsible for the safeguarding of materials and equipment against fire, theft, and vandalism and shall not hold the owner responsible in any way for the occurrence of same.

Care of Coatings and Linings: Pre-cast manholes, pipe and fittings including rings and covers, steps, straps, etc., shall be so handled that the coating or lining will not be damaged. If, however, any part of the coating or lining is damaged, the repair shall be made by the Contractor at his expense in a manner satisfactory to the Engineer.

WORKMANSHIP REQUIREMENTS: The Contractor shall make the necessary excavations, install the sewer pipe and appurtenances, place and compact the backfill, conduct testing and restore the disturbed area as specified below.

Excavation: All excavations for pipe laying, manholes, drainage ditches, grading and any other excavation required for the proper completion of this contract shall be included herein.

Trench Excavation: No more trench (100± LF) shall be opened in advance of the pipe laying than is necessary to expedite the work unless prior approval is given by the Engineer. Ground conditions and/or location requirements shall govern the amount of trench open at any one time as determined by the Engineer.

Trench Width: Trench width for pipe thirty-three (33) inches and smaller in inside diameter shall be equal to the outside diameter (as measured at the bells) of the pipe plus twelve (12) inches on each side of pipe. Trench width shall be measured between faces of cut at the top of the pipe bell. If the Contractor varies from this requirement without prior approval of the Engineer, or if specified trench widths cannot be maintained, improved bedding shall be installed as directed by the Engineer. In certain areas, because of the location of this construction, the Contractor may not be able or may not be allowed by the Engineer to slope trench walls as required by OSHA (i.e. 1 to 1 slope). If this situation occurs, the Contractor will be required to sheet, shore work from within a shoring box, etc., and do all that is necessary to maintain minimal trench widths and still meet OSHA requirements for this construction.

Trench Bottom Conformation: The excavation shall be made to the elevations, grades, and lines shown on the Construction plans unless otherwise approved by the Engineer. The trench bottom shall be excavated slightly above grade and cut down to the pipe grade by hand in the fine grading operation. The trench bottom shall be true and even with bell holes at each joint to provide the barrel of the pipe with soil and/or granular bedding (as applicable) support for its full length. This should prevent point loading at the

bells. If the trench bottom is inadvertently cut below grade, the Contractor shall fill it to grade with approved material thoroughly tamped. Pipe depth and/or soil conditions may dictate a granular embedment as specified below. Such bedding shall also be shaped to allow adequate support of the pipe along the full length of the barrel. If the trench passes either under or over another pipeline or previous excavation, the Contractor shall make the Engineer aware of the same and if so instructed shall install ductile iron pipe for the length specified. The trench bottom in this area shall be tamped, if necessary, so the disturbed soil has approximately the same supportive strength as the native soil regardless of the type pipe ultimately installed.

Preparation of Pipe Subgrade: The pipe subgrade shall be prepared in accordance with the applicable method shown on the plans and shall be true to line and grade and uniformly firm. Where the subgrade material is found to be of poor supporting value, the subgrade shall be conditioned by removing the existing material by undercutting to the depth as directed by the Engineer, within the limits established on the plans, and backfilling with crushed stone or gravel. When necessary, the contractor shall provide for the temporary diversion of water in order to maintain the pipe subgrade in a dry condition. The material used for conditioning the subgrade will be classified as subgrade stone. The quantity of subgrade stone to be paid for will be the actual number of cubic yards of this material, as determined by field measurements made by the Engineer which has been used to replace pipe undercut excavation.

Excavation for Structures: The excavation shall be made to the lines grades and elevations shown on the Plans and Standard Details. The area excavated shall be limited to no more than is necessary to allow the proper installation of the structure as determined by the Engineer. The excavation shall remain open no longer than is necessary to allow the proper and complete installation of the structure.

Structure Pit Bottom Conformation: The pit bottom shall be true and even, and capable of supporting the structure as determined by the Engineer. If the pit bottom is inadvertently cut below grade, the Contractor shall fill it to the proper elevation with approved material capable of continually maintaining adequate supportive strength.

Rock Excavation: See unit prices for payment for rock excavation.

Piling Excavated Material: All excavated material shall be piled in a manner that will not endanger the work. Excavated material will be piled a safe distance away from the edge of the excavation allowing room for an adequate angle of repose and if shoring, sheeting, and bracing is used to protect the excavation, no material will be piled within three (3) feet of the nearest edge. Sidewalks, driveways, hydrants, valve pit covers, valve boxes, curb stopboxes, existing manholes, fire and police call boxes or other utility controls shall be unobstructed and accessible until the work is completed. Gutters, catch basins, and natural watercourses shall not be obstructed or silted. When working in close proximity with a creek channel or natural watercourse the Contractor shall pile all excavated material on the side of his excavation away from the watercourse.

Water Removal: The Contractor shall at all times provide and maintain ample means and equipment with which to remove and properly dispose of any and all water entering the excavation or other parts of the work and keep all excavations dry until such time as pipe laying and grading is completed and structures to be built therein are completed. No water shall be allowed to rise around the pipe in unbackfilled trenches nor shall it be allowed to rise over masonry until the concrete or mortar has set for a minimum of 24 hours. All water pumped or drained from the work shall be disposed of in such a manner as to prevent siltation and erosion to adjacent property or other construction.

Sheeting, Sheathing, Shoring, and Bracing: Safe construction practices are both a legal and moral obligation of the Contractor to his employees and to the general public. Sheeting, sheathing, shoring, and bracing shall be used whenever necessary to prevent caving of trench banks. The Contractor shall make himself fully aware of all rules, regulations, laws, and ordinances governing safe construction practices and shall conform to them for the duration of the project. Faulty and/or unsafe construction practices will

be reported to the appropriate regulatory agency for disposition. Decision of the Engineer relative to bracing for protection of structures and/or roadway will be binding upon the Contractor. The removal of sheathing or sheeting shall be done in such a manner as to minimize the friction loss between the backfill and trench walls. Sheathing or sheeting will be cut off and left in place where its removal will adversely affect the utility installation as determined by the Engineer.

Pipe Laying: In all instances pipe shall be laid in a workman-like manner, true to line and grade, with bell ends facing up-grade in the direction of laying. The various pipes referred to herein shall be handled, belled up and laid in accordance with the manufacturer's requirements and good engineering practices as defined in the various publications referenced in this document.

Trench excavation, sheeting, sheathing, or shoring and bracing, dewatering, etc., shall be performed as specified above.

Pipe Bedding: Unless otherwise specified or noted on the Plans the following bedding classes are as commonly required by the Engineer.

Type I - Shaped Bottom Bedding: Shall be so the pipe bears uniformly upon undisturbed native earth. Hand excavation is required to shape the trench to conform to the pipe barrel and the pipe bells. The pipe bells are not to support the pipe. Clean backfill shall be placed and carefully and uniformly tamped by hand to a 95% standard proctor density so as to eliminate the possibility of lateral movement around the pipe (and completely under the pipe haunches) in uniform layers not exceeding six (6) inches loose to a depth of 1'-0" above the top of pipe.

Type II - Granular Material Embedment: For Type II bedding, the trench bottom is undercut a minimum of six (6) inches below the pipe barrel grade and filled with a No. 67 stone to the pipe midpoint and backfilled with clean backfill, placed in 6 inch loose layers and compacted to 95%.

Type III - Granular Material Embedment: For Type III bedding, the trench bottom is undercut a minimum of six (6) inches below the pipe barrel grade and filled with a No. 67 stone to a minimum of 6" above the top of the pipe, and backfilled with clean backfill, placed in 6 inch loose layers and compacted to 95%.

Concrete Encasement and Cradles: Shall be as shown in the Standard Details, with Class A (3000 psi) concrete a minimum of 6" all around the pipe. When granular material embedment is required, the Contractor will follow the layered procedure specified in Type I for soil placement, above the granular bedding, to an elevation one (1) foot above the top of the pipe bell.

Backfill: All backfill shall be of a relatively non-plastic nature free from roots, vegetative matter, waste, construction material, or other objectionable material (including but not limited to rock larger 4" in any dimension). Rock shall not exceed 25% of the fill material, nor shall any rock be placed within 2 feet of the pipeline. Backfill material shall be capable of being tamped by mechanical tamps using relatively low velocity and heavy blows. The material shall have no tendency to flow or behave in a plastic manner under the tamping blows. Material deemed by the Engineer as unsuitable for backfill purposes shall be removed from the job site before backfilling operations begin.

Backfilling of Trenches: Backfill shall be accomplished immediately after the pipe is laid. Backfill around pipe and to an elevation of one (1) foot above the pipe bell shall be done only by hand and in layers not exceeding six (6) inches with each and every layer thoroughly tamped. The first three (3) feet of fill shall be completely free of rocks. Successive layers of backfill shall be compacted in place as specified below. Under no circumstances shall water be permitted to rise in unbackfilled trenches after the pipe has been placed. Should water rise in an unbackfilled ditch after the pipe has been placed, the Engineer may require the Contractor to remove the pipe, muck the trench and follow the procedure for either Type II or Type III Granular Embedment when re-laying the pipe.

Backfill of trenches within sewer main rights-of-way: Trenches excavated outside existing roadway and railway right-of-way may be backfilled, above the initial one (1) foot, by mechanical means in layers up to six (6) inches thick unless otherwise directed by the Engineer.

Backfill of trenches within road and railway rights-of-way: Trenches excavated within existing road and railway rights-of-way shall be backfilled in layers not to exceed six (6) inches and each successive layer shall be thoroughly tamped.

Compaction Requirements: Compaction shall be attained by the use of mechanical tamps only. Each layer of backfill shall be placed loose and thoroughly compacted in place. Heavy rollers, vehicles or other equipment shall not be used for compacting pipeline and structure backfill nor allowed to cross over completed work except at points adjudged capable of adequately protecting the pipeline. Pneumatic tamps, gasoline ram type tamps or vibrating tamps with sheepsfoot rollers will be required to meet the specifications of "Mechanical Tamp". Variance shall only be with the explicit approval of the Engineer.

Compaction Within Sewer Rights-of-Way: Trenches excavated outside existing road and railway rights-of-way shall be backfilled as herein before specified and tamped thoroughly:

All material greater than 6" below final grade shall have an in-place density of at least 95% standard proctor. All material shall have an in-place density of 100% to a depth of 6" below final grade.

Should any public or private roadways, service roads, drives, etc., be encountered during this construction, the Contractor shall at the Engineer's direction comply with those compaction requirements specified below for work within road and railway rights-of-way.

Compaction Within Road and Railway Rights-of-way: Unless otherwise approved by the controlling agencies, trenches excavated within existing road and railway rights-of-way and all structure excavated regardless of location shall be backfilled as specified above and thoroughly tamped:

Unless otherwise directed by the Engineer, all material from the bottom of trench to within six (6) inches of the subgrade shall have an in-place density of 95% of the maximum dry density as defined by a standard proctor curve for the material.

All material within six (6) inches of the subgrade level shall have an in place density of 100% of the maximum dry density.

On roadway shoulders, all material shall have an in place density of 95% of the maximum dry density. The Contractor shall remove and replace all material failing to meet these requirements with suitable material. The extent of this removal shall be determined by the Engineer.

Replacement of Wet or Unsuitable Material: When the Engineer determines that the material excavated from the trench is unsuitable for backfill because of the material type or because it contains excessive debris, rock or organics, it shall be removed from the project and replaced with a backfill material approved by the Engineer. When the moisture content of an otherwise suitable material is too high to achieve specified compaction, as determined by a moisture content and density test, the Contractor shall replace the material as necessary to meet backfill requirements. The wet material may be dried to optimum moisture content and used for backfill in subsequent phases of the project. Should an otherwise suitable material be found too dry to achieve compaction requirements, water may be added to the material to raise the moisture content to optimum. Borrow material placed at the direction of the Engineer shall be clean earth at optimum moisture content, or ABC stone.

Removal and Restoration of Pavement and Road Surfaces: All restored bituminous and concrete pavements shall be placed to existing cross-section and ride quality. Restored pavement will in all instances be flush and level with existing pavement at the sawed edges, and at existing gutter lines where applicable unless otherwise approved by the Engineer. When pavement repairs do not meet the above criteria or are not performed in a workmanship manner as determined by the Engineer, the Contractor will

remove and re-perform the restoration as specified. Pavement will be replaced as follows. In all pavement cuts either the permanent pavement or a temporary pavement consisting of 1" - 1 1/2" of black asphaltic concrete (later to be replaced permanently) will be placed immediately upon completion of the subgrade unless otherwise approved by the Engineer.

Specifications for Cutting Pavement: Unless otherwise approved or required, concrete pavement shall be removed to the nearest expansion or contraction joint. Where sawed joints are allowed, the depth of the sawed cut shall be at least one (1) inch and shall extend at least 1/5 of the depth of the concrete. More depth may be required if necessary to prevent damage to surrounding pavement. Bituminous pavement shall be cut in a smooth and straight line. Sawing is required on asphaltic concrete. The width of pavement left between the edge of the ditch and the existing edge of the pavement or the front line of the gutter, shall be at least 2 feet. Residual strips of pavement less than 2 feet in width must be removed and replaced. Existing pavement shall be removed on each side of the trench for at least 6 inches beyond top of trench. The Contractor shall remove and replace pavement which, in the opinion of the Engineer, has been cracked or displaced by the operation of the Contractor.

Specification For Restoring Concrete Pavement: The concrete used to restore pavement shall have a minimum 28 day compressive strength of 4000 psi. The concrete as placed shall conform to the shape, grade, and finish of the existing pavement and will be one (1) inch deeper than the original pavement including base, but in no instance less than six (6) inches.

Specification for Restoring Flexible Bituminous Pavement: All material above the sub-base level shall be hot-mix bituminous concrete conforming to North Carolina State Division of Highway Specifications for both mix design and placement. The asphalt pavement as placed shall be one (1) inch deeper than the original pavement including base, but in no instance less than three (3) inches. The asphalt shall be placed in lifts not greater than 4 inches and shall be hot mix bituminous concrete binder type H. The last one (1) inch in either instance shall be bituminous plant mix (I-2) suitable. If a bituminous surfacing overlays a concrete base, the Contractor, at the option of the Engineer, shall replace the concrete to its original thickness, or to a level 2 inches below the finished surface. The Engineer may direct the Contractor to omit all concrete and to replace the pavement with bituminous materials. Tack coats shall be employed with each lift. Tack coats shall be placed on both horizontal and vertical surfaces (pavement cuts or face of concrete gutters).

Portland Cement Concrete:

Acceptance of Concrete: Concrete shall be accepted on the basis of its meeting the requirements listed under the Material Specifications and Detail Specifications Section of this contract. The Engineer shall make or require any tests as he deems necessary to insure that the concrete meets specifications. The Engineer may require the test to be performed by an independent testing laboratory at the Contractor's expense.

Depositing: Concrete will not be accepted if it cannot be placed within ninety (90) minutes of the dispatch time. Time requirements may fluctuate marginally due to temperature. Concrete shall be deposited in such a manner so as to prevent contamination by foreign material and segregation due to rehandling or flowing. Segregated concrete and/or concrete containing foreign material will not be accepted. Depositing will not be permitted when temperature has not exceeded 35 degrees and rising by 10:00 A.M. Depositing shall cease when the descending air temperature in the shade falls below 40 degrees Fahrenheit. It shall not resume until the ascending air temperature rises to 35 degrees F. All concrete shall be kept from freezing by the Contractor. Frozen concrete shall be replaced at the Contractor's expense. Free fall shall not exceed 3 feet in any case. Mechanical vibrators, of an approved type, and continuous spading and/or rodding of concrete shall be used to produce proper contact of concrete with forms and reinforcing steel in piers and with forms and pipe in monolithic inverts insuring a compact, dense and impervious artificial stone of uniform texture.

Curing: All concrete will be cured for a seven (7) day period after placement according to the following procedure.

Forms will normally be left in place for the entire seven (7) day period. Exposed surfaces not covered by forms will be kept moist continuously for the entire seven day period or will be cured through use of an approved curing compound which will be applied after all surface water has disappeared.

At the discretion of the Engineer, forms may be removed after the initial set and before the end of the seven day period. In such cases the areas previously covered by forms shall be cured as described above.

The Engineer may permit backfill of certain structures (e.g. concrete piers) before the end of the curing period. In such cases, the forms shall be stripped and the surfaces that remain exposed after backfill shall be cured as described in (a) above. Curing compound shall not be required for backfill surfaces except where specified by the Plans or Special Provisions.

Finishing: The structure shall have a uniform and textured surface. All form marks exposed to view shall be rubbed off with a stone.

Testing: The Contractor shall cooperate with the Engineer in the testing of materials and workmanship. The Contractor shall make one man available to assist the Engineer in making and handling test specimens on the job. The Engineer should not require this assistance for more than five (5) hours per week. Contractor shall notify Engineer and City Utilities Inspectors a minimum of 48 hours prior to all testing and pre-testing. Attendance of Engineer and City Utilities inspector is mandatory for final tests to pass. Contractor shall perform pre-testing until passing tests are achieved, and shall then schedule final testing with Engineer and Utilities Dept. Inspectors.

Air Testing of Pipe: Low pressure air testing is required. The pipeline is considered acceptable if when tested at an average back pressure of 3.5 psi (or greater than the average back pressure of any ground water that may submerge the pipe) the section under test does not lose air at a rate greater than 0.0015 cfm per square foot of internal pipe surface. The Engineer and City Utilities inspector shall be present for all final passing test of each gravity sewer pipe segment. Contractor shall conduct pre-testing until passing tests are achieved. City Utilities inspector shall be notified a minimum of 48 hours prior to all repairs and final tests.

Flushing of Lines: At completion of the work, lines shall be thoroughly cleaned by flushing with water to remove all dirt and debris. Pipeline shall be flushed at a rate of at least 2.5 feet per second for a duration suitable to the Utilities Director. An approved source of non-potable water may be used to flush sewer lines, however a method to keep silt and debris from entering the pipe must be demonstrated and approved. New Sanitary Sewer mains must either remain disconnected from the existing collection system or must have an approved water-tight plug installed at point of connection to existing collection system until approval to activate the new main is received from Salisbury-Rowan Utilities and NC DENR. Soil and debris shall not be discharged into the existing sanitary sewer collection system.

SAFETY: The Contractor shall be responsible for the safety of all vehicles and persons and shall place barricades, signs, and warnings in the proper areas. The Owner shall not be held responsible for any damage or injuries incurred under this Contract.

The Contractor and any subcontractors or suppliers shall be solely responsible for the complete compliance with all applicable Federal, State, and Local Laws, ordinances, regulations, or decrees relevant to the safe conduct of the work and the protection of both their employees and the general public and private property encountered during construction. This obligation shall include but not be limited to all requirements set forth within Title 29 - Labor, Chapter XVII- Occupational Safety and Health Administration, Department of Labor, Part 1926 - Occupational Safety and Health Regulations for Construction, and Part 1910 - Occupational Safety and Health Standards (applicable to construction work). Pursuant to this OSHA regulation, the Owner and the Engineer do not propose to either delineate

all necessary safety precautions to be employed by the Contractor nor to take corrective measures when said precautions are not taken, but will endeavor to report any unsafe action or violation to the appropriate enforcement agency.

EXISTING UTILITIES: The Construction Plans for this project have been prepared by a consulting Engineer under Contract to the Owner. Utility Lines and/or underground structures shown on the plans are as determined by the Consulting Engineer. In many cases, such locations are not precise and conflicts with the sewer construction may occur. It shall therefore be required that the Contractor excavate to determine the precise location of utilities, or other underground obstructions, which are shown on the Construction Plans. Such location and excavation shall be at least 500 feet ahead of construction.

All utility owners will be notified prior to excavation. Owners who are members of N.C. ONE-CALL may be notified in accordance with current N.C. ONE-CALL procedures. The Contractor will be fully responsible for damage to any utilities. Prior to any test digging, the Contractor shall notify the City of Salisbury Utilities Dept. a minimum of 48 hours prior to beginning any excavation work.

Utility owners may at their option, have representatives present to supervise excavation in the vicinity of their utilities. The cost of such supervision, if any, shall be borne by the Contractor.

Conflicts with underground utilities may necessitate changes in alignment and/or grade of this construction. All such changes will be approved by the Engineer and SRU before construction proceeds.

When underground obstructions not shown on the Construction Plans are encountered, the Contractor shall promptly report the conflict to the Engineer and shall not proceed with construction until the conflict is resolved by the Engineer and all proposed changes affecting water and sanitary sewer alignment, grade, cover, etc. are received by and approved by the City of Salisbury Utilities Dept.

END OF SECTION 02720

SECTION 02721 - STORM SEWER SYSTEM

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings, General Conditions and Supplementary General Conditions and other Division-1 Specification Sections, apply to this Section.

COORDINATE WITH CIVIL DRAWINGS FOR STORM SEWER DETAILS
& REQUIRED DETENTION SYSTEM.

SUMMARY

This Section includes storm sewerage system piping and appurtenances from connection to a point outside the building where it is discharged into the discharge area or retainage pond/erosion control drainage system.

Related Sections: The following sections contain requirements that relate to this section:

Division 2 Section "Earthwork" for excavation and backfill required for storm sewerage system piping and structures.

Division 4 Section "Masonry Work" for masonry materials used to construct drainage structures.

See Division 2 "Concrete "Portland Cement Concrete Paving" for sidewalk checkerplate "Flumes" to convey storm water thru public street sidewalks to curb collection points.

QUALITY ASSURANCE

Environmental Compliance: Comply with applicable portions of local environmental agency regulations pertaining to storm sewerage systems.

Utility Compliance: Comply with local utility regulations and standards pertaining to storm sewerage systems.

PROJECT CONDITIONS

Site Information: Perform site survey, research public utility records, and verify existing utility locations. Verify that storm sewerage system piping may be installed in compliance with original design and referenced standards.

Locate existing storm sewerage system piping and structures that are to be abandoned, maintained, or closed.

SEQUENCING AND SCHEDULING

Coordinate with interior building storm drainage piping.

Coordinate with other utility work.

Install storm work at a point in the construction that load bearing construction traffic over storm drainage system will not adversely damage storm work.

PART 2 - PRODUCTS

MANUFACTURERS

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:

Cleanouts:

Ancon, Inc.
Smith (Jay R.) Mfg. Co.
Wade Div.; Tyler Pipe.

Zurn Industries, Inc.; Hydromechanics Div.

PIPE AND FITTINGS

General: Provide pipe and pipe fitting materials compatible with each other. Where more than one type of materials or products is indicated, selection is Installer's option.

Polyvinyl Chloride (PVC) Sewer Pipe: ASTM D 3033, Type PSP, SDR 35; or ASTM D 3034, Type PSM, SDR 35.

Uses: Piping less-than or equal to 12" diameter located under grade **where noted on drawings as "PVC"**.

Fittings: PVC, ASTM D 3033 or D 3034, solvent cement joints complying with ASTM D 2855 using solvent cement complying with ASTM D 2654; or elastomeric joints complying with ASTM D 3212 using elastomeric seals complying with ASTM F 477.

Flared End Outlet: Provide flared end pipe for PVC storm drainage pipe ending where grade meets daylight.

Downspout roof leader boots: Provide transition boot to connect rectangular downspout to storm drainage below grade. Provide PVC offset adapter transitioning from a 4"x6" rectangular downspout to a round diameter PVC drain pipeboot in sizes as required. Gutterworks Adapter or equal product.

HDPE Storm Sewer Pipe: **(if indicated on Civil Plans as approved for use on this project)**
Double walled plastic pipe shall be HDPE N-12 smooth wall interior pipe as manufactured by Advanced Drainage Systems, Inc. or approved equal. The pipe shall meet the requirements of AASHTO M252, M294, and ASTM D 2412.

Uses: IF indicated on the plans As **"HDPE"** in sizes indicated.

Hubless Cast-Iron Soil Pipe and Fittings: CISPI 301, gray cast iron, for coupling joints.

Couplings: CISPI 310, ASTM C 564 neoprene sealing sleeve, with 300 Series stainless steel corrugated shield and clamp assembly.

Reinforced Concrete Sewer Pipe: (diameters greater than 12" noted as **"RCP"**): ASTM C 76, Class II, grouted joints.

CLEANOUTS

General: Provide cast-iron ferrule and countersunk brass cleanout plug, with round cast-iron access frame and heavy-duty, secured, scoriated cast-iron cover.

CATCH BASINS

Brick or Precast Concrete Catch Basins: See Site Civil drawings for types and configurations of brick and mortar, of depth indicated. Wall thickness shall be 8 inches minimum, and inside diameter shall be 48 inches with tapered top for a 24-inch frame and grate, unless otherwise indicated. Thickness of section of wall deeper than 8 feet shall be 12 inches minimum.

Base, Channel, and Bench: Concrete.

Wall: ASTM C 32, Grade MS, manhole brick.

Mortar and Parging: ASTM C 270, Type S, using ASTM C 150, Type II Portland cement.

Catch Basin Frames and Grates: ASTM A 536 Grade 60-40-18, heavy-duty, ductile iron, shape and size detailed.

CONCRETE AND REINFORCEMENT

Concrete: Portland cement mix, 3,000 psi.

Cement: ASTM C 150, Type II.

Fine Aggregate: ASTM C 33, sand.

Coarse Aggregate: ASTM C 33, crushed gravel.

Water: Potable.

Reinforcement: Steel conforming to the following:

Fabric: ASTM A 185, welded wire fabric, plain.

Reinforcement Bars: ASTM A 615, Grade 60, deformed.

Prior to pouring concrete sidewalk, provide and install preformed plastic trench drains with covers as shown on the drawings. Tie existing downspout into trench drain with boot/connection and drain to daylight; provide couplings, outlet/end caps and support braces per manufacturer's recommendations for a complete trench drain system.

PART 3 - EXECUTION

PREPARATION OF FOUNDATION FOR BURIED STORM SEWERAGE SYSTEMS

Grade trench bottom to provide a smooth, firm, stable, and rock-free foundation, throughout the length of the pipe.

Remove unstable, soft, and unsuitable materials at the surface upon which pipes are to be laid, and backfill with clean sand or pea gravel to indicated level.

Shape bottom of trench to fit bottom of pipe. Fill unevenness with tamped sand backfill. Dig bell holes at each pipe joint to relieve the bells of all loads and to ensure continuous bearing of the pipe barrel on the foundation.

INSTALLATION, GENERAL

General Locations and Arrangements: Drawings (plans and details) indicate the general location and arrangement of the underground storm sewerage system piping. Location and arrangement of piping layout take into account many design considerations. Install the piping as indicated, to the extent practical.

Install piping beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings in accordance with manufacturer's recommendations for use of lubricants, cements, and other installation requirements. Maintain swab or drag in line and pull past each joint as it is completed.

Use manholes or catch basins for changes in direction, except where a fitting is indicated. Use fittings for branch connections, except where direct tap into existing sewer is indicated.

Use proper size increasers, reducers, and couplings, where different size or material of pipes and fittings are connected. Reduction of the size of piping in the direction of flow is prohibited.

Install piping pitched down in direction of flow, at minimum slope of 1 percent, except where indicated otherwise.

Extend storm sewerage system piping to connect to building storm drains, of sizes and in locations indicated.

PIPE AND TUBE JOINT CONSTRUCTION AND INSTALLATION

Join and install hubless cast-iron soil pipe and fittings with CISPI-type couplings in accordance with CISPI "Cast Iron Soil Pipe and Fittings Handbook, Volume I."

Join concrete pipe in accordance with applicable provisions of ACPC "Concrete Pipe Installation Manual" for grouted joints."

CLEANOUTS

Install cleanouts and extension from sewer pipe to cleanout at grade as indicated. Set cleanout frame and cover in concrete collar 18 by 18 by 12 inches deep. Set top of cleanout 1 inch above surrounding earth grade or flush with grade when installed in paving.

CATCH BASINS

Construct catch basins to sizes and shapes indicated.

Set frames and grates to elevations indicated.

TAP CONNECTIONS

Make connections to existing piping and underground structures so that finished work will conform as nearly as practicable to the requirements specified for new work.

Make branch connections from side into existing 4- to 21-inch piping by removing section of existing pipe and installing wye fitting into existing piping. Encase entire wye with not less than 6 inches of 3000-psi 28-day compressive-strength concrete.

Make branch connections from side into existing 24-inch or larger piping or to underground structures by cutting opening into existing unit sufficiently large to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall, unless otherwise indicated. On outside of pipe or structure wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.

Provide concrete that will attain minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.

Protect existing piping and structures to prevent concrete or debris from entering while making tap connections. Remove debris, concrete, or other extraneous material that may accumulate.

FIELD QUALITY CONTROL

Testing: Perform testing of completed piping in accordance with local authorities having jurisdiction.

Cleaning: Clear interior of piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed.

In large, accessible piping, brushes and brooms may be used for cleaning.

Place plugs in ends of uncompleted pipe at end of day or whenever work stops.

Flush piping between manholes, if required by local authority, to remove collected debris.

Interior Inspection: Inspect piping to determine whether line displacement or other damage has occurred.

Make inspections after pipe between manholes and manhole locations has been installed and approximately 2 feet of backfill is in place, and again at completion of project.

If inspection indicates poor alignment, debris, displaced pipe, infiltration, or other defects, correct such defects and reinspect.

Record all storm drainage pipe locations, storm basins, and survey elevations of all storm basin grate tops, inlets and outlets on as built survey being provided as part of the End of Project Survey requirement.

END OF SECTION 02720

SECTION 02900 - LANDSCAPE WORK

PART 1 - GENERAL

RELATED DOCUMENTS:

Drawings, General Conditions and Supplementary General Conditions and other Division-1 specification sections, apply to this section.

DESCRIPTION OF WORK:

Extent of landscape development work is shown on architectural and civil drawings and in schedules.

Subgrade Elevations: Landscape Contractor to grade out existing soils and infill new suitable soils in planting areas. Final grade elevations to match existing conditions except as otherwise noted on drawings.

QUALITY ASSURANCE:

Source Quality Control:

General: Ship landscape materials with certificates of inspection required by governing authorities. Comply with regulations applicable to landscape materials.

Do not make substitutions. If specified landscape material is not obtainable, submit proposal to Owner for use of equivalent material.

Trees, Shrubs and Plants: All trees and shrubs in the plant list are to be specimen quality. Special attention should be made to notes on plant list i.e. multi 3 stem, tree-form etc. All plants shall meet or exceed the minimum standards set forth in The American Standards for Nursery Stock by the American Association of Nurserymen, Inc.

All plants shall be compact, uniform, and well grown. All plants shall be free from disease, insect infestations, and injuries. The owner's landscape architect reserves the right to reject any and all materials, which do not meet these requirements.

The species, varieties, and sizes listed shall be provided as specified. Substitutions will be permitted only upon written application by the contractor to the architect, and when approval by said architect is in writing.

Landscape contractor shall be responsible for protecting existing and new hardscapes; (i.e. walks, patios, paving). Contractor shall assume sole responsibility for any cost incurred due to damage and replacement of hardscape.

Label each tree and shrub with securely attached waterproof tag bearing legible designation of botanical and common name.

Formal arrangement and consecutive order of trees or shrubs is shown, select stock for uniform height and spread, to assure symmetry in planting. Owner may reject unsatisfactory planting material.

DELIVERY, STORAGE AND HANDLING:

Packaged Materials: Deliver packaged materials in containers showing weight, analysis and name of manufacturer. Protect materials from deterioration during delivery, and while stored at site.

Trees and Shrubs: Provide freshly dug trees and shrubs. Do not prune prior to delivery unless otherwise approved by Architect. Do not bend or bind-tie trees or shrubs in such manner as to damage bark, break branches or destroy natural shape. Provide protective covering during delivery. Do not drop balled and bur lapped stock during delivery.

Deliver trees and shrubs after preparations for planting have been completed and plant immediately. If planting is delayed more than 6 hours after delivery, set trees and shrubs in shade, protect from weather

and mechanical damage, and keep roots moist by covering with mulch, burlap or other acceptable means of retaining moisture.

Do not remove container grown stock from containers until planting time.

Special care and preparation should be given to planting beds, using a mixture of 1 part peat moss, 1 part composed cow manure, and 3 parts topsoil. Add 15 pounds of 10-10-10 fertilizer and 75 to 90 pounds of dolomite limestone per 1000 square feet throughout. Till for a consistent homogeneous mixture throughout the top 8 inches of soil throughout shrub beds. Omit limestone where acid loving plants are to be installed.

NOTE: SEE SPECIAL PROVISIONS FOR SHRUBBERY BEDS AND TREES (NOTE #1 AND #2) AT THE END OF THIS SPECIFICATION SECTION.

The planting beds shall be distinct from the adjacent lawn area in that they shall have a 4 inch 'V' cut trench installed at the perimeter of the bed and mulched with 3 – 4 inches of clean pine straw.

All areas to be planted shall be treated with a post emergent herbicide such as Round Up three weeks prior to any tilling, planting or excavating, etc. A follow up treatment 7 - 10 days after initial treatment shall be performed for maximum weed control. Vegetation must be in an active growing state for Round Up treatment to be affective. If vegetation is not in an active growing state, notify the architect immediately. All vegetation not in an active growing state will have to be removed mechanically to a depth of 6" – 8" deep & other acceptable soil brought in from off site. For seeded areas refer to note number 13

All planted areas shall be treated with a pre-emergent herbicide such as Ronstar at manufacturer's recommended rate. Treatment will be applied after all areas have been mulched. Water in immediately and rinse any residue from plant material.

SPECIAL PROJECT WARRANTY:

Warranty trees and shrubs, for a period of one year after date of substantial completion, against defects including death and unsatisfactory growth, except for defects resulting from neglect by Owner, abuse or damage by others, or unusual phenomena or incidents which are beyond Landscape Installer's control.

Remove and replace trees, shrubs, or other plants found to be dead or in unhealthy condition during warranty period. Make replacements during growth season following end of warranty period. Replace trees and shrubs, which are in doubtful condition at end of warranty period.

PART 2 - PRODUCTS

It will be the responsibility of the landscape contractor to insure that all planted areas are graded properly for positive drainage. Special care should be taken to grade for positive drainage away from existing and new structures. Finish grade should be 1 - 1 ½ inches below all adjacent walks, curbs, pavement etc.

TOPSOIL:

Topsoil must be provided in planting beds of landscape work. Some top soil exists and may be reused if the required soil amendments are added. If it is determined that there is not enough adequate topsoil on site, it will be the responsibility of the Landscape Contractor to bring it to the attention of the architect. Clean weed free topsoil will consist of fertile, friable, natural, topsoil free of clay, lumps, roots, stones and all other foreign matter with an acidity range of 6.0 – 6.9.

NOTE: SEE SPECIAL PROVISIONS FOR SHRUBBERY BEDS AND TREES (NOTE #1 AND #2) AT THE END OF THIS SPECIFICATION SECTION.

NOTE: SEE SPECIAL PROVISIONS FOR NEW SEEDED OR SODDED LAWN AREAS (NOTE #1) AT THE END OF THIS SPECIFICATION SECTION.

Obtain topsoil from local sources or from areas having similar soil characteristics to that found at project site. Obtain topsoil only from naturally, well-drained sites where topsoil occurs in a depth of not less than 4"; do not obtain from bogs or marshes. Topsoil shall be fertile, friable, natural loam,

surface soil, reasonably free of subsoil, clay, lumps, brush, weeds, and other litter, and free of roots, stumps, stones larger than 2" in any dimension, and other extraneous or toxic matter harmful to plant growth.

TOPSOIL NOT FOUND ON SITE WILL BE PAID FOR ON A PER CU. YD. BASIS.

SOIL AMENDMENTS:

Lime: Natural limestone containing not less than 85% of total carbonates, ground so that not less than 90% passes a 10-mesh sieve and not less than 50% passes a 100-mesh sieve.

Peat Humus: FS Q-P-166 decomposed peat with no identifiable fibers and with ph range suitable for intended use.

Sand: Clean washed sand, free of toxic materials.

Bonemeal: Commercial, raw, finely ground; 4 percent nitrogen and 20 percent phosphoric acid.

Superphosphate: Soluble mixture of treated minerals; 20 percent available phosphoric acid.

Perlite: Conforming to National Bureau of Standards PS 23.

Vermiculite: Horticultural grade, free of toxic substances.

Manure: Well rotted, unleached stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials and containing no chemicals or ingredients harmful to plants.

Mulch: Organic mulch free from deleterious materials and suitable for top dressing of trees, shrubs or plants and consisting of one of the following:

3" of Pine Bark "Mini Nugget" Mulch . See drawings for locations.

Brick Chips (Dark or Light Gray in color). See drawings for locations.

Commercial Fertilizer: Complete slow release fertilizer of neutral character, with some elements derived from organic sources and containing following percentages of available plant nutrients:

For trees and shrubs, provide fertilizer with not less than 5% total nitrogen, 10% available phosphoric acid and 5% soluble potash. See also fertilizer specs on Landscape drawing sheets.

For lawns, provide fertilizer with percentage of nitrogen required to provide not less than 1 lb. of actual nitrogen per 100 sq. ft. of lawn area and not less than 4% phosphoric acid and 2% potassium. Provide nitrogen in a form that will be available to lawn during initial period of growth; at least 50% of nitrogen to be in organic form. See also fertilizer specs on Landscape drawing sheets.

PLANT MATERIALS:

Quality: Provide trees, shrubs, and other plants of size, genus, species, and variety shown and scheduled for landscape work and complying with recommendations and requirements of ANSI Z60.1 "American Standard for Nursery Stock."

Deciduous Trees: Provide trees of height and caliper scheduled or shown and with branching configuration recommended by ANSI Z60.1 for type and species required. Provide single stem trees except where special forms are shown or listed.

Provide balled and burlapped (B&B) deciduous trees, see schedule for height and caliper requirements.

Deciduous Shrubs: Provide shrubs of the height shown or listed and with not less than minimum number of canes required by ANSI Z60.1 for type and height of shrub required.

Container grown deciduous shrubs will be acceptable in lieu of balled and burlapped deciduous shrubs subject to specified limitations of ANSI Z60.1 for container grown stock.

Coniferous and Broadleafed Evergreens: Provide evergreens of sizes shown or listed. Dimensions indicate minimum spread for spreading and semi-spreading type evergreens and height for other types, such as globe, dwarf, cone, pyramidal, broad up-right, and columnar. Provide normal quality evergreens

with well-balanced form complying with requirements for other size relationships to the primary dimension shown.

Container grown evergreens will be acceptable subject to specified limitations for container grown stock.

GENERAL GRASS MATERIALS:

Renovate existing lawn areas by core aerating. Apply lime and fertilizer as specified and overseed with a turf type 3 way blend hybrid fescue if not specified otherwise. Apply straw mulch in thin areas.

New lawn areas shall be sodded or seeded with turf type 3 way blend hybrid fescue if not specified otherwise. Cover seeded area with straw mulch.

NOTE: SEE SPECIAL PROVISIONS FOR NEW SEEDED OR SODDED LAWN AREAS (NOTE #1) AT THE END OF THIS SPECIFICATION SECTION.

GRASS MATERIALS: SOD

Grass Seed: Provide harvested sod grown from fresh, clean, new-crop seed complying with tolerance for purity and germination established by Official Seed Analysts of North America. Provide seed mixture composed of grass species, proportions and minimum percentages of purity, germination, and maximum percentage of weed seed, as specified at the end of this section.

Erosion Control Materials:

Erosion control Fiber Mesh: Biodegradable twisted jute or spun-coil mesh, a minimum of 0.92 lbs/sqyd. With 50 to 65 percent open area. Include manufacturer's recommended steel wire staples, 6 inches long. (Remove stabilization fabric and staples after the establishment of a suitable and stable stand of grass has been established.)

GROUND COVER:

Provide plants established and well-rooted in removable containers or integral peat pots and with not less than minimum number and length of runners required by ANSI Z60.1 for the pot size shown or listed. See schedule at end of section.

MISCELLANEOUS LANDSCAPE MATERIALS:

Anti-Erosion Mulch: Provide clean, seed-free salt hay or threshed straw of wheat, rye, oats or barley.

Plastic Sheet: Weed block fabric, manufactured by Agri-Tex, Inc. or equal. Product is made from woven polypropylene fabric and allows water, air, nutrients to penetrate.

Wrapping: Tree-wrap tape not less than 4" wide, designed to prevent bore damage and winter freezing.

Stakes and Guys: Provide stakes and deadmen of sound new hardwood, treated softwood, or redwood, free of knot holes and other defects. Provide wire ties and guys of 2-strand, twisted, pliable galvanized iron wire not lighter than 12 ga. with zinc-coated turnbuckles. Provide not less than 1/2" diameter rubber or plastic hose, cut to required lengths and of uniform color, material and size to protect tree trunks from damage by wires.

Washed, rounded riverbed (white) gravel or other acceptable smooth-faced stone ranging in size from 3/4" to 1-1/2" in diameter.

PART 3 - EXECUTION

PREPARATION:

Contractor shall review all existing site conditions prior to submitting bid and prior to commencing installation. If any discrepancies exist, they shall be brought to the immediate attention of the architect.

Contractor shall provide all labor, materials and equipment for the installation of plant materials as shown on the drawings. If any discrepancies exist between the quantities listed on the plant list and the

quantities shown on the plan, the contractor shall provide quantities illustrated on the plan. If any plants are shown not labeled, the contractor shall verify the plant identity with the architect and these plantings shall be included on the contractor's bid.

Contractor shall be responsible for locating and staking all sewer, water, and utility lines above and below grade that might be damaged as a result of planting operations. Contractor shall assume sole responsibility for any cost incurred due to damage and replacement of aforementioned utilities. Call North Carolina One Call to locate all utility lines 1-800-632-4949.

PREPARATION OF PLANTING SOIL:

Mix specified soil amendments and fertilizers with topsoil at rates specified. Delay mixing of fertilizer if planting will not follow placing of planting soil within a few days. See schedule at end of section.

For planting beds and lawns, mix planting soil either prior to planting or apply on surface of topsoil and mix thoroughly before planting.

Mix lime with dry soil at a rate of 90 lbs. per 1000 sq. ft prior to mixing of fertilizer.

Prevent lime from contacting roots of acid-loving plants.

Apply phosphoric acid fertilizer directly to subgrade before applying planting soil and filling.

SEE NOTE #1 - SPECIAL PROVISIONS FOR SHRUBBERY BEDS AND TREES AT THE END OF THIS SPEC SECTION.

PREPARATION FOR PLANTING LAWNS:

Preparation of Disturbed or Excavated Lawn: Where lawns are to be planted in areas that have been altered or disturbed by excavating, grading, or stripping operations, prepare soil for lawn planting as follows: Loosen to a depth of not less than 4"; apply soil amendments and initial fertilizers as specified; remove high areas and fill in depressions; till soil to a homogenous mixture of fine texture, free of lumps, clods, stones, roots and other extraneous matter.

Spread top soil to depth required to meet existing lines, grades after light rolling and natural settlement. Add specified soil amendments and mix thoroughly into upper 4 inches of topsoil. Allow for sod thickness in areas to be sodded.

Apply specified commercial fertilizer at rates specified by manufacturer and thoroughly mix into upper 2" of topsoil. Delay application of fertilizer if lawn planting will not follow within a few days.

Fine grade lawn areas to smooth, even surface with loose, uniformly fine texture. Roll, rake and drag lawn areas, remove ridges and fill depressions, as required to meet finish grades. Limit fine grading to areas, which can be planted immediately after grading.

Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface moisture to dry before planting lawns. Do not create a muddy soil condition.

PREPARATION OF PLANTING BEDS:

Loosen subgrade of planting bed areas to a minimum depth of 6" using a cultimulcher or similar equipment. Remove stones over 1" in any dimension, and sticks, stones, rubbish and other extraneous matter. Add specified soils, soil amendments and fertilizers to upper 6-8" layer.

Where no suitable top soil exists remove 10" of soil and replace with prepared planting soil mixture enhanced with specified soil amendments and fertilizers.

Excavation for Trees and Shrubs:

Excavate pits, beds and trenches, with vertical sides and with bottom of excavation slightly raised at center to provide proper drainage. Loosen hard subsoil in bottom of excavation.

For balled and burlapped (B&B trees and shrubs), make excavations at least half again as wide as the ball diameter and equal to the ball depth, plus following allowance for setting of ball on a layer of compacted backfill:

Allow for 6" setting layer of planting soil mixture.

For container grown stock, excavate as specified for balled and burlapped stock, adjusted to size of container width and depth.

Dispose of subsoil removed from planting excavations. Do not mix with planting soil or use as backfill.

Fill excavations for trees and shrubs with water and allow to percolate out before planting.

PLANTING:

Planting Trees and Shrubs:

Verify exact location of any existing trees and adjust new plantings so as not to damage roots of existing trees.

Set balled and burlapped (B&B) stock on layer of compacted planting soil mixture, plumb and in center of pit or trench with top of ball at same elevation as adjacent finished landscape grades. Remove burlap from sides of balls; retain on bottoms. When set, place additional backfill around base and sides of ball, and work each layer to settle backfill and eliminate voids and air pockets. When excavation is approximately 2/3-full, water thoroughly before placing remainder of backfill. Repeat watering until no more is absorbed. Water again after placing final layer of backfill.

Set container grown stock as specified for balled and burlapped stock, except cut cans on 2 sides with an approved can cutter; remove bottoms of wooden boxes after partial backfilling so as not to damage root balls.

Dish top of backfill to allow for mulching.

Mulch pits, trenches and all planted areas. Provide not less than following thickness of mulch and work into top of backfill and finish level with adjacent finish grades.

Provide 3" thickness of mulch typ.

Prune, thin out and shape trees and shrubs in accordance with standard horticultural practice. Prune trees to retain required height and spread. Unless otherwise directed by Architect, do not cut tree leaders, and remove only injured or dead branches from flowering trees, if any. Prune shrubs to retain natural character.

Wrap tree trunks of 2" caliper and larger. Start at ground and cover trunk to height of first branches and securely attach. Inspect tree trunks for injury, improper pruning and insect infestation and take corrective measures before wrapping.

Guy and stake trees immediately after planting, as indicated.

Sod

Remove all existing vegetation from area to be soded.

Test soil to verify pH of 6.0-7.5.

Apply lime and phosphorous per soil analysis & fertilizer at rate of 1200 pounds per acre.

Break up compacted soil with a tiller to a depth of 3"-5" and hand rake smooth.

Roll with water filled drum to level soil surface.

Water area to be soded prior to laying sod.

Install sod such that top of soil and root layer is level with top of pavement starting on the outside edges and working inward.

Lay sod with butted edges and ends firmly together without overlapping. Stagger ends so the ends don't align.

Shim low spots with top soil for level sodded grade.

Roll sod to press it firmly into soil, removing air pockets.

Water daily, thoroughly for 3 weeks until established.

Remove sod that doesn't thrive. Over seed areas that are not lush and green.

SEEDING NEW LAWNS:

Do not use wet seed or seed, which is moldy or otherwise, damaged in transit or storage.

Rake seed lightly into top 1/8" of soil, roll lightly, and water with a fine spray.

Protect seeded areas against erosion by spreading specified lawn mulch after completion of seeding operations. Spread uniformly to form a continuous blanket not less than 1-1/2" loose measurement over seeded areas.

Water newly planted areas and keep moist until new grass is well established.

Within 2 weeks of initial seeding, contractor to inspect grass stand. Replant areas that have sparse or no new growth.

PLANTING GROUND COVER:

Space ground cover plants as indicated or scheduled to fill the planting areas shown shaded on plans.

Space ground cover plants not more than 24 inches o.c.

Dig holes enough to allow for spreading of roots and backfill with planting soil. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water. Water thoroughly after planting, taking care not to cover crowns of plants with wet soils.

Mulch areas between ground cover plants; place not less than 3 inches thick.

MISCELLANEOUS LANDSCAPE WORK:

Where indicated. Compact soil subgrades before placing gravel.

Continuously over compacted subgrade prior to placing gravel. Overlap edges 4 inches at joints between sheets. Lap joints in the direction of water drainage.

MAINTENANCE:

Begin maintenance immediately after planting.

Maintain lawns by watering, fertilizing, weeding and other operations such as rolling, regrading and replanting as required to establish a smooth, acceptable lawn, free of eroded or bare areas.

Mowing and trimming shall be by Contractor prior to Substantial completion and by Owner after substantial Completion.

CLEANUP AND PROTECTION:

During landscape work, keep pavements clean and work area in an orderly condition.

INSPECTION AND ACCEPTANCE:

When landscape work is completed, (approximately 4 to 6 weeks later) Architect will, upon request, make an inspection to determine acceptability.

Where inspected landscape work does not comply with requirements, replace rejected work and continue specified maintenance until reinspected by Architect and found to be acceptable. Remove rejected plants and materials promptly from project site.

SCHEDULE OF PLANTING SOIL MIXTURE REQUIREMENTS:

For lawn areas, provide not less than the following quantities of specified materials:

90 pounds of lime per 1000sf.

8 pounds fertilizer per 1000 sf (Scotts Proturf (20-26-6)

SCHEDULE OF GRASS SEED MIXTURES:

Seed all disturbed areas not scheduled to receive SOD with Festuca Arundinaceal turf type tall fescue Grass (96% purity, 85% minimum germination). Seed shall be free of noxious weed seeds.

Apply at a rate of 6-7 lbs. per 1000 S.f.

September 15 - March 30: 5 pounds of Kentucky 31 Tall Fescue and 1 pound Kentucky Bluegrass per 1000 SF

April 1 - June 15: 2 pounds Hulled Common Bermuda per 1000 SF

SCHEDULE OF planting materials:

See Landscaping sheet L1 for planting materials and quantities.

SPECIAL PROVISION NOTES:

Note #1 - SPECIAL PROVISIONS FOR SHRUBBERY BEDS & TREES

1. SHRUBBERY BEDS

In lieu of providing 6" of topsoil in all planting beds, Contractor will install 2" of PermaTill and 1"-1 ½" of Mushroom Compost or other approved compost to all planting beds and tilled thoroughly to a depth of 8"-10" deep. Where possible all planting beds shall be deep plowed with a frost ripper on a Backhoe or similar implement to a depth of 18"-24" deep and 24" on center before PermaTill and compost have been added and tilled in. This method is to be implemented for all planting beds where underground utilities, water lines, sewer lines, etc. permit.

2. TREES

Prior to planting trees all areas where trees are indicated will be deep plowed with a frost ripper on a Backhoe or similar implement to obtain a depth of 24"-30" deep in an X pattern at least 3 times across the center of where the tree is to be planted with a diameter of a least 25 to 30 feet or a radius of 12.5 feet to 15 feet. This method is to be implemented for all trees where underground utilities, water lines, sewer lines, etc. permit. **Backfill for trees will consist of 2 parts PermaTill, 1 part Compost and 4 parts topsoil.**

NOTE #2 - SPECIAL PROVISIONS FOR NEW SEEDED OR SODDED LAWN AREAS.

1. All new seeded areas shall be ripped, plowed, etc. to a minimum depth of not less than 4"-6" deep. Apply all the lime and ½ the recommended rate of fertilizer and fine grade to a smooth finished texture containing no extraneous matter; sticks, stones, etc more than 1" – 1 ½" in diameter. Hand rake if necessary. Apply the remaining ½ of fertilizer, all the seed as specified and mulch with clean weed free Wheat Straw. **For on site seeded areas use the existing soil on site unless otherwise specified on the plans.**

END OF SECTION 02900

SECTION 03310 - CONCRETE WORK

PART 1 - GENERAL

RELATED DOCUMENTS:

Drawings, General Conditions and Supplementary General Conditions and other Division-1 Specification Sections, apply to this Section.

DESCRIPTION OF WORK:

Extent of concrete work shown on drawings.

Concrete paving and walks are specified in Division 2.

QUALITY ASSURANCE:

Codes and Standards: Comply with provisions of following codes, specifications and standards, except where more stringent requirements are shown or specified:

ACI 301 "Specifications for Structural Concrete for Buildings".

ACI 318 "Building Code Requirements for Reinforced Concrete."

Concrete Reinforcing Steel Institute, "Manual of Standard Practice".

Materials and installed work may require testing and retesting, as directed by Architect, at any time during progress of work. Allow free access to material stockpiles and facilities. Tests, including retesting of rejected materials and installed work, shall be done at Contractor's expense.

SUBMITTALS:

Product Data: Submit data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, waterstops, joint systems, curing compounds, dry-shake finish materials, and others as requested by Architect.

Shop Drawings; Reinforcement: Submit shop drawings for fabrication, bending, and placement of concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, diagrams of bent bars, arrangement of concrete reinforcement. Include special reinforcement required and openings through concrete structures.

Samples: Submit samples of materials as specified and as otherwise requested by Architect, including names, sources and descriptions.

Laboratory Test Reports: Submit laboratory test reports for concrete materials and mix design test as specified.

PART 2 - PRODUCTS

FORM MATERIALS:

Forms for Exposed Finish Concrete: Unless otherwise indicated, construct formwork for exposed concrete surfaces with plywood, metal, metal-framed plywood faced or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings. Provide form material with sufficient thickness to withstand pressure of newly-placed concrete without bow or deflection.

Use plywood complying with U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood", Class I, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.

Forms for Unexposed Finish Concrete: Form concrete surfaces which will be unexposed in finished structure with plywood, lumber, metal or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.

Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.

REINFORCING MATERIALS:

Reinforcing Bars : ASTM A 615, Grade 60, deformed.

Steel Wire: ASTM A 82, plain, cold-drawn, steel.

Welded Wire Fabric: ASTM A 185, welded steel wire fabric.

Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place. Use wire bar type supports complying with CRSI recommendations, unless otherwise acceptable.

For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.

CONCRETE MATERIALS:

Portland Cement: ASTM C 150, Type I, unless otherwise acceptable to Architect.

Use one brand of cement throughout project, unless otherwise acceptable to Architect. Fly ash and other cement substitutes shall not be used.

Normal Weight Aggregates: ASTM C 33, and as herein specified. Provide aggregates from a single source for exposed concrete.

For exterior exposed surfaces, do not use fine or coarse aggregates containing spalling-causing deleterious substances.

Lightweight Aggregates: ASTM C 330.

Coarse Aggregate Size: Maximum size shall not exceed 1/5 of the narrowest dimension between sides of forms, 1/3 of the depth of slabs, nor 5/8" minimum clear spacing between individual reinforcing or bundled bars. Maximum size of coarse aggregate shall not exceed 3/4 inch for concrete fill over composite metal deck.

Water: Drinkable.

Air-Entraining Admixture: ANSI/ASTM C 260 and contain no chloride ions.

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

- "Darex ARA" - W. R. Grace
- "MB-VR or MB-AE" - Master Builders
- "Sika Air" - Sika Chemical Co.

Water-Reducing Admixture: ASTM C 494, Type A, and **contain no chloride ions.**

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

- "Eucon WR-75" - Euclid Chemical Co.
- "Pozzoloth 344" - Master Builders.

"Plastocrete 160" - Sika Chemical Corp.

High-Range Water-Reducing Admixture (Superplasticizer): ASTM C 494, Type F or Type G and **contain no chloride ions.**

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

"WRDA 19" - W.R. Grace.

"Eucon Super 37" - The Euclid Chemical Co.

"Pozzolith 400N" - Master Builders.

Certifications: Written conformance to the above mentioned requirements and the chloride ion content of the admixture will be required from the admixture manufacturer prior to mix design review by the Engineer.

Prohibited Admixtures: Calcium chloride, thiocyanates or admixture containing chloride ions are **not permitted.**

RELATED MATERIALS:

Waterstops: Provide flat, dumbbell type or centerbulb type waterstops at construction joints and other joints as indicated. Size to suit joints.

Polyvinyl Chloride Waterstops: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include; but are not limited to, the following:

Manufacturer: Subject to compliance with requirements, provide products of one of the following:

The Burke Co.

W.R. Meadows.

Progress Unlimited.

Vynlex Corp.

Vapor Retarder: Provide vapor retarder/moisture barrier over prepared base material where indicated. Use only materials which are resistant to decay when tested in accordance with ASTM E 154, as follows:

Unless otherwise noted, a vapor barrier equivalent to "Vapor Block 15" manufactured by Raven Industries, shall be installed under all interior slabs-on-grade and other locations noted on drawings.

Or equal product by:

- Reef Industries (Griffolyn 15 mil Green)
- Stego Industries (Stego Wrap Vapor Barrier 15 mil)
- VIPOR (VaporCheck II 15 mil, ASTM E 1745 Class A)
- Barrier-Bac VB-350 (16 mil) Vapor Retarder by Interplast Group

Tape all joints with 2" wide tape that features vapor retarding performance characteristics as required by ASTM E 1745-97.

Non-Shrink Grout: CRD-C 621, factory pre-mixed grout.

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

Non-metallic

"Euco-NS" - Euclid Chemical Co.

"Masterflow 713" - Master Builders.

"Five Star Grout" - U.S. Grout Corp.

Non-slip Aggregate Finish: Provide fused aluminum oxide grits, or crushed emery, as abrasive aggregate for non-slip finish with emery aggregate containing not less than 40% aluminum oxide and not less than 25% ferric oxide. Use material that is factory-graded, packaged, rust-proof and non-glazing, and is unaffected by freezing, moisture and cleaning materials.

Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M 182, Class 2.

Moisture-Retaining Cover: One of the following, complying with ASTM C 171 of milky white color.

Waterproof paper.

Polyethylene film.

Polyethylene-coated burlap.

Curing and Sealing Compound: The compound shall be a clear styrene acrylate type, 30% solids content minimum, and have test data from an independent testing laboratory indicating a maximum moisture loss of 0.055 grams per sq.cm. when applied at a coverage rate of 200 sq. ft. per gallon. Manufacturer's Certification required.

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

"Ecocure" - Euclid Chemical Co.

"Masterseal" - Master Builders

"Hardtop" - Gifford-Hill

Bonding and Repair Materials:

Bonding Materials: The compound shall be a polyvinyl acetate, rewettable type, "Euco Weld" by The Euclid Chemical Co. or Acrylic Bonocrete by The Burke Co. Use only in areas not subject to moisture.

Epoxy Adhesive: The compound shall be a two (2) component, 100% solids, 100% reactive compound suitable for use on dry or damp surfaces. "Euco Epoxy #463 or #615 by The Euclid Chemical Co. or Patch & Bono Epoxy by The Burke Co.

Patching Mortar: Free-flowing, polymer-modified cementitious coating, "Euco Thin Coat" by The Euclid Chemical Co. or "Sikatop 121" by the Sika Chemical Corp.

Bonding Admixture: The compound shall be a latex, non-rewettable type, "SBR Latex" or "Flex-con" by The Euclid Chemical Co. or "Daraweld C" by W. R. Grace.

Patching Mortar: Free flowing, polymer modified cementitious coating.

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

"Euco Thin Coat" or "Euco Concrete Coat" - The Euclid Chemical Co.

"Sikatop 121 or 122" - Sika Chemical Corp.

Underlayment Compound: Freeflowing, self-leveling, pumpable cementitious base compound.

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

"Flo-Top" by The Euclid Chemical Co. or approved equal.

"K-15" Self Leveling Underlayment Concrete; Ardex, Inc.

Epoxy Joint Filler: The epoxy joint filler shall be a three (3) component, 100% solids compound, with a minimum shore D hardness of 50.

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

"Euco Epoxy #600 or #700" - The Euclid Chemical Company

"Sikadur Lo-Mod" - Sika Chemical Corp.

Penetrating Anti-spalling Sealer: "Euco-Guard" by The Euclid Chemical Co. or approved equal. The sealer shall be a siloxane-based compound which has a 92% chloride-ion screen and a repellency factor of 92% when tested in accordance with NCHRP #244, Test Method. In addition, the sealer-treated concrete must exhibit no scaling when exposed to 120 cycles of freezing-and-thawing in accordance with ASTM C 672.

The tests must be made by an independent testing laboratory. The manufacturer shall offer a three-year warranty bond issued by an insurance company in the amount agreed upon by the manufacturer and the owner.

PROPORTIONING AND DESIGN OF MIXES:

Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. If trial batches are used, the mix design shall be prepared by an independent testing laboratory and shall achieve a compressive strength 1200 PSI higher than the specified strength. The testing facility shall not be the same as used for field quality control testing unless otherwise acceptable to Architect.

Submit written reports to Architect of each proposed mix for each class of concrete at least 15 days prior to start of work. Do not begin concrete production until mixes have been reviewed by Architect.

Design mixes to provide normal weight concrete with the following properties, as indicated on drawings and schedules:

4000 psi 28-day compressive strength.

3000 psi 28-day compressive strength. W/C ratio, 0.58 maximum (non-air-entrained), 0.46 maximum (air-entrained).

Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant; at no additional cost to Owner and as accepted by Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Architect before using in work.

Admixtures:

Use water-reducing admixture and/or high range water-reducing admixture (superplasticizer) in concrete as required for placement and workability.

All pumped concrete, architectural concrete, parking-structure slabs, concrete required to be watertight and concrete with a water/cement ratio below 0.50 shall contain the specified high-range water-reducing admixture (superplasticizer).

Use air-entraining admixture in exterior exposed concrete, unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content with a tolerance of plus-or-minus 1-1/2% within following limits:

Concrete structures and slabs exposed to freezing and thawing deicer chemicals, or subjected to hydraulic pressure:

5.0% (moderate exposure); 6.0% (severe exposure) 3/4" max. aggregate.

Other Concrete: 2% to 4% air.

Use admixtures for water-reducing and set-control in strict compliance with manufacturer's directions.

Water-Cement Ratio: Provide concrete for following conditions with maximum water-cement (WC) ratios as follows:

Subjected to freezing and thawing; WC 0.50.

Subjected to deicers/watertight; WC 0.45.

Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:

Ramps slabs, and sloping surfaces: Not more than 3".

All reinforced foundation systems: Not less than 2" and not more than 4".

All concrete containing the high-range water-reducing admixture (superplasticizer) shall have a maximum slump of 8" unless otherwise approved by the Architect. The concrete shall arrive at the job site at a slump of 2" to 3", verified, then the high-range water-reducing admixture added to increase the slump to the approved level.

All other Concrete shall have a maximum slump of 4".

CONCRETE MIXES:

Ready-Mix Concrete: Comply with requirements of ASTM C 94, and as herein specified.

During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C 94 may be required.

When air temperature is between 85 degrees F (30 degrees C) and 90 degrees F (32 degrees C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90 degrees F (32 degrees C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

FORMS:

Design, erect, support, brace and maintain formwork to support vertical and lateral loads that might be applied until such loads can be supported by concrete structure. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation and position.

Design formwork to be readily removable without impact, shock or damage to cast-in-place concrete surfaces and adjacent materials.

Care must be taken to not damage or compromise the vapor retarder.

Construct forms to sizes shapes, lines and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent leakage of cement paste.

Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for easy removal.

Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings on forms at inconspicuous locations.

Chamfer exposed corners and edges as indicated, using wood, metal, PVC or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

Form Ties: Factory-fabricated, adjustable-length, removable or snapoff metal form ties, designed to prevent form deflection, and to prevent spalling concrete surfaces upon removal.

Unless otherwise indicated, provide ties so portion remaining within concrete after removal is 1" inside concrete and will not leave holes larger than 1" diameter in concrete surface.

Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses and chases from trades providing such items. Accurately place and securely support items built into forms.

Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is placed. Retighten forms and bracing after concrete placement is required to eliminate mortar leaks and maintain proper alignment.

PLACING REINFORCEMENT:

Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports, and as herein specified.

Clean reinforcement of loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.

Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.

Place reinforcement to obtain at least minimum coverages for concrete protection. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

Installed welded wire fabric in as long lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.

JOINTS:

Construction Joints: Locate and install construction joints as indicated or, if not indicated, locate so as not to impair strength and appearance of the structure, as acceptable to Architect.

Provide keyways at least 1-1/2" deep in construction joints in walls, slabs and between walls and footings; accepted bulkheads designed for this purpose may be used for slabs.

Place construction joints perpendicular to the main reinforcement. Continue reinforcement across construction joints.

Waterstops: Provide waterstops in construction joints as indicated. Install waterstops to form continuous diaphragm in each joint. Make provisions to support and protect exposed waterstops during progress of work. Fabricate field joints in waterstops in accordance with manufacturer's printed instructions.

Isolation Joints in Slabs-on-Ground: Construct isolation joints in slabs-on-ground at points of contact between slabs on ground and vertical surfaces, such as column pedestals, foundation walls, grade beams and elsewhere as indicated.

Joint filler and sealant materials are specified in Division 7 sections of these specifications.

Contraction (Control) Joints in Slabs-on-Ground: Construct contraction joints in slabs-on-ground to form panels of patterns as shown. Use saw cuts or inserts 1/8" to 1/4" wide x 1/4 of the slab depth, unless otherwise indicated.

Form contraction joints by inserting premolded plastic strip into fresh concrete until the top surface of strip is flush with slab surface. Tool slab edges round on each side of insert. After concrete has cured, remove inserts and clean groove of loose debris.

Saw Contraction joints in slabs on ground shall be made using saw cuts or approved inserts creating a plane of 1/4 slab thickness. Saw cuts shall be made as soon as possible without dislodging aggregate.

Joint sealant material is specified in Division-7 sections of these specifications.

INSTALLATION OF EMBEDDED ITEMS:

General: Set and build into work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions and directions provided by suppliers of items to be attached thereto.

Care must be taken to not damage or compromise the vapor retarder and openings around and thru vapor retarder must be properly sealed.

Edge Forms and Screed Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surface. Provide and secure units sufficiently strong to support types of screed strips by use of strike-off templates or accepted compacting type screeds.

PREPARATION OF FORM SURFACES:

Clean re-used forms of concrete matrix residue, repair and patch as required to return forms to acceptable surface condition.

Coat contact surfaces of forms with a form-coating compound before reinforcement is placed.

Thin form-coating compounds only with thinning agent of type, and in amount, and under conditions of form-coating compound manufacturer's directions. Do not allow excess form-coating material to accumulate in forms or to come into contact with concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.

CONCRETE PLACEMENT:

Preplacement Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast-in. Notify other trades to permit installation of their work; cooperate with other trades in setting such work. Moisten wood forms immediately before placing concrete where form coatings are not used.

Coordinate the installation of joint materials and moisture barriers with placement of forms and reinforcing steel.

Care must be taken to not damage or compromise the vapor retarder and openings around and thru vapor retarder must be properly sealed.

General: Comply with ACI 304 "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete", and as herein specified.

Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation.

Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 24" and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI recommended practices.

Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 6" into preceding layer. Do not insert vibrators into lower layers of concrete that

have begun to set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.

Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.

Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.

Bring slab surfaces to correct level with straightedge and strikeoff. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.

Maintain reinforcing in proper position during concrete placement operations.

Cold Weather Placing: Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306 and as herein specified.

When air temperature has fallen to or is expected to fall below 40 degrees F (4 degrees C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 degrees F (10 degrees C), and not more than 80 degrees F (27 degrees C) at point of placement.

Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

Do not use calcium chloride, salt and other materials containing antifreeze agents or chemical accelerators, unless otherwise accepted in mix designs.

Hot Weather Placing: When weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.

Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 degrees F (32 degrees C). Mixing water may be chilled, or chopped ice may be used to control temperature provided water equivalent of ice is calculated to total amount of mixing water. Use of liquid nitrogen to cool concrete is Contractor's option.

Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.

Fog spray forms, reinforcing steel and subgrade just before concrete is placed.

FINISH OF FORMED SURFACES:

Rough Form Finish: For formed concrete surfaces not exposed-to-view in the finish work or by other construction, unless otherwise indicated. This is the concrete surface having texture imparted by form facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4" in height rubbed down or chipped off.

Smooth Form Finish: For formed concrete surfaces exposed-to-view, or that are to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, painting or other similar system. This is as-cast concrete surface obtained with selected form facing material, arranged orderly and symmetrically with a minimum of seams. Repair and patch defective areas with fins or other projections completely removed and smoothed.

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

MONOLITHIC SLAB FINISHES:

Scratch Finish: Apply scratch finish to monolithic slab surfaces that are to receive concrete floor topping or mortar setting beds for tile, portland cement terrazzo, and other bonded applied cementitious finish flooring material, and as otherwise indicated.

After placing slabs, plane surface so that depressions between high spots do not exceed 1/2" in 10' straightedge. Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set, with stiff brushes, brooms or rakes.

Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as hereinafter specified, and slab surfaces which are to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo, and as otherwise indicated.

After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units. Check and level surface plane so that depressions between high spots do not exceed 5/16" under a 10' straightedge. Cut down high spots and fill low spots. Refloat surface to a uniform, smooth, granular texture.

Trowel Finish: Apply trowel finish to monolithic slab surfaces to be exposed-to-view, and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint or other thinfilm finish coating system.

After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and with a level surface plane so that depressions between high spots do not exceed 1/8" under a 10'-0" straightedge.

Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, apply trowel finish as specified, then immediately follow with slightly scarifying surface by fine brooming.

Non-Slip Broom Finish: Apply non-slip broom finish to exterior concrete platforms, steps and ramps, and elsewhere as indicated.

Immediately after trowel finishing, slightly roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

Chemical-Hardener Finish: Apply chemical-hardener finish to interior concrete floors where indicated. Apply liquid chemical-hardener after complete curing and drying of the concrete surface. Dilute liquid hardener with water, (parts of hardener/water as follows), and apply in 3 coats; first coat, 1/3-strength; second coat, 1/2-strength; third coat, 2/3-strength. Evenly apply each coat, and allow 24 hours for drying between coats.

Apply proprietary chemical hardeners, in accordance with manufacturer's printed instructions.

After final coat of chemical-hardener solution is applied and dried, remove surplus hardener by scrubbing and mopping with water.

Non-slip Aggregate Finish: Apply non-slip aggregate finish to concrete stair treads, platforms, ramps, and elsewhere as indicated.

After completion of float finishing, and before starting trowel finish, uniformly spread 25 lbs. of dampened non-slip aggregate per 100 sq. ft. of surface. Tamp aggregate flush with surface using a steel trowel, but do not force below surface. After broadcasting and tamping, apply trowel finishing as herein specified.

After curing, lightly work surface with a steel wire brush, or an abrasive stone, and water to expose non-slip aggregate.

CONCRETE CURING AND PROTECTION:

General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.

Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 7 days in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.

Curing Methods: Perform curing of concrete by application of curing compounds, by moist curing, by moisture-retaining cover curing, and by combinations thereof, as herein specified.

Provide moisture curing by following methods.

Keep concrete surface continuously wet by covering with water.

Continuous water-fog spray.

Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4" lap over adjacent absorptive covers.

Provide moisture-cover curing as follows:

Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3" and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

Provide curing and sealing compound to interior slabs with resilient flooring, carpet over cushion, or left exposed; and to exterior slabs, walks, and curbs, as follows:

Apply specified curing and sealing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours). Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.

Do not use membrane curing compounds on surfaces which are to be covered with coating material applied directly to concrete, liquid floor hardener, waterproofing, dampproofing, membrane roofing, flooring, (such as ceramic or quarry tile, glue-down carpet), painting, and other coatings and finish materials, unless otherwise acceptable to Architect.

Curing Formed Surfaces: Cure formed concrete surfaces, including undersides of beams, supported slabs and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

REMOVAL OF FORMS:

Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 degrees F (10 degrees C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations, and provided curing and protection operations are maintained.

Form facing material may be removed 4 days after placement, only if shores and other vertical supports have been arranged to permit removal of form facing material without loosening or disturbing shores and supports.

RE-USE OF FORMS:

Clean and repair surfaces of forms to be re-used in work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable for exposed surfaces. Apply new form coating compound as specified for new formwork.

When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use "patched" forms for exposed concrete surfaces, except as acceptable to Architect.

MISCELLANEOUS CONCRETE ITEMS:

Filling-In: Fill-in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place and cure concrete as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.

Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections and terminations slightly rounded.

Equipment Bases and Foundations: Provide machine and equipment bases and foundations, as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with certified diagrams or templates of manufacturer furnishing machines and equipment.

Non-Shrink Grout: All column base plates, equipment bases and other locations noted on the structural drawings shall be grouted with the specified non-shrink grout. All exposed grout shall be the specified non-metallic type.

Steel Pan Stairs: Provide concrete fill for steel pan stair treads and landings and associated items. Cast-in safety inserts and accessories as shown on drawings. Screed, tamp, and finish concrete surfaces as scheduled.

Reinforced Masonry: Provide concrete grout for reinforced masonry lintels and bond beams where indicated on drawings and as scheduled. Maintain accurate location of reinforcing steel during concrete placement.

CONCRETE SURFACE REPAIRS:

Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to Architect.

Cut out honeycomb, rock pockets, voids over 1/4" in any dimension, and holes left by tie rods and bolts, down to solid concrete but, in no case to a depth of less than 1". Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water and brush-coat the area to be patched with specified bonding agent. Place patching mortar after bonding compound has dried.

For exposed-to-view surfaces, blend white portland cement and standard portland cement so that, when dry, patching mortar will match color surrounding. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Architect. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets; fins and other projections on surface; and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes, fill with dry pack mortar, or precast cement cone plugs secured in place with bonding agent.

Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.

Repair of Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness, using a template having required slope.

Repair Finished unformed surfaces that contain defects which affect durability of concrete. Surface defects, as such, include crazing, cracks in excess of 0.01" wide or which penetrate to reinforcement or completely through non-reinforced sections regardless of width, spalling, pop-outs, honeycomb, rock pockets, and other objectionable conditions.

Correct high areas in unformed surfaces by grinding, after concrete has cured at least 14 days.

Correct low areas in unformed surfaces during, or immediately after completion of surface finishing operations by cutting out low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to Architect.

Repair defective areas, except random cracks and single holes not exceeding 1" diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least 3/4" clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding compound. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact and finish to blend with adjacent finished concrete. Cure in the same manner as adjacent concrete.

Repair isolated random cracks and single holes not over 1" in diameter by dry-pack method. Groove top of cracks and cut-out holes to sound concrete and clean of dust, dirt and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Mix dry-pack, consisting of one part portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Place dry-pack after bonding compound has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for not less than 72 hours

Structural Repairs: All structural repairs shall be made with prior approval of the Engineer as to method and procedures, using the specified epoxy adhesive and/or epoxy mortar. Where epoxy injection procedures must be used, an approved low viscosity epoxy made by the manufacturers previously specified shall be used.

Underlayment Application: Leveling of floors for subsequent finishes shall be achieved by use of the specified underlayment material.

QUALITY CONTROL TESTING DURING CONSTRUCTION:

The Owner will employ a testing laboratory to perform other tests and to submit test reports.

Sampling and testing for quality control during placement of concrete may include the following, as directed by Architect.

Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.

Slump: ASTM C 143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.

Air Content: ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231 pressure method for normal weight concrete; one for each day's pour of each type of air-entrained concrete.

Concrete Temperature: Test hourly when air temperature is 40' F (4'C) and below, and when 80' F (27'C) and above; and each time a set of compression test specimens made.

Compression Test Specimen: ASTM C 31; one set of 4 standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field-cure test specimens are required.

Compressive Strength Tests: ASTM C 39; one set of four cylinders for each day's pour exceeding 5 cu.yds. plus additional sets for each 50 cu.yds. over and above the first 25 cu.yds. of each concrete class placed in any one day; one specimen tested at 7 days for information, two specimens tested at 28 days for acceptance, and one specimen retained in reserve for later testing if required.

When frequency of testing will provide less than 5 strength tests for a given class of concrete, conduct testing from at least 5 randomly selected batches or from each batch if fewer than 5 are used.

When strength of field-cured cylinders is less than 85% of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.

Strength level of concrete will be considered satisfactory if average of sets of three consecutive strength test results equal or exceed specified compressive strength, and no individual strength test result falls below specified compressive strength by more than 500 psi.

Test results will be reported in writing to Architect and Contractor within 24 hours after tests are made. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength of 28 days, concrete mix proportions and materials; compressive breaking strength and type of break for both 7-day tests and 28-day tests.

Non-destructive Testing: Impact hammer, sonoscope, or other non-destructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

Additional Tests: The testing service will make additional tests of in-place concrete when test results indicate specified concrete strength and other characteristics have not been attained in the structure, as directed by Architect. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying ASTM C 42, or by other methods as directed.

Contractor shall pay for such tests conducted, and any other additional testing as may be required, when unacceptable concrete is verified.

END OF SECTION 03310

SECTION 03451 – CAST STONE

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings, General Conditions and Supplementary General Conditions and other Division-1 Specification Sections, apply to this Section.

SUMMARY

This Section includes architectural cast stone.

Architectural cast stone includes the following:

Plain smooth-faced cast stone units indicated as

Parapet Copings - as indicated on the elevations and sections.

And any other items indicated on drawings.

Related Sections: The following sections contain requirements that relate to this section:

Mortar, Masonry Grout and Unit Masonry Assemblies are specified in Division 4.

Caulking, sealants, and gaskets are specified in Division 7.

SUBMITTALS

General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

Manufacturer's Qualification Data: Documentation showing compliance with specified requirements.

Product data and instructions for manufactured materials and products. Include mix designs, certifications, and laboratory test reports as required.

Include water absorption test reports for units with exterior exposure.

Shop drawings prepared by or under supervision of a qualified professional engineer showing complete information for fabrication and installation of precast concrete units. Indicate member dimensions and cross-section; fabrication tolerances; location, size, and type of reinforcement, including special reinforcement; and lifting devices necessary for handling and erection.

Indicate welded connections by AWS standard symbols. Detail inserts, connections, and joints, including accessories and construction at openings in precast units.

Show caulked joints, including expansion joints ("soft" type) and grouted joints ("rigid" type).

Show location and details of anchorage devices to be embedded in other construction.

Indicate protective finishes for metal items including connectors.

Samples approximately 12 by 12 by 2 inches to illustrate quality, color, and texture of surface finish.

REFERENCES

ACI 318 – Building Code Requirements for Reinforced Concrete
ASTM A 185 – Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete; 2002
ASTM A 615/A 615M – Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement; 2004
ASTM 33 - Standard Specification for Concrete Aggregates; 2003
ASTM C 150 – Standard Specification for Portland Cement; 2002a
ASTM C 270 – Standard Specification for Mortar for Unit Masonry; 2003b
ASTM C 494/C 494M – Standard Specification for Chemical Admixtures to concrete; 2004
ASTM C 1364 – Standard Specifications for Architectural Cast Stone; 2003

DESIGN REQUIREMENTS

Please Note – Any supporting steel (anchors, angles, etc.) beyond what is shown on drawings (See Wall Sections) must be coordinated with Cast Stone Supplier and included in Contractor's base bid dollar amount.

Design units to withstand design loads as calculate in accordance with North Carolina Sate Building Code and erection forces. Calculate structural properties of units in accordance with SCI 318.

Design units to withstand static loads and anticipated dynamic loading, including positive and negative wind loads and thermal movement loads.

Design and size components to withstand seismic loads and sway displacement as calculated in accordance with North Carolina State Building Code.

Design component connections to accommodate building movement and thermal movement. Provide adjustment to accommodate misalignment of structure without unit distortion or damage.

QUALITY ASSURANCE

Engineer Qualifications: A professional engineer legally authorized to practice in jurisdiction where project is located and experienced in providing engineering services that have resulted in successful installation of architectural precast concrete units similar in material, design, and extent as required for this Project.

Fabricator Qualifications: A current producer member of the Cast Stone Institute or producer who *"adheres to the current requirements of the Cast Stone Institute."* Firm having a minimum of 5 years successful experience in fabrication of architectural precast concrete units, similar to members required for this project, will be acceptable. Fabricator must have sufficient production capacity to produce, transport, and deliver required units without causing delay in the work.

Cunningham Brick, RockCast, Cincinnati, OH 513-874-2345 www.readingrock.com

MarcStone, LLC Hampton, MN 651-437-7972 www.marystone.com

- Or equal meeting fabricator qualifications.

DELIVERY, STORAGE, AND HANDLING

Deliver precast concrete units to project site in such quantities and at such times to assure continuity of installation. Store units at project site to prevent cracking, distorting, warping, staining, or other physical

damage and so that markings are visible. Lift and support units only at designated lifting or supporting points as shown on final shop drawings.

PART 2 - PRODUCTS

ARCHITECTURAL CAST STONE

Cast Stone: Architectural concrete product manufactured to simulate appearance of natural limestone, complying with ASTM C 1364.

Compressive Strength: As specified in ASTM C 1364; calculate strength of pieces to be field cut at 80 percent of uncut piece.

Freeze-Thaw Resistance: Demonstrated by laboratory testing in accordance with ASTM C 1364.

Surface texture: Fine grained texture with no bug holes, air voids or other surface blemishes visible from distance of 10 feet.

Color: Selected by RBS Architects for **manufacturers full range**.

Remove cement film from exposed surfaces before packaging for shipment.

Shapes: Provide shapes as indicate don drawings.

Variation on Any Dimension, including Bow, Camber and Twist: Maximum of plus/minus 1/16 inch or length divided by 360, whichever is greater, but not more than 1/8 inch.

Unless otherwise indicated on drawings, provide:

Wash or slope of 1:12 on exterior horizontal surfaces,

Drips on all projecting components, wherever possible,

Raised fillets at back of sills and at ends to be built in.

Reinforcement: Provide reinforcement as required ot withstand handling and structural stresses; comply with ACI 318.

MATERIALS

Portland Cement: ASTM C 150

For Units: Type I or II, white.

For Mortar: Type I or II, except Type III may be used in cold weather.

Coarse Aggregate: ASTM C 33, except for gradation; granite, quartz or limestone.

Fine Aggregate: ASTM C 33, except for gradation; natural or manufactured sands.

Admixtures: ASTM C 494/C 494M.

Water: Potable.

Reinforcing Bars: ASTM A 615/A 615M deformed bars, galvanized or epoxy coated.

Steel Welded Wire Reinforcement: ASTM A 185, galvanized or epoxy coated.

Embedded Anchors, Dowels, and Inserts: Type 304 stainless steel of type and size as required for conditions.

Mortar: Portland cement-lime, ASTM C 270, Type N; do not use masonry cement.

Sealant: As specified in Division 7.

Cleaner: General purpose cleaner designed for removing mortar and grout stains, efflorescence and other construction stains from new masonry surfaces without discoloring or damaging masonry surfaces; approved for intended use by cast stone manufacturer and by cleaner manufacturer for use on cast stone and adjacent masonry materials.

PART 3 - EXECUTION

EXAMINATION

Examine construction to receive cast stone components. Notify Architect if construction is not acceptable.

Do not begin installation until unacceptable conditions have been corrected.

INSTALLATION

Install cast stone components in conjunction with masonry, complying with requirements of Division 4.

Erect units level and plumb within allowable tolerances.

Align and maintain uniform horizontal and vertical joints as erection progresses.

Mechanically anchor cast stone units indicated; set remainder in mortar.

Setting:

Drench cast stone components with clear, running water immediately before installation.

Set units in full bed mortar unless otherwise detailed.

Fill vertical joints with mortar.

Fill dowel holes and anchor slots completely with mortar or non-shrink grout.

Joints: Make all joints 3/8 inch, except as otherwise detailed.

Rake mortar joints 3/4 inch for pointing. Scrub face of each stone to remove excess mortar before it sets.

Point joints with mortar in layers 3/8 inch thick and tool to a slight concave profile.

Leave the following joints open for sealant:

Head joints in top courses, including copings, parapets, cornices, sills and steps.

Joints in projection units.

Joints between rigidly anchored units, including soffits, panels and column covers.

Joints below lugged sills and stair treads.

Joints below ledge and relieving angles.

Joints labeled "expansion joints".

Sealant Joints: Install sealants as specified Division 7.

Installation Tolerances:

Variation from Plumb: Not more than 1/16 inch in 10 feet or 1/8 inch in 20 feet or more.

Variation from Level: Not more than 1/16 inch in 10 feet or 1/8 inch in 20 feet, or 1/4 inch maximum.

Variation in Joint Width: Not more than 1/8 inch in 36 inches or 1/4 of nominal joint width, whichever is less.

Variation in Plane Between Adjacent Surfaces (Lipping): Not more than 1/16 inch difference between planes of adjacent units or adjacent surfaces indicated to be flush with units.

CLEANING AND PROTECTION

Repair chips and other surface damage noticeable when viewed in daylight at 10 feet.

Repair with matching touchup material provided by the manufacturer and in accordance with manufacturer instructions.

Repair methods and results are subject to RBS Architects, Inc. approval.

Clean exposed cast stone after mortar is thoroughly set and cured.

Wet surface with water before applying cleaner.

Apply cleaner to cast stone in accordance with manufacturers instructions.

Remove cleaner promptly by rinsing thoroughly with clear water.

Do not use acidic cleaners.

Protect form splashing by mortar and other damage.

END OF SECTION 03451

SECTION 04200 - UNIT MASONRY

PART 1 - GENERAL

RELATED DOCUMENTS

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

SUMMARY

This Section includes the following:

Concrete unit masonry. (6", 8" and 12" standard units).

Clay unit masonry in the form of brick-

Brick unit masonry for veneered and infill masonry applications.

Typical Face Brick – via Brick Allowance per 1000 units.

Clay unit masonry in the form of special shapes.

NOTE: Special shapes (including solids) are part of base bid price and unit costs are not covered by the brick allowance.

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

Steel lintels in unit masonry are specified in Division 5 Section "Metal Fabrications."

Wood nailers and blocking built into unit masonry are specified in Division 6 Section "Rough Carpentry."

Reglets in masonry joints for metal flashing are specified in Division 7 Section "Flashing and Sheet Metal."

Rigid Insulation for building perimeter and exterior continuous insulation sheathing are specified in Division 7 Section "Insulation."

Hollow metal frames in unit masonry openings are specified in Division 8 Section "Steel Doors and Frames."

SYSTEM PERFORMANCE REQUIREMENTS

Provide unit masonry that develops the following installed compressive strengths (f'm):

For clay unit masonry: As follows:

f'm = 2500 psi.

As indicated.

For concrete unit masonry: As follows:

f'm = 1500 psi.

As indicated.

SUBMITTALS

General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

Product data for each different masonry unit, accessory, and other manufactured product indicated.

Shop drawings for reinforcing detailing fabrication, bending, and placement of unit masonry reinforcing bars. Comply with ACI 315 "Details and Detailing of Concrete Reinforcing" showing bar schedules, stirrup spacing, diagrams of bent bars, and arrangement of masonry reinforcement.

Samples for initial selection purposes of the following:

Unit masonry samples in small-scale form showing full extent of colors and textures available.

Cold-weather construction procedures evidencing compliance with requirements specified in referenced unit masonry standard.

Hot-weather construction procedures evidencing compliance with requirements specified in referenced unit masonry standard.

Results from tests and inspections performed by Owner's representatives will be reported promptly and in writing to Architect and Contractor.

QUALITY ASSURANCE

Unit Masonry Standard: Comply with ACI 530.1/ASCE 6 "Specifications for Masonry Structures," except as otherwise indicated.

Fire Performance Characteristics: Where indicated, provide materials and construction identical to those of assemblies whose fire resistance has been determined per ASTM E 119 by a testing and inspecting organization, by equivalent concrete masonry thickness, or by another means, as acceptable to authorities having jurisdiction.

Single-Source Responsibility for Masonry Units: Obtain exposed masonry units of uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from one manufacturer for each different product required for each continuous surface or visually related surfaces.

Single-Source Responsibility for Mortar Materials: Obtain mortar ingredients of uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source and producer for each aggregate.

Field-Constructed Mock-Ups: Prior to installation of unit masonry, erect sample wall panels to further verify selections made under sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution. Build mock-ups to comply with the following requirements, using materials indicated for final unit of Work:

Locate mock-ups on site in locations indicated or, if not indicated, as directed by Architect.

Build mock-ups for the following types of masonry in sizes of approximately 4 feet long by 4 feet high by full thickness, including face and backup wythes as well as accessories.

Each type of exposed unit masonry construction.
Typical interior unit masonry wall.

Where masonry is to match existing, erect panels parallel to existing surface.

Retain and maintain mock-ups during construction in undisturbed condition as standard for judging completed unit masonry construction.

When directed, demolish and remove mock-ups from Project site.

DELIVERY, STORAGE, AND HANDLING

Deliver masonry materials to project in undamaged condition.

Store and handle masonry units off the ground, under cover, and in a dry location to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion, and other causes. If units become wet, do not place until units are in an air-dried condition.

Store cementitious materials off the ground, under cover, and in dry location.

Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

Store masonry accessories including metal items to prevent corrosion and accumulation of dirt and oil.

PROJECT CONDITIONS

Protection of Masonry: During erection, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

Extend cover a minimum of 24 inches down both sides and hold cover securely in place.

Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.

Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Remove immediately any grout, mortar, and soil that come in contact with such masonry.

Protect base of walls from rain-splashed mud and mortar splatter by means of coverings spread on ground and over wall surface.

Protect sills, ledges, and projections from mortar droppings.

Protect surfaces of window and door frames, as well as similar products with painted and integral finishes from mortar droppings.

COLD WEATHER PROTECTION

Do not lay masonry units which are wet or frozen.

Remove any ice or snow formed on masonry bed by carefully applying heat until top surface is dry to the touch.

Remove masonry damaged by freezing conditions.

Perform the following construction procedures while the work is progressing. Temperature ranges indicated below apply to air temperatures existing at time of installation except for grout. For grout, temperatures ranges apply to anticipated minimum night temperatures. In heating mortar and grout materials, maintain mixing temperature selected within 10 degrees F.

40 degrees F to 34 degrees F:

Mortar: Heat mixing water to produce mortar temperature between 40 degrees F and 120 degrees F.

Grout: Follow normal masonry procedures.

34 degrees F or below:

DISCONTINUE MASONRY WORK.

Protect completed masonry and masonry not being worked on in the following manner. Temperature ranges indicated apply to mean daily air temperatures except for grouted masonry. For grouted masonry temperature ranges apply to anticipated minimum night temperatures.

40 degrees F to 34 degrees F:

Protect masonry from rain or snow for at least 24 hours by covering with weather-resistive membrane.

32 degrees F to 25 degrees F:

Completely cover masonry with weather-resistive membrane for at least 24 hours.

25 degrees F to 20 degrees F:

Completely cover masonry with weather-resistive insulative blankets or similar protection for at least 24 hours, 48 hours for grouted masonry.

Except as otherwise indicated, maintain masonry temperature above 32 degrees F (0 degrees C) for 24 hours using enclosures and supplementary heat, electric heating blankets, infrared lamps or other methods proved to be satisfactory. For grouted masonry maintain heated enclosure to 40 degrees F (4 degrees C) for at least 48 hours.

Hot-Weather Construction: Comply with referenced unit masonry standard.

PART 2 - PRODUCTS

MATERIALS, GENERAL

Comply with referenced unit masonry standard and other requirements specified in this Section applicable to each material indicated.

CLAY MASONRY UNITS

General: Comply with the following requirements applicable to each form of brick required:

Provide special molded shapes where indicated and as follows:

For applications requiring brick of form, color, texture, and size on exposed surfaces that cannot be produced by sawing standard brick sizes.

Provide units without cores or frogs and with all exposed surfaces finished for ends of sills, caps, and similar applications that expose brick surfaces that otherwise would be concealed from view.

Face Brick Standard: ASTM C 216 and as follows:

Grade and Unit Compressive Strength: Provide units of grade and minimum average net area compressive strength indicated below:

Grade SW.
3000 psi.

Type FBS (for general use in exposed masonry requiring wider variations in size and color ranges than Type FBX).

Size: Provide bricks manufactured to the following actual dimensions within the tolerances specified in ASTM C 216:

Standard Modular: 3-5/8 inches thick by 2-1/4 inches high by 7-5/8 inches long.

Application: Use where brick is exposed, unless otherwise indicated.

<u>Color:</u>	Brick Color A (typical) - Medium GRAY	<u>via Allowance \$419 / 1000</u>
	Brick Accent B - Light GRAY to WHITE	<u>via Allowance \$425 / 1000</u>
	Brick Accent C - Dark GRAY to BLACK	<u>via Allowance \$425 / 1000</u>

Building (Common) Brick: ASTM C 62, and as follows:

Grade and Unit Compressive Strength: Provide units of grade and minimum average net area compressive strength indicated below:

Grade SW.
3000 psi.

Size: Provide bricks manufactured to the following actual dimensions within the tolerances specified in ASTM C 216:

Standard Modular: 3-5/8 inches thick by 2-1/4 inches high by 7-5/8 inches long.

Application: Use where brick is indicated for concealed locations.

CONCRETE MASONRY UNITS

General: Comply with requirements indicated below applicable to each form of concrete masonry unit required.

Provide special shapes where indicated and as follows:

For lintels, corners, jambs, sash, control joints, headers, bonding, and other special conditions.

Size: Provide concrete masonry units complying with requirements indicated below for size that are manufactured to specified face dimensions within tolerances specified in the applicable referenced ASTM specification for concrete masonry units.

Concrete Masonry Units: Manufactured to specified dimensions of 3/8 inch less than nominal widths by nominal heights by nominal lengths indicated on drawings.

Concrete Building Brick: Specified dimensions as follows:

Standard Modular: 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long.

Provide Type I, moisture-controlled units.

Exposed Faces: Manufacturer's standard color and texture, unless otherwise indicated.

Standard aggregate, ground finish.

Hollow Load-Bearing Concrete Masonry Units: ASTM C 90, Grade N and as follows:

Unit Compressive Strength: Provide units with minimum average net area compressive strength indicated below:

2000 psi.

Not less than the unit compressive strengths required to produce concrete unit masonry construction of compressive strength indicated.

Weight Classification: Lightweight.

Solid Load-Bearing Concrete Masonry Units: ASTM C 145, Grade N and as follows:

Unit Compressive Strength: Provide units with minimum average net area compressive strength indicated below:

75% solid units

2000 psi.

Weight Classification: Lightweight.

Concrete Building Brick: ASTM C 55 and as follows:

Unit Compressive Strength: Provide units with minimum average net area compressive strength indicated below:

3500 psi.

Weight Classification: Lightweight.

MORTAR AND GROUT MATERIALS

Comply with ASTM C 476 for grout for use in construction of reinforced and nonreinforced unit masonry.

Grout shall conform to ASTM 476 and compressive strength of grout determined in accordance with ASTM C1019; 2000 psi minimum.

Reference and comply with ACI-530-08 for grout requirements.

Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction.

Provide natural color cement.

Mortar for this project shall be Standard, Type-S mortar. (Colored Mortar is not required)

Sand shall meet the requirements of Standard Specifications for Aggregate for Masonry Mortar (ASTM C-144-81), with the gradation to satisfy paragraph 4, Grading, and with the omission of sub-paragraph 4.4 Sand color shall be determined as required to produce masonry mortar color specified.

Ready-Mixed Mortar: Cementitious materials, water, and aggregate complying with requirements specified in this article, combined with set-controlling admixtures to produce a ready-mixed mortar complying with ASTM C 1142.

Hydrated Lime: ASTM C 207, Type S.

Aggregate for Mortar: ASTM C 144, except for joints less than 1/4 inch use aggregate graded with 100 percent passing the No. 16 sieve.

Aggregate for Grout: ASTM C 404.

Water: Clean and potable.

PREPACKAGED MORTAR CEMENTS

Prepackaged mortar cements may be used with the prior approval. The mortar cement shall be in accordance with ASTM C91-83, and meet the following minimum requirements.

Type S Mortar Cement: The masonry mortar made from the mortar cement shall have a compressive strength of 1800 psi minimum at 28 days when tested in accordance with ASTM C-270, with maximum air volume of 16%.

The mortar cement shall contain Portland cement, hydrated lime, plasticized admixtures and/or hydraulic hydrated lime. Mortar cements which contain other materials, including ground limestone, ground slag or other cementitious and non-cementitious materials, are not acceptable.

Instructions for mixing the mortar shall be published and accompany all shipments. The instructions shall be volumetric measurements, and shall be developed to show proper proportions of sand to one (1) bag of the prepackaged mortar cement with volume of water to produce a flow of the proper consistency.

Freeze-thaw resistance: The mortar cement shall comply with the following requirements when subjected to 50 cycles of the freeze-thaw test:

Loss of compressive strength	35.0% maximum
Loss of dry weight	1.0% maximum

The test specimen shall be made in accordance with ASTM C-91, Paragraphs 18, 19, and 20, and be tested in accordance with ASTM C-91, Paragraphs 22.1 and 22.2.1, and ASTM C-67, Paragraphs 8.1, 8.3, and 8.4.

ON-THE-JOB MORTAR CEMENT

Type S Mortar shall have a compressive strength of 1800 psi minimum at 28 days. The mortar shall be proportioned within the following volumetric limits:

1 part Portland Cement

1/2 part Hydrated Lime

Masonry sand measured in a damp loose condition is to be not less than 2-1/4 nor more than 3 times the sum of the volumes of cement plus lime used.

Plasticizer per instructions of the manufacturer, the quantity of which is not to exceed 2% by volume of the cement and lime combination.

MEASUREMENTS AND MIXING

The method of measuring materials shall be by volume, and shall be such that the specified proportions of the mortar materials can be controlled and accurately maintained. A measuring device to make consistent volume measurements shall be used throughout the project. Measurement of sand by shovel shall not be permitted.

Mortar Mixer shall be paddle-type mechanical mixer. It shall be of such design and size to accommodate the mixing of the ingredients.

The mortar mixer shall be charged in this order: add approximately one-half the water required, one-half the sand, the cement and lime (or prepackaged mortar cement), the remaining amount of sand, and then sufficient water to bring the mix to desired consistency. Mortar shall be mixed for a minimum of five minutes after all materials have been charged into the mixer with all batches being mixed to the same consistency.

Mortars that have stiffened because of evaporation of water from the mortar may be retempered by adding water as frequently as needed to restore the required consistency. Mortars shall be used and placed in their final position within 2 hours after mixing. When the temperature is over 80 degrees F., the mortar shall be used within 1-1/2 hours after mixing. Mortar not used within the stated time periods shall be discarded.

JOINT REINFORCEMENT, TIES AND ANCHORING DEVICES:

Materials: Comply with requirements indicated below for basic materials and with requirements indicated under each form of joint reinforcement, tie and anchor for size and other characteristics:

Zinc-Coated (galvanized) Steel Wire: ASTM A 82 for uncoated wire and with ASTM C 641 for zinc coating of class indicated below:

Class 1 (0.40 oz. per sq. ft. of wire surface).

Application: Use for masonry not exposed to exterior or earth.

Hot-Dip Galvanized Steel Wire: ASTM A 82 for uncoated wire and with ASTM A 153, Class B-3 for zinc coating applied after prefabrication into units.

Application: Use for masonry exposed to exterior and in contact with earth.

Zinc-Coated (Galvanized) Steel Sheet: Carbon steel with zinc coating complying with ASTM A 525, Coating Designation G90.

Application: For dovetail and anchors slots used in masonry and concrete not exposed to exterior or earth.

Hot-Dip Galvanized Carbon Steel Sheet: ASTM A 366, Class 2 or ASTM A 635; hot dip galvanized after fabrication to comply with ASTM A 153; Class B.

Application: For dovetail slots and anchors used in masonry and concrete exposed to exterior or in contact with earth.

Joint Reinforcement: Provide welded-wire units prefabricated with deformed continuous side rods and plain cross rods into straight lengths of not less than 10', with prefabricated corner and tee units, and complying with requirements indicated below:

Width: Fabricate joint reinforcement in units with widths of approximately 2" less than nominal width of walls and partitions as required to provide mortar coverage of not less than 5/8" on joint faces exposed to exterior and 1/2" elsewhere.

Wire Size for Side Rods: 0.1483" diameter.

Wire Size for Cross Rods: 0.1483" diameter.

For single-wythe masonry provide type as follows with single pair of side rods:

Ladder type with perpendicular cross rods spaced not more than 16 inches o.c. and 1 side rod for each face shell of hollow masonry units more than 4 inches in width, plus 1 side rod for each wythe of masonry 4 or less in width.

Uses: Typical interior walls.

For multi-wythe masonry provide type as follows:

Adjustable (2-piece) type with single pair of side rods and cross ties spaced not more than 16 inches o.c. and with separate adjustable veneer ties engaging the cross ties. Cross ties are either U-shaped with eyes or rectangular. Space side rods for embedment within each face shell of backup wythe and size adjustable ties to extend at least halfway through outer wythe but with at least 5/8-inch cover on outside face.

Uses: Typical exterior brick veneer walls.

For masonry veneer on stud framing provide type as follows:

Masonry Veneer Anchors: One-piece unit, rib-stiffened steel sheet metal plate, pre-punched for nail or screw attachment through sheathing into metal framing, resist tension and compression forces perpendicular to plane of wall; 12 gage x 1" minimum width x length required to anchor into brick wythe 2-1/2" minimum.

Anchor spacing: Arrange anchors not more than 16" o.c. both vertically and horizontally to allow spacing of ties.

Available Products: Subject to compliance with requirements, masonry veneer anchors which may be incorporated in the work includes, but is not limited to, the following:

Heckman Building Products Inc. or approved equal.

No. 315-C Screw-On Anchor Strap with No. 316 Triangle Tie.

Uses: Typical exterior brick veneer on stud framing.

Hardware cloth: See drawings for indicated locations and applications. Hot dip mill-galvanized wire, 16 gauge 2 x 2 (1/2") mesh. Tie is 1" less than nominal width of unit or wall.

D/A WMT Wire Mesh Ties; Dur-O-Wall, Inc.
269 Wire Mesh Ties; Heckman Building Products.

Structural Steel and Masonry Wall Anchors: Tie masonry walls to column flanges parallel to the wall. Anchors are 3/8" diameter mill-galvanized wire. Provide anchor width required for masonry bend to extend 2" into horizontal joint.

Hot dip mill-galvanized wire, 16 gage 2 x 2 (1/2") mesh. Tie is 1" less than nominal width of unit or wall.

No.216 Wire Type Anchor; Heckmann Building Products
D/A-F/P and D/A-F/RA; Dur-O-Wall, Inc.

Channel Slots and Anchors: Two piece Assemblies which permit vertical or horizontal differential movement between wall and steel framework parallel to, but resist tension and compression forces perpendicular to wall. Consists of wire tie section and extended type metal anchor section.

D/A 902 anchor with ties 912 and 918-921; Dur-O-WALL, Inc.
131 anchor with ties 134 and 129; Heckman building products.

Weld-on Adjustable Anchor Rods and Straps: Two piece assemblies for tying masonry walls to steel columns and beams.

D/A 709-711 anchor and D/A 701/708 tie; Dur-O-Wall, Inc.
No. 315 anchor and No.316 tie; Heckman Building Products.

Unit type Masonry Inserts in Concrete:

Dovetail Slots: Furnish dovetail slots, with filler strips, of slot size indicated and entire height of wall, fabricated from 22 gage sheet metal. Cast into concrete walls backing brick veneer at 24" o.c. horizontally to allow veneer anchors to be spaced not more than 24" o.c. horizontally and 16" o.c. vertically.

Dovetail Anchors:

Wire Size: 0.1483" diameter.

Wire tie Shape: Triangular.

Wire Tie Coating: Hot dipped galvanized.

Wire tie Length: As required to extend within 1" of masonry veneer face.

Products: Subject to compliance with requirements, provide the following or equal products:

"D/A 100 slot and D/A 720-723 anchor"; Dur-O-Wal, Inc.

"100 slot and 103 anchor " Heckman Building Products.

Anchor Bolts: Provide steel bolts with hex nuts and flat washers complying with ASTM A 307, Grade A, hot-dip galvanized to comply with ASTM C 153, Class C, in sizes and configurations indicated.

CONCEALED FLASHING MATERIAL

Vinyl Sheet Flashing: Flexible sheet flashing especially formulated from virgin polyvinyl chloride with plasticizers and other modifiers to remain flexible and waterproof in concealed masonry applications, black in color and thickness indicated below.

Thickness: 30 mils.

Application: Use where flashing is fully concealed in masonry.

Adhesives for Flashings: Of type recommended by manufacturer of flashing material for use indicated.

MISCELLANEOUS MASONRY ACCESSORIES:

Reinforcing Bars: Deformed steel, ASTM A 615, Grade 60 for bars No. 3 to No. 18.

Non-Metallic Expansion Joint Strips: Premolded, flexible filler strips complying with ASTM D 1056, Type 2 (Closed cell), Class A (cellular rubber and rubber-like materials with specific resistance to petroleum base oils), Grade 1 (Compression-deflection range of 2-5 psi), compressible up to 35%, of width and thickness indicated, formulated from the following material:

Neoprene.

Preformed Control Joint Gaskets: Material as indicated below, designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

Styrene-Butadiene Rubber Compound: ASTM D 2000, Designation 2AA-805.

Polyvinyl Chloride: ASTM D 2287, General Purpose Grade, Type PVC-65406.

Face brick Expansion Joint Bridge: D/A by Dur-O-Wal, Inc.

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

Weepholes: Provide weepholes in masonry construction just above thru-wall flashing and at points indicated on drawing. At the ground level provide "open head joints" in brick at 2'-0" o.c. along the length of the wall. For all weep holes required above the ground level install weep ropes at 2'-0" o.c. above windows doors or other miscellaneous thru-wall flashing points

Wicking Material: Material as indicated below in lengths required to produce a 2" exposure on exterior and 18' in cavity between wythes.

Fibrous glass rope.

GROUT FOR UNIT MASONRY

Comply with ASTM C 476 for grout for use in construction of reinforced and nonreinforced unit masonry. Use grout of consistency indicated or if not otherwise indicated, of consistency (fine or coarse) at time of placement which will completely fill all spaces intended to receive grout.

Use fine grout in grout spaces less than 2" in horizontal direction, unless otherwise indicated.

Use coarse grout in grout spaces 2" or more in least horizontal dimension, unless otherwise indicated.

Do not use calcium chloride in grout.

MASONRY CLEANERS:

Job-Mixed Detergent Solution: Solution of trisodium phosphate (1/2 cup dry measure) and laundry detergent (1/2 cup dry measure) dissolved in one gallon of water.

PART 3 - EXECUTION

INSTALLATION, GENERAL:

Wetting Clay Brick: Wet brick made from clay or shale that have ASTM C 67 initial rates of absorption (suction) of more than 30 grams per 30 sq. in. per minute. Use wetting methods that ensure each clay masonry unit being nearly saturated but surface dry when laid.

Do not wet concrete masonry units.

Cleaning Reinforcing: Before placing, remove loose rust, ice and other coatings from reinforcing.

Thickness: Build cavity and composite walls, floors and other masonry construction to the full thickness shown. Build single-wythe walls (if any) to the actual thickness of the masonry units, using units of nominal thickness indicated holding dimension to face or unit same as indicated on drawings.

Build chases and recesses as shown or required for the work of other trades. Provide not less than 8" of masonry between chase or recess and jamb of openings, and between adjacent chases and recesses.

Leave openings for equipment to be installed before completion of masonry work. After installation of equipment, complete masonry work to match work immediately adjacent to the opening.

Cut masonry units using motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide continuous pattern and to fit adjoining work. Use full-size units without cutting where possible.

Use dry cutting saws to cut concrete masonry units.

CONSTRUCTION TOLERANCES:

Variation from Plumb: For vertical lines and surfaces of columns, walls and arises do not exceed 1/4" in 10', or 3/8" in a story height. For external corners, expansion joints, control joints and other conspicuous lines, do not exceed 1/4" in any story. For vertical alignment of head joints do not exceed plus or minus 1/4" in 10', 1/2" maximum.

Variation from Level: For bed joints and lines of exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines, do not exceed 1/4" in any bay or 20' maximum, not 1/2" in 40' or more. For top

surface of bearing walls do not exceed 1/8" between adjacent floor elements in 10' or 1/16" within width of a single unit.

Variation of Linear Building Line: For position shown in plain and related portion of columns, walls and partitions, do not exceed 1/2" in any bay or 20' maximum, or 3/4" in 40' or more.

Variation in Cross-Sectional Dimensions: For columns and thickness of walls, from dimensions shown, do not exceed minus 1/4" nor plus 1/2".

Variation in Mortar Joint Thickness: Do not exceed bed joint thickness indicated by more than plus or minus 1/8", with a maximum thickness limited to 1/2". Do not exceed head joint thickness indicated by more than plus or minus 1/8".

LAYING MASONRY WALLS:

Layout walls in advance for accurate spacing of surface bond patterns with uniform joint widths and to accurately locate opening, movement-type joints, returns and offsets. Avoid the use of less-than-half-size units at corners, jambs and wherever possible at other locations.

Lay-up walls to comply with specified construction tolerances, with courses accurately spaced and coordinated with other work.

Pattern Bond: Lay exposed masonry in the bond pattern shown or, if not shown, lay in running bond with vertical joint in each course centered on units in courses above and below. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2". Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4" horizontal face dimensions at corners or jambs.

Stopping and Resuming Work: Rack back 1/2-unit length in each course; do not tooth. Clean exposed surfaces of set masonry, wet units lightly (if required) and remove loose masonry units and mortar prior to laying fresh masonry.

Built-in Work: As the work progresses, build-in items specified under this and other sections of these specifications. Fill in solidly with masonry around built-in items.

Fill space between hollow metal frames and masonry solidly with mortar.

Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.

Fill cores in hollow masonry units with grout 3 courses (24") under bearing plates, beams, lintels, posts and similar items, unless otherwise indicated.

MORTAR BEDDING AND JOINTING:

Lay solid brick-size masonry units with completely filled bed and head joint; butter ends with sufficient mortar to fill head joints and shove into place. Do not slush head joints.

Lay hollow concrete masonry units with full mortar coverage on horizontal and vertical face shells. Bed webs in mortar in starting course on footings and in all courses of piers, columns and pilasters, and where adjacent to cells or cavities to be reinforced or filled with concrete or grout. For starting course on footings where cells are not grouted, spread out full mortar bed including areas under cells.

Maintain joint widths shown, except for minor variations required to maintain bond alignment. If not shown, lay walls with 3/8" joints.

Cut joints flush for masonry walls which are to be concealed or to be covered by other materials, unless otherwise indicated.

Tool exposed joints slightly concave using a jointer larger than joint thickness, unless otherwise indicated.

Remove masonry units disturbed after laying; clean and reset in fresh mortar. Do not pound corners or jambs to shift adjacent stretcher units which have been set in position. If adjustments are required, remove units, clean off mortar and reset in fresh mortar.

Collar Joints: After each course is laid, fill in vertical longitudinal joint between wythes solidly and with mortar for the following masonry work:

Interior walls and partitions.

Exterior walls, except cavity walls.

Nonloadbearing interior walls or partitions where metal ties or horizontal reinforcing are indicated for structural bonding and nominal thickness of wall or partition is required to meet code requirements for height-to-thickness ratio.

STRUCTURAL BONDING OF MULTI-WYTHE MASONRY:

Use continuous horizontal joint reinforcement installed in horizontal mortar joints for bond tie between wythes. Install at not more than 16" o.c. vertically.

For horizontally reinforced masonry, provide continuity at corners with prefabricated "L" units, in addition to masonry bonding.

Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, provide same type of bonding specified for structural bonding between wythes and space as follows:

Provide continuity with horizontal joint reinforcement using prefabricated "T" units.

Non-bearing Interior Partitions: Build full height of story to underside of solid floor or roof structure above, unless otherwise shown. (See Wall Rating Legend on plan drawings to determine which walls are intended to run full height.)

Run non-bearing partitions (indicated to be full height) within 1" of structure above and secure against lateral movement with channel section width of wall x 1'-0" length spaced at 4'-0" o.c. unless detailed otherwise on drawings.

HORIZONTAL JOINT REINFORCEMENT:

General: Provide continuous horizontal joint reinforcement as indicated. Install longitudinal side rods in mortar for their entire length with a minimum cover of 5/8" exterior side of walls, 1/2" elsewhere. Lap reinforcing a minimum of 6".

Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.

Reinforce walls with continuous horizontal joint reinforcing unless specifically noted to be omitted.

Provide continuity at corners and wall intersections by use of prefabricated "L" and "T" sections. Cut and bend reinforcement units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.

Space continuous horizontal reinforcement as follows:

For multi-wythe walls (solid or cavity), space reinforcement 16" o.c. vertically.

For single-wythe walls, space reinforcement at 16" o.c. vertically, unless otherwise indicated.

Reinforce masonry openings greater than 1'-0" wide, with horizontal joint reinforcement placed in 2 horizontal joints approximately 8" apart, immediately above the lintel and immediately below the sill. Extend reinforcement a minimum of 2'-0" beyond jambs of the opening except at control joints.

In addition to wall reinforcement, provide additional reinforcement at openings as required to comply with the above.

ANCHORING MASONRY WORK:

General: Provide anchor devices of type indicated.

Anchor Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153, Class C; of diameter and length indicated and in the following configurations:

Headed Bolts.

Postinstalled Anchors: Anchors as described below, with capability to sustain, without failure, load imposed within factors of safety indicated, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

Type: Expansion Anchors.

Corrosion Protection: Stainless-steel components with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Alloy Group 1 or 4) for bolts and nuts; ASTM A 167 or ASTM A 276, Type 304 or 316, for anchors.

For Postinstalled Anchors in Grouted Concrete Masonry Units: Capability to sustain, without failure, a load equal to 6 times the loads imposed by masonry.

Installation of Anchor Bolts: Position fixture, drill hole. Insert anchor bolt, tap flush with fixture, and tighten.

Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:

Provide an open space not less than 1" in width between masonry and structural member, unless otherwise indicated. Keep open space free of mortar or other rigid materials.

Anchor masonry to structural members with flexible anchors embedded in masonry joints and attached to structure.

Space anchors as indicated, but not more than 24" o.c. vertically and 36" o.c. horizontally.

CONTROL AND EXPANSION JOINTS:

General: Provide vertical and horizontal expansion, control and isolation joints in masonry where shown. Build-in related items as the masonry work progresses.

Build-in non-metallic joint filler where indicated.

Build in vertical pressure relieving joints where indicated; construct joints by inserting non-metallic compressible joint filler of width required to permit installation of sealant and backer rod.

LINTELS:

Provide masonry lintels where shown or wherever openings of more than 1'-0" for brick size units and 2'-0" for block size units are shown without structural steel or other supporting lintels. Provide precast or formed-in-place masonry lintels. Cure precast lintels before handling and installation.

For hollow concrete masonry unit walls, use specially formed U-shaped lintel units with reinforcement bars placed as shown filled with coarse grout.

Provide minimum bearing of 8" at each jamb, unless otherwise indicated.

FLASHING OF MASONRY WORK:

General: Provide concealed flashing in masonry work at, or above, shelf angles, lintels, ledges and other obstructions to the downward flow of water in the wall so as to divert such water to the exterior. Prepare masonry surfaces smooth and free from projections which could puncture flashing. Place through-wall flashing on sloping bed of mortar and cover with mortar. Seal penetrations in flashing with mastic before covering with mortar. Extend flashings through exterior face of masonry.

Extend flashing the full length of lintels and shelf angles and minimum of 4" into masonry each end. Extend flashing from exterior face of outer wythe of masonry, through the outer wythe, turned up a minimum of 4", and through the inner wythe half the width of the inner wythe unit.

Install flashing to comply with manufacturer's installation.

Provide weep holes in the head joints of the first course of masonry immediately above concealed flashings. Space 2'-0" o.c., unless otherwise indicated. Trim wicking material used in weep holes flush with outside face of wall after mortar is set.

Install reglets and nailers for flashing and other related work where shown to be built into masonry work.

REPAIR, POINTING, AND CLEANING:

Remove and replace masonry units which are loose, chipped, broken, stained or otherwise damaged, or if units do not match adjoining units as intended. Provide new units to match adjoining units and install in fresh mortar or grout, pointed to eliminate evidence of replacement.

Pointing: During the tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar. Point-up all joints including corners, openings and adjacent work to provide a neat, uniform appearance, prepared for application of sealants.

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

Remove large mortar particles by hand with wooden paddles and non-metallic scrape hoes or chisels.

Test cleaning methods on sample wall panel; leave 1/2 panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.

Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film or waterproof masking tape.

Saturate wall surfaces with water prior to application of cleaners; remove cleaners promptly by rinsing thoroughly with clear water.

Use bucket and brush hand cleaning method described in BIA "Technical Note No. 20 Revised" to clean brick masonry made from clay or shale, except use masonry cleaner indicated below.

Detergent.

Protection: Provide final protection and maintain conditions in a manner acceptable to Installer, which ensures unit masonry work being without damage and deterioration at time of substantial completion.

End of SECTION 04200

SECTION 05120 - STRUCTURAL STEEL

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings, General Conditions and Supplementary General Conditions and other Division-1 Specification Sections, apply to this Section.

SUMMARY

This Section includes fabrication and erection of structural steel work, as shown on drawings including schedules, notes, and details showing size and location of members, typical connections, and types of steel required.

Structural steel is that work defined in American Institute of Steel Construction (AISC) "Code of Standard Practice" and as otherwise shown on drawings.

Miscellaneous Metal Fabrications are specified elsewhere in Division 5.

Refer to Division 3 for anchor bolt installation in concrete, Division 4 for anchor bolt installation in masonry.

SUBMITTALS

General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

Product data or manufacturer's specifications and installation instructions for following products. Include laboratory test reports and other data to show compliance with specifications (including specified standards).

Structural steel (each type), including certified copies of mill reports covering chemical and physical properties.

High-strength bolts (each type), including nuts and washers.

Structural steel primer paint.

Shrinkage-resistant grout.

Shop drawings including complete details and schedules for fabrication and assembly of structural steel members, procedures, and diagrams.

Include details of cuts, connections, camber, holes, and other pertinent data. Indicate welds by standard AWS symbols and show size, length, and type of each weld.

Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed as work of other sections.

Test reports conducted on shop- and field-bolted and welded connections. Include data on type(s) of tests conducted and test results.

QUALITY ASSURANCE

Steel fabricators must have **American Institute of Steel Construction (AISC) Quality Certification.**

Steel erectors must be **Quality Certified Steel Erectors (CSE).**

SEE STRUCTURAL DRAWINGS FOR RELATED INFORMATION.

Codes and Standards: Comply with provisions of following, except as otherwise indicated:

American Institute of Steel Construction (AISC) "Code of Standard Practice for Steel Buildings and Bridges."

AISC "Specifications for Structural Steel Buildings," including "Commentary."

"Specifications for Structural Joints using ASTM A 325 or A 490 Bolts" approved by the Research Council on Structural Connections.

American Welding Society (AWS) D1.1 "Structural Welding Code -Steel."

ASTM A 6 "General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use."

Qualifications for Welding Work: Qualify welding procedures and welding operators in accordance with AWS "Qualification" requirements.

Provide certification that welders to be employed in work have satisfactorily passed AWS qualification tests.

If re-certification of welders is required, retesting will be Contractor's responsibility.

DELIVERY, STORAGE, AND HANDLING

Deliver materials to site at such intervals to ensure uninterrupted progress of work.

Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete or masonry, in ample time to not to delay work.

Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration. If bolts and nuts become dry or rusty, clean and relubricate before use.

Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

PART 2 - PRODUCTS

MATERIALS

Metal Surfaces, General: For fabrication of work that will be exposed to view, use only materials that are smooth and free of surface blemishes including pitting, rust and scale seam marks, roller marks, rolled trade names, and roughness. Remove such blemishes by grinding, or by welding and grinding, prior to cleaning, treating, and applying surface finishes.

Structural Steel Shapes, Plates, and Bars: ASTM A572, ASTM A 36.

Cold-Formed Steel Tubing: ASTM A 500, Grade B.

High-Strength Threaded Fasteners: Heavy hexagon structural bolts, heavy hexagon nuts, and hardened washers, as follows:

Quenched and tempered medium-carbon steel bolts, nuts, and washers, complying with ASTM A 325.

Electrodes for Welding: Comply with AWS Code.

Structural Steel Primer Paint: Fabricator's standard rust-inhibiting primer.

Nonmetallic Shrinkage-Resistant Grout: Premixed, nonmetallic, noncorrosive, nonstaining product containing selected silica sands, Portland cement, shrinkage compensating agents, plasticizing and water-reducing agents, complying with CE-CRD-C621.

Available Products: Subject to compliance with requirements, products that may be incorporated in the work include, but are not limited to, the following:

100 Non-Shrink Grout (Non-Metallic); Conspec, Inc.
Supreme Grout; Cormix, Inc.
Sure Grip Grout; Dayton Superior.
Euco N.S.; Euclid Chemical Co.
Crystex; L & M Construction Chemicals, Inc.
Masterflow 713; Master Builders.
Sealtight 588 Grout; W. R. Meadows.
Propak; Protex Industries, Inc.
Set Non-Shrink; Set Products, Inc.
Five Star Grout; U.S. Grout Corp.

FABRICATION

Shop Fabrication and Assembly: Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specifications and as indicated on final shop drawings. Provide camber in structural members where indicated.

Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence that will expedite erection and minimize field handling of materials.

Where finishing is required, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in final structure free of markings, burrs, and other defects.

Connections: Weld or bolt shop connections, as indicated.

Bolt field connections, except where welded connections or other connections are indicated.

Provide high-strength threaded fasteners for all bolted connections, except where unfinished bolts are indicated.

High-Strength Bolted Construction: Install high-strength threaded fasteners in accordance with AISC "Specifications for Structural Joints using ASTM A 325 or A 490 Bolts."

Welded Construction: Comply with AWS Code for procedures, appearance and quality of welds, and methods used in correcting welding work.

Holes for Other Work: Provide holes required for securing other work to structural steel framing and for passage of other work through steel framing members, as shown on final shop drawings.

Provide threaded nuts welded to framing and other specialty items as indicated to receive other work.

Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame-cut holes or enlarge holes by burning. Drill holes in bearing plates.

SHOP PAINTING

General: Shop-paint structural steel, except those members or portions of members to be embedded in concrete or mortar. Paint embedded steel that is partially exposed on exposed portions and initial 2 inches of embedded areas only.

Do not paint surfaces to be welded or high-strength bolted with friction-type connections.

Do not paint surfaces scheduled to receive sprayed-on fireproofing.

Apply 2 coats of paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

Painting: Provide a one-coat, shop-applied paint system complying with Steel Structures Painting Council (SSPC) Paint System Guide No. 7.00.

SOURCE QUALITY CONTROL

General: Materials and fabrication procedures are subject to inspection and tests in mill, shop, and field, conducted by a qualified inspection agency. Such inspections and tests will not relieve Contractor of responsibility for providing materials and fabrication procedures in compliance with specified requirements.

Promptly remove and replace materials or fabricated components that do not comply.

Design of Members and Connections: Details shown are typical; similar details apply to similar conditions, unless otherwise indicated. Verify dimensions at site whenever possible without causing delay in the work.

Promptly notify Architect whenever design of members and connections for any portion of structure are not clearly indicated.

PART 3 - EXECUTION

ERECTION

Temporary Shoring and Bracing: Provide temporary shoring and bracing members with connections of sufficient strength to bear imposed loads. Remove temporary members and connections when permanent members are in place and final connections are made. Provide temporary guy lines to achieve proper alignment of structures as erection proceeds.

Temporary Planking: Provide temporary planking and working platforms as necessary to effectively complete work.

Setting Bases and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of base and bearing plates.

Set loose and attached base plates and bearing plates for structural members on wedges or other adjusting devices.

Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.

Pack grout solidly between bearing surfaces and bases or plates to ensure that no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.

For proprietary grout materials, comply with manufacturer's instructions.

Field Assembly: Set structural frames accurately to lines and elevations indicated. Align and adjust various members forming part of complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces that will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

Level and plumb individual members of structure within specified AISC tolerances.

Splice members only where indicated and accepted on shop drawings.

Erection Bolts: On exposed welded construction, remove erection bolts, fill holes with plug welds, and grind smooth at exposed surfaces.

Comply with AISC Specifications for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.

Do not enlarge unfair holes in members by burning or by using drift pins, except in secondary bracing members. Ream holes that must be enlarged to admit bolts.

Gas Cutting: Do not use gas-cutting torches in field for correcting fabrication errors in primary structural framing. Cutting will be permitted only on secondary members that are not under stress, as acceptable to Architect. Finish gas-cut sections equal to a sheared appearance when permitted.

Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting.

Apply by brush or spray to provide minimum dry film thickness of 1.5 mils.

QUALITY CONTROL

Engage an independent testing and inspection agency to inspect high-strength bolted connections and welded connections and to perform tests and prepare test reports.

Testing agency shall conduct and interpret tests, state in each report whether test specimens comply with requirements, and specifically state any deviations there from.

Provide access for testing agency to places where structural steel work is being fabricated or produced so that required inspection and testing can be accomplished.

Correct deficiencies in structural steel work that inspections and laboratory test reports have indicated to be not in compliance with requirements. Perform additional tests, at Contractor's expense, as necessary to reconfirm any noncompliance of original work and to show compliance of corrected work.

Field-Bolted Connections: Inspect in accordance with AISC specifications.

Field Welding: Inspect and test during erection of structural steel as follows:

Certify welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.

Perform visual inspection of all welds.

Perform tests of welds as follows:

Ultrasonic Inspection: ASTM E 164. Where indicated on drawings or as required by visual inspection question.

End of SECTION 05120

SECTION 05220 - STEEL JOISTS AND JOIST GIRDERS

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings, General Conditions and Supplementary General Conditions and other Division-1 Specification Sections, apply to this Section.

SUMMARY

This Section includes steel joists and joist girders for floor and roof framing. Types of joists required include the following:

K-Series Open Web Steel Joists.

Refer to Division 3 Sections for installation of anchors set in concrete.

Refer to Division 4 Sections for installation of anchors set in masonry.

SUBMITTALS

General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

Product data and installation instructions for each type of joist and accessories.

Include manufacturer's certification that joists comply with SJI "Specifications."

Shop drawings showing layout of joist members, special connections, joining and accessories. Include mark, number, type, location and spacing of joists and bridging.

Provide templates or location drawings for installation of anchor bolts and metal bearing plates.

QUALITY ASSURANCE

Steel fabricators must have **American Institute of Steel Construction (AISC) Quality Certification.**

Steel erectors must be **Quality Certified Steel Erectors (CSE).**

SEE STRUCTURAL DRAWINGS FOR RELATED INFORMATION.

General: Provide joists fabricated in compliance with Steel Joist Institute (SJI) "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."

Qualification of Field Welding: Qualify welding processes and welding operators in accordance with American Welding Society (AWS) "Structural Welding Code - Steel," AWS D1.1.

Inspection: Inspect joists and girders in accordance with SJI "Specifications."

DELIVERY, STORAGE AND HANDLING

Deliver, store and handle steel joists as recommended in SJI "Specifications." Handle and store joists in a manner to avoid deforming members and to avoid excessive stresses.

PART 2 - PRODUCTS

MATERIALS

Steel: Comply with SJI "Specifications" for chord and web sections.

Steel Bearing Plates: ASTM A 36.

Unfinished Threaded Fasteners: ASTM A 307, Grade A, regular hexagon type, low carbon steel.

Steel Prime Paint: Manufacturer's standard.

FABRICATION

General: Fabricate steel joists in accordance with SJI "Specification."

Holes in Chord Members: Provide holes in chord members where shown for securing other work to steel joists; however, deduct area of holes from the area of chord when calculating strength of member.

Extended End: Provide extended ends on joists where indicated, complying with SJI "Specifications" and load tables.

Ceiling Extension: Provide ceiling extensions in areas having ceilings attached directly to joist bottom chord. Provide either an extended bottom chord element or a separate unit, to suit manufacturer's standards, of sufficient strength to support ceiling construction. Extend ends to within 1/2 inch of finished wall surface, unless otherwise indicated.

Bridging: Provide horizontal or diagonal type bridging for joists and joist girders, complying with SJI "Specifications."

Provide bridging anchors for ends of bridging lines terminating at walls or beams.

End Anchorage: Provide end anchorages, including steel bearing plates, to secure joists to adjacent construction, complying with SJI "Specifications."

Header Units: Provide header units to support tail joists at openings in floor or roof system not framed with steel shapes.

Shop Painting: Remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories before application of shop paint.

Apply one shop coat of steel prime paint to joists and accessories, by spraying, dipping, or other method to provide a continuous dry paint film thickness of not less than 0.50 mil.

PART 3 - EXECUTION

ERECTION

Place and secure steel joists in accordance with SJI "Specifications," final shop drawings, and as herein specified.

Anchors: Furnish anchor bolts, steel bearing plates, and other devices to be built into concrete and masonry construction.

Provide unfinished threaded fasteners for anchor bolts, unless high strength bolts indicated.

Placing Joists: Do not start placement of steel joists until supporting work is in place and secured. Place joists on supporting work, adjust and align in accurate locations and spacing before permanently fastening.

Provide temporary bridging, connections, and anchors to ensure lateral stability during construction.

Where "open-web" joist lengths are 40 feet and longer, install a center row of bolted bridging to provide lateral stability before slackening of hoisting lines.

Bridging: Install bridging simultaneously with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords where terminating at walls or beams.

Fastening Joists: Comply with the following:

Field weld joists to supporting steel framework and steel bearing plates where indicated in accordance with SJI "Specifications" for type of joists used. Coordinate welding sequence and procedure with placing of joists.

Touch-Up Painting: After joist installation, wire brush welded areas, abraded or rusty surfaces, and clean with solvent. Paint field-applied bolt heads and nuts and prepared surfaces on joists and steel supporting members. Use same type of paint as used for shop painting.

End of SECTION 05220

SECTION 05310 - STEEL DECK

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings, General Conditions and Supplementary General Conditions and other Division-1 Specification Sections, apply to this Section.

SUMMARY

This Section includes galvanized steel deck units for roof applications.

SUBMITTALS

General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

Product data including manufacturer's specifications and installation instructions for each type of decking and accessories.

Provide test data for mechanical fasteners used in lieu of welding for fastening deck to supporting structures.

Shop drawings showing layout and types of deck units, anchorage details, and conditions requiring closure strips, supplementary framing, sump pans, cant strips, cut openings, special jointing, and other accessories.

QUALITY ASSURANCE

Codes and Standards: Comply with provisions of the following codes and standards, except as otherwise indicated:

American Iron and Steel Institute (AISI), "Specification for the Design of Cold-Formed Steel Structural Members."

American Welding Society (AWS), D1.3 "Structural Welding Code - Sheet Steel."

Steel Deck Institute (SDI), "Design Manual for Composite Decks, Form Decks and Roof Decks."

Qualification of Field Welding: Use qualified welding processes and welding operators in accordance with "Welder Qualification" procedures of AWS.

Welded decking in place is subject to inspection and testing. Owner will bear expense of removing and replacing portions of decking for testing purposes if welds are found to be satisfactory. Remove work found to be defective and replace with new acceptable work.

FM Listing: Provide steel roof deck units that have been evaluated by Factory Mutual System and are listed in "Factory Mutual Approval Guide" for "Class I" fire-rated construction.

PART 2 - PRODUCTS

MANUFACTURERS

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:

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

Consolidated Systems, Inc.
Epic Metals Corp.
Roll Form Products, Inc.
Roof Deck, Inc.
United Steel Deck, Inc.
Vulcraft Div., Nucor Corp.
Wheeling Corrugating Co.

MATERIALS

Steel for Galvanized Metal Roof Deck Units: ASTM A 611, grade as required to comply with SDI specifications.

Steel for Galvanized Metal Floor Deck Units: ASTM A 525, G60.

Miscellaneous Steel Shapes: ASTM A572, ASTM A36.

Sheet Metal Accessories: ASTM A 526, commercial quality, galvanized.

Paint: Manufacturer's baked-on, rust-inhibitive paint, for application to metal surfaces that have been chemically cleaned and phosphate chemical treated.

Flexible Closure Strips: Manufacturer's standard vulcanized, closed-cell, synthetic rubber.

FABRICATION

General: Form deck units in lengths to span three or more supports, with flush, telescoped, or nested 2-inch laps at ends and interlocking or nested side laps, of metal thickness, depth, and width as indicated.

Roof Deck Units (Galvanized Units): Provide deck configurations that comply with SDI "Specifications and Commentary for Steel Roof Deck."

Composite Steel Form Deck (Galvanized Units): Provide fluted sections of metal deck as permanent forms for reinforced concrete slabs.

PART 3 - EXECUTION

INSTALLATION

General: Install deck units and accessories in accordance with manufacturer's recommendations, shop drawings, and as specified herein.

Place deck units on supporting steel framework and adjust to final position with ends accurately aligned and bearing on supporting members before being permanently fastened. Do not stretch or contract side lap interlocks.

Align deck units for entire length of run of cells and with close alignment between cells at ends of abutting units.

Place deck units flat and square, secured to adjacent framing without warp or deflection.

Coordinate and cooperate with structural steel erector in locating decking bundles to prevent overloading of structural members.

Do not use roof deck units for storage or working platforms until permanently secured.

Fastening Deck Units:

Fasten roof deck units to steel supporting members by not less than 1/2-inch-diameter puddle welds or elongated welds of equal strength, spaced not more than 12 inches at every support, and at closer spacing where indicated on the drawings. In addition, secure deck to each supporting member in ribs where side laps occur.

Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work.

Use welding washers where recommended by deck manufacturer.

Mechanical fasteners, either powder-actuated or pneumatically driven, may be used in lieu of welding. Locate mechanical fasteners and install in accordance with deck manufacturer's instructions.

Mechanically fasten side laps of adjacent deck units between supports, at intervals not exceeding 36 inches o.c., using self-tapping No. 8 or larger machine screws.

Uplift Loading: Install and anchor roof deck units to resist gross uplift loading of 45 lbs. psf at eave overhang and 30 lbs. psf for other roof areas.

Cutting and Fitting: Cut and neatly fit deck units and accessories around other work projecting through or adjacent to the decking, as shown.

Reinforcement at Openings: Provide additional metal reinforcement and closure pieces as required for strength, continuity of decking, and support of other work shown.

Joint Covers: Provide metal joint covers at abutting ends and changes in direction of floor deck units, except where taped joints are required.

Closure Strips: Provide metal closure strips at open uncovered ends and edges of roof decking and in voids between decking and other construction. Weld into position to provide a complete decking installation.

Provide flexible closure strips instead of metal closures, at Contractor's option, wherever their use will ensure complete closure. Install with adhesive in accordance with manufacturer's instructions.

Touch-Up Painting: After decking installation, wire brush, clean, and paint scarred areas, welds, and rust spots on top and bottom surfaces of decking units and supporting steel members.

Touch-up painted surfaces with same type of shop paint used on adjacent surfaces.

Galvanized Repair Paint: High zinc-dust content paint for repair of damaged galvanized surfaces complying with Military Specifications MIL-P-21035 (ships).

In areas where shop-painted surfaces are to be exposed, apply touch-up paint to blend into adjacent surfaces.

End of SECTION 05310

SECTION 05400 – COLD-FORMED METAL FRAMING

PART 1 - GENERAL

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

DESCRIPTION OF WORK:

Extent of lightgauge framing is shown on drawings.

Types of lightgauge metal framing units include the following:

- "C"-shaped steel studs.
- "C"-shaped steel joists.

SUBMITTALS:

Product Data: Submit manufacturer's product information and installation instructions for each item of cold-formed metal framing and accessories. Certify products manufactured in compliance with ASTM C 645, including requirements for minimum thickness.

Design Data: Submit copies of design data and structural calculations for selection of all studs and framing components sealed by an engineer registered in the state of North Carolina and employed by the manufacturer. Calculations shall support all member selection and connections, and shall include all wind and/or seismic bracing calculations.

It is the Contractor's responsibility to hire an engineer to calculate the required gage of metal studs and submit all specified data, calculations, etc. HOWEVER, the **minimum gage of stud shall be 18 gage.**

Certificate of Compliance: Submit certificate evidencing compliance of studs and components and installation with referenced standards.

Shop Drawings: Submit shop drawings for special components and installations not fully dimensioned or detailed in manufacturer's product data.

Include placing drawings for framing members showing size and gage designations, number, type, location and spacing. Indicate supplemental strapping, bracing, splices, bridging, accessories, and details required for proper installation.

QUALITY ASSURANCE:

Component Design: Calculate structural properties of studs and joists in accordance with American Iron and Steel Institute (AISI) "Specification for Design of Cold-Formed Steel Structural Members".

Design Criteria: Cold-formed metal framing shall be designed to withstand wind pressures as stated in Section 1609 of the 2012 North Carolina Building Code for a minimum wind velocity of 90 mph with 50-year mean recurrence interval, exposure category "C". Increased pressures for height variation and applicable shape factors shall be included. External pressure coefficients may be calculated based on effective wind area supported by each component (minimum area 10 square feet). No further reduction to the components and cladding pressures are allowed for strength or deflections calculations. The maximum allowable deflection for exterior studs shall be L/600 with deflection based on the section properties of the stud only.

Welding: Use qualified welders and comply with American Welding Society (AWS) D1.3, "Structural Welding Code - Sheet Steel."

DELIVERY, STORAGE AND HANDLING:

Protect metal framing units from rusting and damage as required in AISI's "Code of Standard Practice". Deliver to project site in manufacturer's unopened containers or bundles, fully identified with name, brand, type and grade. Store off ground in a dry ventilated space or protect with breathable waterproof coverings.

PART 2 - PRODUCTS

METAL FRAMING:

System Components: Manufacturers; standard load-bearing steel studs and joists of type, size, shape, and gage as indicated. With each type of metal framing required, provide manufacturer's standard, steel runners (tracks), blocking, lintels, clip angles, shoes, reinforcements, fasteners, and accessories for applications indicated, as needed to provide a complete metal framing system. Studs and joist to be of "C" configuration with a minimum 1-5/8 inch flange and minimum 1/2 inch return lip. Runner tracks to be unpunched with 1-1/4 inch flanges unless noted otherwise.

Materials and Finishes: Comply with ASTM C 955.

For 16 gage and heavier units, fabricate metal framing components of structural quality steel sheet with a minimum yield point of 50,000 psi; ASTM A 653.

For 18-gage (minimum gage allowed), fabricate metal framing components of commercial quality steel sheet with a minimum yield point of 33,000 psi; ASTM A 653.

Protective Coating: minimum CP 60: G60 (Z180)

Finish of installation accessories to match that of main framing components.

"C"-Shape Studs: Manufacturer's standard load-bearing steel studs of size and shape, indicated, with 1.625" or 2 1/2" flange and flange return lip.

Available Manufacturers: Subject to compliance with requirements, manufacturers offering "C"-shaped, load-bearing steel studs which may be incorporated in the work include, but are not limited to, the following:

ClarkDietrich Building Systems.
MarinoWare; Div. of Ware Industries, Inc.
The Steel Network, Inc.
United Metal Products, Inc.

Joists: Manufacturer's standard C-shape sections of size and shape gage indicated.

Available Manufacturers: Subject to compliance with requirements, manufacturers offering "C"-shaped steel joists which may be incorporated in the work include, but are not limited to, the following:

Manufacturer: Subject to compliance with requirements, provide "C"-shaped steel joists of one of the following:

ClarkDietrich Building Systems.
Ceco Corp.
Inryco/Milcor.
U.S. Gypsum.

Headers and Jambs: Manufacturer's proprietary shape used to form header beams and jambs, columns or posts, of web depths indicated, unpunched, with stiffened flanges.

Anchor Clips: Manufacturer's foundation connectors.

FABRICATION:

General: Framing components may be prefabricated into panels prior to erection. Fabricate panels plumb, square, true to line and braced against racking with joints welded. Perform lifting of prefabricated panels in a manner to prevent damage or distortion.

Fastenings: Attach similar components by welding. Attach dissimilar components by welding, bolting, or screw fasteners, as standard with manufacturer.

Wire tying of framing components is not permitted.

Fabrication Tolerances: Fabricate panels to a maximum allowable tolerance variation from plumb, level, and true to line of 1/8" in 10'-0".

PART 3 - EXECUTION

INSPECTION AND PREPARATION:

Pre-Installation Conference: Prior to start of installation of metal framing systems, meet at project site with installers of other work including door and window frames and mechanical and electrical work. Review areas of potential interference and conflicts, and coordinate layout and support provisions for interfacing work.

INSTALLATION:

Manufacturer's Instructions: Install metal framing systems in accordance with ASTM C 1007 and manufacturer's printed or written instructions and recommendations, unless otherwise indicated.

Runner Tracks: Install continuous tracks sized to match studs. Align tracks accurately to layout at base and tops of studs. Secure tracks as recommended by stud manufacturer for type of construction involved, except do not exceed 24" o.c. spacing for nail or power-driven fasteners, or 16" o.c. for other types of attachment. Provide fasteners at corners and ends of tracks.

Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements.

Where stud system abuts structural columns or walls, including masonry walls, anchor ends of stiffeners to supporting structure.

Install supplementary framing, blocking and bracing in metal framing system wherever walls or partitions are indicated to support fixtures, equipment, services, casework, heavy trim and furnishings, and similar work requiring attachment to the wall or partition. Where type of supplementary support is not otherwise indicated, comply with stud manufacturer's recommendations and industry standards in each case, considering weight or loading resulting from item supported.

Installation of Wall Stud System: Secure studs to top and bottom runner tracks by either welding or screw fastening at both inside and outside flanges. Provide for vertical structural movement at the attachment points for the stud system at floors and roof.

Frame wall openings larger than 2'-0" square with double stud at each jamb of frame except where more than 2 are either shown or indicated in manufacturer's instructions. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with stud shoes or by welding, and space jack studs same as full-height studs of wall. Secure stud system wall opening frame in manner indicated.

Frame both sides of expansion and control joints, with separate studs; do not bridge the joint with components of stud system.

Install horizontal stiffeners in stud system, spaced (vertical distance) at not more than 4'-6" o.c. Weld at each intersection.

Installation of Joists: Install level and plumb, complete with bracing and reinforcing as indicated on drawings. Provide not less than 1-1/2" end bearing.

Reinforce ends with end clips, steel hangers, steel angle clips, steel stud section, end grain wood block, or as otherwise recommended by joist manufacturer.

Where required, reinforce joists at interior supports with single short length of joist section located directly over interior support, snap-on shoe, 30% side-piece lapped reinforcement, or other method recommended by joist manufacturer.

Secure joists to interior support systems to prevent lateral movement of bottom flange.

Erection Tolerances: Bolt or weld wall panels (at both horizontal and vertical Junctures) to produce flush, even, true-to-line joints.

Maximum variation in plane and true position between prefabricated assemblies should not exceed 1/16 inch.

Field Painting: Touch-up shop-applied protective coatings damaged during handling and installation. Use galvanizing repair paint for galvanized surfaces.

END OF SECTION 05400

SECTION 05500 - METAL FABRICATIONS:

PART 1 - GENERAL

RELATED DOCUMENTS:

Drawings, General Conditions and Supplementary General Conditions and other Division-1 Specification Sections, apply to this Section.

DESCRIPTION OF WORK:

Definition: Metal fabrications include items made from iron and steel shapes, plates, bars, strips, tubes, pipes and castings which are not a part of structural steel or other metal systems specified elsewhere.

Extent of metal fabrications is indicated on drawings and schedules.

Types of work in this section include metal fabrications for:

- Loose bearing and leveling plates.
- Loose steel lintels.
- Miscellaneous framing and supports.
- Miscellaneous steel angles and trim.
- Gates for Dumpster Enclosure.
- Steel Railings and Handrails.
- Pipe Bollards.
- Custom Bike Racks / Drain Chain Barrels – Wine Barrel Design – See Site Plan A1.

Structural steel is specified in another section within Division 5.

Concrete for Stair Pan Fill is specified in Division 3.

SYSTEM PERFORMANCES:

Structural Performances: Provide assemblies which, when installed, comply with the following minimum requirements for structural performance, unless otherwise indicated.

Treads and Platforms of Steel Stairs: Capable of withstanding a uniform load of 100 lbf per sq. ft. or a concentrated load of 300 lbf so located as to produce maximum stress conditions.

Handrails and Toprails: Capable of withstanding the following loads applied as indicated when tested per ASTM E 935.

Concentrated loads of 200 lbs applied at any point in any direction.

Uniform load of 50 lbf per linear ft. applied simultaneously in both vertical and horizontal directions.

Concentrated and uniform loads above need not be assumed to act concurrently.

Handrails Not Serving as Top Rails: Capable of withstanding the following loads applied as indicated:

Concentrated load of 200 lbs/ft applied at any point nonconcurrently, vertically downward or horizontally.

Uniform load of 50 lbs/ft per linear foot applied nonconcurrently, vertically downward or horizontally.

Concentrated and uniform loads above need not be assumed to act concurrently.

Infill Area of Guardrail Systems: Capable of withstanding a horizontal concentrated load of 200 lbs/ft applied to one sq. ft. at any point in the system including panels, intermediate rails balusters, or other elements composing the infill area.

Above load need not be assumed to act concurrently with uniform horizontal loads on top rails of railing systems in determining stress on guard.

Treads of Steel Stairs: Capable of withstanding a uniform load of 100 lbs per sq. ft. or a concentrated load of 300 lbs on a area of 4 sq. inches located in the center of the tread, whichever produces the greater stress.

Platforms of Steel Stairs: Capable of withstanding a uniform load of 100 lbs per sq. ft.

QUALITY ASSURANCE:

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. Clearly mark units for reassembly and coordinated installation.

SUBMITTALS:

Product Data: Submit manufacturer's specifications, anchor details and installation instructions for products used in miscellaneous metal fabrications, including paint products and grout.

Shop Drawings: Submit shop drawings for fabrication and erection of miscellaneous metal fabrications. Include plans, elevations and details of sections and connections. Show anchorage and accessory items. Provide templates for anchor and bolt installation by others.

PART 2 - PRODUCTS:

MATERIALS:

Ferrous Metals:

Metal Surfaces, General: For fabrication of miscellaneous metal work which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness.

Steel Plates, Shapes and Bars: ASTM A 36.

Structural Steel Sheet: Hot-rolled, ASTM A 570; or cold-rolled ASTM A 611, Class 1; of grade required for design loading.

Galvanized Structural Steel Sheet: ASTM A 446, of grade required for design loading. Coating designation as indicated, or if not indicated, G90.

Steel Pipe: ASTM A 53; Type and grade (if applicable) as selected by fabricator and as required for design loading; black finish unless galvanizing is indicated; standard weight (schedule 40), unless otherwise indicated.

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

Concrete Inserts: Threaded or wedge type; galvanized ferrous castings, either malleable iron, ASTM A 47, or cast steel, ASTM A 27. Provide bolts, washers and shims as required, hot-dip galvanized, ASTM A 153.

Aluminum Pipe: Extruded 6063-T6 1-1/2" schedule 40 pipe and 6064-T4 formed elbows.

Aluminum Pickets: Extruded 6063 T5 aluminum.

Grout:

Non-Shrink Non-Metallic Grout: Pre-mixed, factory-packaged, non-staining, non-corrosive, non-gaseous grout complying with CE CRD-C621. Provide grout specifically recommended by manufacturer for interior and exterior applications of type specified in this section.

Fasteners:

General: Provide zinc-coated fasteners for exterior use or where built into exterior walls. Select fasteners for the type, grade and class required.

Bolts and Nuts: Regular hexagon head type, ASTM A 307, Grade A.

Lag Bolts: Square head type, FS FF-B-561.

Machine Screws: Cadmium plated steel, FS FF-S-92.

Wood Screws: Flat head carbon steel, FS FF-S-111.

Plain Washers: Round, carbon steel, FS FF-W-92.

Masonry Anchorage Devices: Expansion shields, FS FF-S-325.

Toggle Bolts: Tumble-wing type, FS FF-B-588, type, class and style as required.

Lock Washers: Helical spring type carbon steel, FS FF-W-84.

Paint:

Shop Primer for Ferrous Metal: Manufacturer's or Fabricator's standard, fast-curing, lead-free, "universal" primer; selected for good resistance to normal atmospheric corrosion, for compatibility with finish paint systems indicated and for compatibility to provide a sound foundation for field-applied topcoats despite prolonged exposure.

FABRICATION, GENERAL:

Workmanship: Use materials of size and thickness indicated or, if not indicated, as required to produce strength and durability in finished product for use intended. 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 work.

Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to a radius of approximately 1/32" unless otherwise indicated. Form bent- metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

Weld corners and seams continuously, complying with AWS recommendations. At exposed connections, grind exposed welds smooth and flush to match and blend with adjoining surfaces.

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.

Provide for anchorage of type indicated, coordinated with supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use.

Cut, reinforce, drill and tap miscellaneous metal work as indicated to receive finish hardware and similar items.

Fabricate joints which will be exposed to weather in a manner to exclude water or provide weep holes where water may accumulate.

Shop Painting:

Apply shop primer to surfaces of metal fabrications except those which are galvanized or as indicated to be embedded in concrete or masonry, unless otherwise indicated, and in compliance with requirements of SSPC-PA1 "paint Application Specification No. 1" for shop painting.

Surface Preparation: Prepare ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:

LOOSE BEARING AND LEVELING PLATES:

Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction, made flat, free from warps or twists, and of required thickness and bearing area. Drill plates to receive anchor bolts and for grouting as required. Galvanize after fabrication for exterior and wet conditions.

LOOSE STEEL LINTELS:

Provide loose structural steel lintels for openings and recesses in masonry walls and partitions as shown. Weld adjoining members together to form a single unit where indicated. Provide not less than 8" bearing at each side of openings, unless otherwise indicated. **Galvanize** after fabrication for exterior and wet conditions.

MISCELLANEOUS FRAMING AND SUPPORTS:

Provide miscellaneous steel framing and supports which are not a part of structural steel framework, as required to complete work.

Fabricate miscellaneous units to sizes, shapes and profiles indicated or, if not indicated, of required dimensions to receive adjacent other work to be retained by framing. Except as otherwise indicated, 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 and similar items.

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.

Except as otherwise indicated, space anchors 24" o.c. and provide minimum anchor units of 1-1/4" x 1/4" x 8" steel straps.

Equip units with integrally welded anchors, plates, installation angles, etc. necessary for attaching units to steel structure where required.

MISCELLANEOUS STEEL ANGLES AND TRIM:

Provide structural steel shelf angles of sizes indicated for attachment to concrete framing. Provide slotted holes to receive 3/4" bolts, spaced not more than 6" from ends and not more than 24" o.c., unless otherwise indicated.

Furnish wedge-type concrete inserts, complete with fasteners, for attachment of shelf angles to cast-in-place concrete.

GATES FOR TRASH DUMPSTER

Fabricate 3 pairs of double leaf hinged gates fabricated from light gage steel tube frames with tube picket infill to design, dimensions, and details indicated. Provide gate leaves formed of steel tube sections of sizes and wall thickness indicated, but not less than that required supporting design loading. Provide powder coated galvanized steel hinges mounted on tube hinge posts (3 per leaf) capable of carrying the weight of the gates. Provide cane bolt and padlock hasp to secure gates together or to latch post.

STEEL RAILINGS AND HANDRAILS:

Fabricate steel pipe and square picket railings and handrails to design, dimensions, and details indicated. Provide railings and handrails members formed of pipe of sizes and wall thickness indicated, but not less than that required supporting design loading.

Structural Performances: Provide railing and handrail assemblies which, when installed, comply with the following minimum requirements for structural performance, unless otherwise indicated.

Handrails and Toprails: Capable of withstanding the following loads applied as indicated:

Concentrated load of 250 lbf applied at any point in any direction.

Uniform load of 75 lbf per linear ft. applied simultaneously in both vertical and horizontal directions.

Concentrated and uniform loads above need not be assumed to act concurrently.

Number of hand rails shall in all cases be two (one on each side of stairs and ramps whether or not shown in pairs on drawings, unless SPECIFICALLY called out on drawing to be a single rail).

Guards: Intermediate rails, balusters and panel fibers capable of withstanding a uniform load of 250 lbs per sq. ft. of gross area of guard, including any open areas, of which they are a part.

Above load need not be assumed to be acting concurrently with uniform horizontal loads on top rails of railing assembly in determining stress on guard supporting members.

Interconnect railing and handrail members by butt-welding or welding with internal connectors, at fabricator's option, unless otherwise indicated.

At tee and cross intersections provide coped joints.

At elbow bends provide mitered joints.

Close exposed ends of pipe by welding 3/16" thick steel plate in place or by use of prefabricated fittings.

Brackets, Flanges, Fittings and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings and anchors for interconnections of pipe and attachment of railings and handrails to other work. Furnish inserts and other anchorage devices for connecting railings and handrails to concrete or masonry work.

Shop prime railings with manufacturer's standard rust-prohibitive primer, compatible with finish coat of paint. Do not prime surfaces intended to receive field welded connections.

PIPE BOLLARDS:

Fabricate pipe bollards from Schedule 80 steel pipe. See plans for bollard details. Provide round top end cap as required for pipe diameter.

CUSTOM BIKE RACK / BARREL:

Fabricate barrel design using 1/4" thick steel. Provide powder coat finish on all steel. Barrels should arrive fully fabricated & finished and ready to bolt in place – as indicated.

PART 3 - EXECUTION

PREPARATION:

Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible. Do not delay job progress; allow for trimming and fitting where taking field measurements before fabrication might delay work.

Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as concrete inserts, sleeves, anchor bolts and miscellaneous items having integral anchors, which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

INSTALLATION:

General:

Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; including threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws and other connectors as required.

Cutting, Fitting and Placement: Perform cutting, drilling and fitting required for installation of miscellaneous metal fabrications. Set work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items which are to be built into concrete, masonry or similar construction.

Fit exposed connections accurately together to form tight hairline joints. Weld connections which are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations. Grind exposed joints smooth and touch-up shop paint coat.

Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, and methods used in correcting welding work.

Setting Loose Plates: Clean concrete and masonry bearing surfaces of any bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of bearing plates.

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. Use metallic non-shrink grout in concealed locations where not exposed to moisture; use non-metallic non-shrink grout in exposed locations, unless otherwise indicated.

Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

Secure non-removable units to supporting members by welding where both materials are the same, otherwise fasten by bolting as indicated above.

Steel Railings and Handrails: Connect railing to stair assemblies as detailed on drawings. Grind smooth field welds and touch-up shop primer paint.

For concrete and solid masonry anchorage, use drilled-in expansion shield and either concealed hanger bolt or exposed lag bolt, as applicable. See drawings for wall mounted railing applications.

ADJUST AND CLEAN:

Touch-Up 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.

Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

Touch-Up Painting: Cleaning and touch-up painting of field welds, bolted connections and abraded areas of the shop paint on miscellaneous metal is specified in Division 9 of these specifications.

End of SECTION 05500

SECTION 06105 - MISCELLANEOUS CARPENTRY

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings, General Conditions and Supplementary General Conditions and other Division-1 Specification Sections, apply to this Section.

SUMMARY

This Section includes the following:

Miscellaneous blocking, grounds, nailers, and panels. **(fire treated as required for Type IIB construction.)**

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

Division 3 Section "Cast-In-Place Concrete" for wood formwork.

Division 6 Section "Interior Architectural Woodwork" for cabinetry.

SUBMITTALS

General: Submit the following according to Conditions of Contract and Division 1 Specification Sections.

Wood treatment data from chemical treatment manufacturer. Include chemical treatment manufacturer's instructions for handling, storing, installing, and finishing treated material.

Preservative Treatment: Include certification by treatment plant stating type of solution and pressure process used, net amount of preservative retained, and compliance with applicable standards.

Waterborne Preservative Treatment: Include certification that moisture content of treated wood was reduced to levels specified prior to shipment to Project site.

Fire-Retardant Treatment: Include certification by treating plant that treated wood complies with specified requirements.

Warranty: Include warranty of chemical treatment manufacturer for each type of treatment.

DELIVERY, STORAGE, AND HANDLING

Delivery and Storage: Keep materials under cover and dry. Protect against exposure to weather and contact with damp or wet surfaces. Stack material above ground level on uniformly spaced supports to prevent deformation.

PART 2 - PRODUCTS

LUMBER, GENERAL

Standards: Furnish lumber manufactured to comply with PS 20 "American Softwood Lumber Standard" and with applicable grading rules of inspection agencies certified by American Lumber Standards Committee's (ALSC) Board of Review.

Grade Stamps: Furnish lumber with each piece factory-marked with grade stamp of inspection agency that indicates grading agency, grade, species, moisture content at time of surfacing, and mill.

Sizes: Provide nominal sizes indicated, complying with PS 20 except where actual sizes are specifically noted as being required.

Surfacing: Dressed lumber, S4S, unless otherwise indicated.

DIMENSION LUMBER FOR CONCEALED CONDITIONS

Species: Southern yellow pine.

Moisture Content: S-DRY, KD 19 or MC 19 (19 percent maximum moisture content).

Grade: No. 2 standard grade. (Firetreated)

CONSTRUCTION PANELS

Standards: Comply with requirements of PS 1 Voluntary Product Standard "Construction and Industrial Plywood" for veneer plywood and APA PRP-108 "Performance Standards and Policies for Structural-Use Panels" for performance-rated panels.

Trademark: factory-mark each construction panel with APA trademark evidencing compliance with grade requirements.

APA Performance-Rated panels: Where construction panels will be used in the following applications, provide APA Performance-Rated Panels complying with requirements indicated for grade designation, exposure, durability classification, edge detail (where applicable) and thickness.

Wall/Roof Parapet Sheathing: APA Rated SHEATHING (**fire rated**)

Exposure Durability Classification: Exterior

Thickness: ¾", Unless noted otherwise.

Applications: Includes but is not limited to:

Roof edge wood trim.

Plywood perimeter roof nailing substrate panels

Plywood Backing Panels: For mounting electrical or telephone equipment, provide fire-retardant treated plywood panels with grade designation, APA C-D PLUGGED INT with exterior glue, in thickness indicated, or, if not otherwise indicated, not less than 15/32".

TYPICAL EXTERIOR FOAM BOARD INSULATING SHEATHING:

SEE DIVISION 7 – INSULATION

CLOSET, UTILITY SHELVING:

~~Shelving for Opaque Finish: Comply with the following requirements:~~

~~Grade: Economy.~~

~~Shelving Material: Lumber, any closed grain hardwood listed in referenced woodworking standard.~~

~~**At contractor's option, Utility shelving provided by a shelving system manufacturer such as Palmetto Shelving, Excalibur Shelving or equal to match configurations indicated on the drawings.**~~

~~A clear sealer finish may be utilized if uniform appearance solid wood products are used. Typically units are 7' 4" tall at 16" thru 24" deep for 5 tier shelves.~~

General: Where miscellaneous 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 or of AISI Type 304 stainless steel.

Nails, Wire, Brads and Staples: FS FF-N-105.

Bolts: ASTM A 307, Grade A; with ASTM A 563 hex nuts and flat washers.

PRESERVATIVE WOOD TREATMENT BY PRESSURE PROCESS

General: Obtain preservative-treated lumber complying with AWPB Standard C2. Mark each treated item with AWPB or SPIB Quality Mark Requirements. Coat surfaces cut after treatment to comply with AWPB M4.

Above-Ground Wood Treatment: Pressure treat with waterborne preservatives to a minimum retention of 0.25 pcf.

Kiln-dry interior dimension lumber after treatment to 19 percent maximum moisture content.

Kiln-dry interior construction panels after treatment to 15 percent maximum moisture content.

Treat wood items indicated and in the following circumstances:

In contact with roofing, flashing, or waterproofing.

In contact with masonry or concrete.

Within 18 inches of grade.

Ground-Contact Wood Treatment: Pressure treat with waterborne preservatives to a minimum retention of 0.40 pcf.

PART 3 - EXECUTION

INSTALLATION, GENERAL

Discard units of material with defects that impair quality of miscellaneous carpentry and in sizes that would require an excessive number or poor arrangement of joints.

Cut and fit miscellaneous carpentry accurately. Install members plumb and true to line and level.

Coat cut edges of preservative-treated wood to comply with AWPB M4.

Securely fasten miscellaneous carpentry as indicated and according to applicable codes and recognized standards.

Countersink nail heads on exposed carpentry work and fill holes.

Use fasteners of appropriate type and length. Predrill members when necessary to avoid splitting wood.

WOOD GROUNDS, NAILERS, BLOCKING, AND SLEEPERS

Install where shown and where required for screeding or attachment of other work. Cut and shape to required size. Coordinate location with other work involved.

Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise indicated.

Furring to Receive Plaster Lath: Install 1-by-2-inch furring at 16 inches o.c., vertically.

CONSTRUCTION PANELS

Comply with applicable installation recommendations in APA Form E30 "Design/Construction Guide--Residential & Commercial."

END OF SECTION 06105

SECTION 06200 - FINISH CARPENTRY

PART 1 - GENERAL

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

DESCRIPTION OF WORK

Definition: Finish carpentry includes carpentry work which is exposed to view, is non-structural, and which is not specified as part of other sections.

Types of finish carpentry work in this section include:

Pre-Finished Laminated Aluminum Plywood Panels
Interior Finish Carpentry - running and standing trim. (painted) - **If applicable**

Miscellaneous carpentry is specified in another Division-6 section.

Metal trim/fascia units are specified in Division-7 section.

Builders Hardware and wood doors are specified in Division-8 sections.

Architectural woodwork is specified in another Division-6 section.

Wood Flooring is specified in another Division-9 section.

QUALITY ASSURANCE:

Factory-mark each piece of lumber and plywood with type, grade, mill and grading agency identification; except omit marking from 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.

PRODUCT DELIVERY, STORAGE AND HANDLING:

Protect finish carpentry materials during transit, delivery, storage and handling to prevent damage, soiling and deterioration.

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.

JOB CONDITIONS:

Maintain temperature and humidity in installation area as required to maintain moisture content of installed finish carpentry within a 2.0 percent tolerance of optimum moisture content, from date of installation through remainder of construction period. The fabricator of woodwork shall determine optimum moisture content and required temperature and humidity conditions.

PART 2 - PRODUCTS

WOOD PRODUCT QUALITY STANDARDS:

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.

Plywood Standard: Comply with PS 1/ANSI A199.

Woodworking Standard: Where indicated for a specific product comply with specified provision of the following:

Architectural Woodwork Institute (AWI) "Quality Standards."

MATERIALS:

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 pattern as shown, unless otherwise indicated.

Moisture Content of Softwood Lumber: Provide kiln-dried (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.

Moisture Content of Hardwood Lumber: Provide kiln-dried (KD) lumber having a moisture content from time of manufacture until time of installation within the ranges required in the referenced woodworking standard.

Lumber for Transparent Finish (Stained or Clear) or Painted Finish: Use pieces made of solid lumber stock.

Plywood for Painted Finish: Any softwood species, Exterior type, Medium Density Overlay (MDO/EXT-APA).

Thickness: 3/4" thick unless noted otherwise on drawings.

PRE-FINISHED LAMINATED ALUMINUM PLYWOOD PANELS

<u>Component:</u>	Prefinished Textured Aluminum Face	Standard .010"
	Standard Texture Finish	Coil Coated Polyester
	Exterior Grade Douglas Fir Plywood Core	Standard 5/16"
	Fiberglass Reinforced Foil Scrim Backer	Standard .008"
<u>Panel Performance:</u>	Panel Weight	Standard 1.02 lbs / sf
	Flame Spread	ASTM E 84 Class A
	Stiffness (E) and Durability	ASTM D 1037
	Racking Design	ASTM E 72
	Warranty	5 Years
<u>Basis of Design:</u>	Panel 15 Prefinished Architectural Panel - by Citadel Architectural Products, inc. -Or Equal.	

Use: as indicated on drawings –
Exterior Wall Composite between High & Low Storefront Windows

INTERIOR FINISH CARPENTRY:

Standing and Running Trim (painted trim): For trim formed of boards and worked products, provide lumber manufactured to sizes and patterns (profile) shown from selected first grade lumber (NHLA); **(finger jointed trim is unacceptable)** complying with following grade requirements of referenced woodworking standard, for quality of materials and manufacture:

Species: poplar.

Grade: Clear.

Texture: Smooth surfaced.

Finish: Stained and Sealed unless noted otherwise on drawings.

Replicated Existing Mouldings: Provide new moulding cut from matching species wood that is identical to the existing one. Contractor shall provide mill with a field sample of the moulding to be replicated for the fabrication of cutting blade required to produce new moulding.

MISCELLANEOUS MATERIALS:

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.

Where finish carpentry is exposed on exterior or in areas of high relative humidity, provide fasteners and anchorages with a hot-dipped zinc coating (ASTM A 153).

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

PREPARATION:

Condition wood materials to average prevailing humidity conditions in installation areas prior to installing.

Back prime lumber for painted finish exposed on the exterior or, where indicated, to moisture and high relative humidities on the interior. Comply with requirements of section on painting within Division 9 for primers and their application.

INSTALLATION:

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.

Install the work plumb, level, true and straight with no distortions. Shim as required using concealed shims.

Scribe and cut work to fit adjoining work, and refinish cut surfaces or repair damaged finish at cuts.

Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to the greatest extent possible. Stagger joints in adjacent and related members. Cope at returns, miter at corners, to produce tight fitting joints with full surface contact throughout length of joint. Use scarf joints for end-to-end joints.

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 nail for exposed nailings, countersunk and filled flush with finished surface, and matching final finish where transparent is indicated.

ADJUSTMENT, CLEANING, FINISHING AND PROTECTION:

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.

Clean finish carpentry work on exposed and semi-exposed surfaces. Touch-up shop-applied finishes to restore damaged or soiled areas.

Refer to Division 9 sections for final finishing of installed finish carpentry work.

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 06200

SECTION 07160 - BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

RELATED DOCUMENTS:

Drawings, General Conditions and Supplementary General Conditions and other Division-1 Specification Sections, apply to this Section.

DESCRIPTION OF WORK:

Extent of each type of dampproofing work is indicated on drawings.

Following types and applications of work are specified in this section:

Cold-applied asphalt emulsion dampproofing.

QUALITY ASSURANCE:

General: For each type of work, obtain primary materials from single manufacturer, to greatest extent possible. Provide secondary materials only as recommended by manufacturer of primary materials.

SUBMITTALS:

Product Data: Submit manufacturer's technical product data, installation instructions, and general recommendations for each dampproofing material required. Include data substantiating that materials comply with specified requirements.

JOB CONDITIONS:

Substrate: Proceed with dampproofing work only after substrate construction and penetrating work have been completed.

Weather: Proceed with dampproofing work only when existing and forecasted weather conditions will permit work to be performed in accordance with manufacturer's recommendations.

PART 2 - PRODUCTS

BITUMINOUS DAMPPROOFING MATERIALS:

General: Provide bituminous dampproofing materials which comply with the following requirements, or provide other similar products which are certified in writing by manufacturer of primary dampproofing materials to be superior in performance for application indicated.

Cold-Applied Asphalt Emulsion Dampproofing:

Asphalt Emulsion: Manufacturer's standard asphalt and water emulsion coating, recommended for below-grade and for above-grade applications to either damp (green) or dry substrates, compounded to penetrate substrate and build to moisture-resistant coating.

Provide non-fibrated type liquid asbestos-free emulsion; ASTM D 1227, Type III.

Available Manufacturers: Subject to compliance with requirements, manufacturers offering asphalt emulsion products which may be incorporated in the work include, but are not limited to, the following:

Celotex Corporation.
Koppers Company, Inc.

Manville Building Products Corp.
Sonneborne Bldg. Products/Rexnord Chemical Products Inc.
Tamko Asphalt Products, Inc.
Tremco Company.

PART 3 - EXECUTION

PREPARATION OF SUBSTRATE:

Clean substrate of projections and substances detrimental to work; comply with recommendations of prime materials manufacturer.

Prime substrate as recommended by prime materials manufacturer.

Protection of Other Work: Do not allow liquid and mastic compounds to enter and clog drains and conductors. Prevent spillage and migration onto other surfaces of work, by masking or otherwise protecting adjoining work.

INSTALLATION:

General: Comply with manufacturer's instructions, except where more stringent requirements are shown or specified, and except where project conditions require extra precautions or provisions to ensure satisfactory performance of work.

Asphalt Emulsion on Exterior and Interior Surfaces:

Apply coat of liquid asphalt emulsion dampproofing material by brushing or spraying at rate of 1.5 to 2.5 gal. per 100 sq. ft., depending upon substrate texture, as required to produce uniform dry film thickness of not less than 15 mils. Apply in 2 coats if necessary to obtain required thickness, allowing time for complete drying between coats.

End of SECTION 07160

SECTION 07180 - WATER REPELLENTS

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings, General Conditions and Supplementary General Conditions and other Division-1 Specification Sections, apply to this Section.

SUMMARY

This Section includes surface preparation and application of clear water repellent coating to the following vertical and nontraffic horizontal exposed surfaces:

Exterior Brick Masonry

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

Division 3 Sections for concrete work including floor sealers and curing agents, precast concrete, and concrete restoration and cleaning.

Division 7 Section "Joint Sealants" for joint fillers and sealants.

Division 7 Sections for fluid-applied waterproofing and dampproofing.

Division 9 Section "Painting" for paints and coatings.

SUBMITTALS

General: Submit the following according to the Conditions of Contract and Division 1 Specification Sections.

Product data including manufacturer's specifications, surface preparation and application instructions, recommendations for water repellents for each surface specified, and protection and cleaning instructions. Include data substantiating that materials are recommended by manufacturer for applications indicated and comply with requirements.

Samples: Submit 16-inch-square samples of each substrate indicated to receive water repellent with the specified repellent treatment applied to half of each sample.

Certification by water repellent manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOC).

QUALITY ASSURANCE

Installer Qualifications: Engage an experienced Installer who employs only persons trained and approved by water repellent manufacturer for installation of manufacturer's products.

Manufacturer Qualifications: Firm experienced in manufacturing products similar to those indicated for this Project and that has a record of successful in-service performance.

Regulatory Requirements: Comply with applicable rules of the pollution-control regulatory agency having jurisdiction in the Project locale regarding volatile organic compounds (VOC) and use of hydrocarbon solvents.

Project Mockup: Apply water repellent to mockup, either partial or full coverage as directed, before proceeding with installation. Comply with installation requirements of this Section.

Performance Requirements: Indicate test results for water repellents on substrate simulating Project conditions, as close as possible. Use same materials and methods of application to be used on the Project.

Absorption Tests: Comparison of treated and untreated specimens:

Brick: ASTM C 67.

Water Vapor Transmission: ASTM E 96. Comparison of treated and untreated specimens:

Water Penetration and Leakage Through Masonry: ASTM E 514.

PROJECT CONDITIONS

Weather and Substrate Conditions: Do not proceed with application of water repellent (except with written recommendation of manufacturer) under any of the following conditions:

- Ambient temperature is less than 40 deg F (4 deg C).
- Substrate surfaces have cured for less than one month.
- Rain or temperatures below 40 deg F (4 deg C) are predicted for a period of 24 hours.
- Earlier than 24 hours after surfaces became wet.
- Substrate is frozen or surface temperature is less than 40 deg F (4 deg C).
- Windy condition such that repellent may be blown to vegetation or substrates not intended.

WARRANTY

Warranty: Submit a written warranty, executed by the Applicator and water repellent manufacturer covering materials and labor, agreeing to repair or replace materials that fail to provide water repellency within the specified warranty period. This warranty shall be in addition to, and not a limitation of, other rights the Owner may have against the contractor under the contract documents.

Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

MANUFACTURERS

Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

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

- Siloxane: (Water Based) (Exterior)
 - Euco Weather-Guard, The Euclid Chemical Company.
 - Dynatrete, Huls America, Inc.
 - Weather Seal Siloxane WB, ProSoCo, Inc.

- VOC Complying Water Repellents (Type): (Exterior)
 - Hydrozo Enviroseal 20, Hydrozo Inc. (water-based silane, 20 percent solids with water).

WATER REPELLENTS AND GRAFETTI GUARDS

Siloxanes: Penetrating water repellent. Alkylalkoxysiloxanes that are , water, or other proprietary solvent carrier.

VOC-Complying Water Repellents: Products certified by the manufacturer that they comply with local regulations controlling use of volatile organic compounds.

PART 3 - EXECUTION

PREPARATION

Clean substrate of substances that might interfere with penetration or performance of water repellents. Test for moisture content, according to repellent manufacturer's instructions to ensure that surface is sufficiently dry.

Test for pH level, according to repellent manufacturer's instructions to ensure chemical bond to silicates minerals.

Protect adjoining work, including sealant bond surfaces, from spillage or blow-over of water repellent. Cover adjoining and nearby surfaces of aluminum and glass where there is the possibility of the water repellent being deposited on surfaces. Cover live plants and grass. Immediately clean water repellent from adjoining surfaces, complying with manufacturer's cleaning recommendations.

Coordination with Sealants: Do not apply water repellent until the sealants for joints adjacent to surfaces receiving water repellent treatment have been installed and cured.

INSTALLATION

Apply a heavy-saturation spray coating of water repellent on surfaces indicated for treatment using low-pressure spray equipment. Comply with manufacturer's instructions and recommendations using airless spraying procedure unless otherwise indicated.

Provide protective coverings for floors, adjacent walls, ceilings, etc.

Remove protective coverings from adjacent surfaces at completion.

End of SECTION 07180

SECTION 07200 - INSULATION

PART 1 - GENERAL

RELATED DOCUMENTS:

Drawings, General Conditions and Supplementary General Conditions and other Division-1 Specification Sections, apply to this Section.

DESCRIPTION OF WORK:

Extent of insulation work is shown on drawings and indicated by provisions of this section.

Applications of insulation specified in this section include the following:

Insulation under slabs-on-grade.

Foam Board Insulation Sheathing— masonry veneer/metal stud wall.

Blanket/Batt-type building insulation.

Wall assembly thermal insulation.

Sound insulation in wall and above ceiling - See drawings for locations.

General usage throughout perimeter wall / roof intersection gap filler.

Insulative sheathing (noted as insulative sheathing on drawings) is specified in Division-6 section "Misc. Carpentry".

Sound attenuation blankets installed as part of metal-framed gypsum drywall assemblies are specified in Division-9 section "Gypsum Drywall".

QUALITY ASSURANCE:

Thermal Resistivity: Where thermal resistivity properties of insulation materials are designated by R-values they represent the rate of heat flow through a homogenous material exactly 1" thick, measured by test method included in referenced material standard or otherwise indicated. They are expressed by the temperature difference in degrees F between the two exposed faces required to cause one BTU to flow through one square foot per hour at mean temperatures indicated.

Fire Performance Characteristics: Provide insulation materials which are identical to those whose fire performance characteristics, as listed for each material or assembly of which insulation is a part, have been determined by testing, per methods indicated below, by UL or other testing and inspecting agency acceptable to authorities having jurisdiction.

Surface Burning Characteristics: ASTM E 84.

Fire Resistance Ratings: ASTM E 119.

Combustion Characteristics: ASTM E 136.

SUBMITTALS:

Product Data: Submit manufacturer's product literature and installation instructions for each type of insulation and vapor retarder material required.

DELIVERY, STORAGE, AND HANDLING:

General Protection: Protect insulations from physical damage and from becoming wet, soiled, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storage and protection during installation.

Do not expose to sunlight, except to extent necessary for period of installation and concealment.

Protect against ignition at all times. Do not deliver plastic insulating materials to project site ahead of installation time.

Complete installation and concealment of plastic materials as rapidly as possible in each area of work.

PART 2 - PRODUCTS

ACCEPTABLE MANUFACTURERS:

Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:

Manufacturers of Extruded Polystyrene Board Insulation:

Amoco Foam Products Co.
Dow Chemical U.S.A.
Minnesota Diversified Products, Inc.
UC Industries.

Manufacturers of Glass Fiber Insulation:

CertainTeed Corp.
Johns Manville
Knauf Fiber Glass GbmH.
McCormick Corp.
Owens-Corning Fiberglas Corp.

INSULATING MATERIALS:

General: Provide insulating materials which comply with requirements indicated for materials, compliance with referenced standards, and other characteristics.

Preformed Units: Sizes to fit applications indicated, selected from manufacturer's standard thicknesses, widths and lengths.

EXTRUDED POLYSTYRENE BOARD INSULATION: Rigid, cellular thermal insulation with closed-cells and integral high density skin, formed by the expansion of polystyrene base resin in an extrusion process to comply with ASTM C 578 for Type indicated; with 5-year aged r-values of 5.4 and 5 at 40 and 75 deg. F (4.4 and 23.9 deg.C), respectively; and as follows:

Type IV, 1.6 lb./cu. ft. min. density, unless otherwise indicated.

Surface Burning Characteristics: Maximum flame spread and smoke developed values of 5 and 165, respectively.

Use: Rigid board perimeter insulation.

Size: 2'-0" widths (4'-0" total width of horizontal and vertical widths if installation requires both direction placement. See details.) x **3" thickness** x continuous placement around building perimeters at slab-on-grades. Horizontal length may be shortened if distance from bottom of slab to top of footing is less than 2'-0".

RIGID INSULATION FOR TYPICAL EXTERIOR CONTINUOUS FOAM BOARD INSULATING SHEATHING: Glass-Fiber-Reinforced Polyisocyanurate Foam Core Insulating Sheathing Board with aluminum facers.

Application: Typical exterior sheathing over metal stud framing.

Thickness: **2.0" typical** for masonry/stud walls - unless noted otherwise on drawings.

Joints: Seal all exterior joints (bottom, top, sides, and corners) with aluminum foil tape along all edges.

Code requirements for Foam Plastic Insulation (2012 NC Building Code, Section 2603):

Surface Burning: ASTM E 84 or UL 723

Fire-Resistance-rated walls: ASTM E 119 or UL 263

Thermal Barrier: FM 4880, UL 1040, NFPA 286 or UL 1715.

Potential Heat: NFPA 259

Wall Assembly - Test Standard and Labeling Standard: NFPA 285

Exterior Wall Ignition: NFPA 268

Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:

"Thermax Sheathing" - by Dow Chemical USA

"Hunter Panels Xci Class A by Hunter Panels

-Or equal - by Owens Corning or DiversiFoam Products.

FACED MINERAL FIBER BLANKET/BATT INSULATION: Thermal insulation produced by combining mineral fibers of type described below with thermosetting resins to comply with ASTM C 665 for Type II, Class C, Category 1 and ASTM E 84 or UL 723 for Surface Burning Characteristics (blankets with foil/scrim) and as follows:

Mineral Fiber Type: Fibers manufactured from glass.

Thickness: Fiber blanket/batt insulation shall completely fill framing space of wall receiving insulation.

Use: Exterior stud walls: R-19 with foil/scrim facing.

(SEE NOTE REGARDING INSTALLATION AND ARCHITECT'S INSPECTION)

Combustion Characteristics: Unfaced blanket/batt passes ASTM E 136 test.

Surface Burning Characteristics: Maximum flame spread and smoke developed values of 25 and 50, respectively.

UNFACED MINERAL FIBER BLANKET/BATT INSULATION: Thermal insulation produced by combining mineral fibers of type described below with thermosetting resins to comply with ASTM C 665, Type I and ASTM E 84 Surface Burning Characteristics (with flame spread of 25 or less) and as follows:

Sound Insulation: Above ceilings - R=11 batt insulation. If any, Where noted on drawings.
Within interior walls - R=11 batt insulation. Typical, all interior walls.

AUXILIARY INSULATING MATERIALS:

Adhesive for Bonding Insulation: Type recommended by insulation manufacturer, and complying with requirements for fire performance characteristics.

Mechanical Anchors: Type and size indicated or, if not indicated, as recommended by insulation manufacturer for type of application and condition of substrate.

Mastic Sealer: Type recommended by insulation manufacturer for bonding edge joints between units and filling voids in work.

Polypropylene Netting: Type recommended by insulation manufacturer for suspending insulation between structural members.

Vinyl Tape: Type recommended by insulation manufacturer for sealing plastic vapor barrier seams.

PART 3 - EXECUTION

INSPECTION AND PREPARATION:

Require Installer to examine substrates and conditions under which insulation work is to be performed. A satisfactory substrate is one that complies with requirements of the section in which substrate and related work is specified. Obtain Installer's written report listing conditions detrimental to performance of work

in this section. Do not proceed with installation of insulation until unsatisfactory conditions have been corrected.

Clean substrates of substances harmful to insulations or vapor retarders, including removal of projections which might puncture vapor retarders.

INSTALLATION, GENERAL:

Comply with manufacturer's instructions for particular conditions of installation in each case. If printed instructions are not available or do not apply to project conditions, consult manufacturer's technical representative for specific recommendations before proceeding with work.

Extend insulation full thickness as shown over entire area to be insulated. Cut and fit tightly around obstructions, and fill voids with insulation. Remove projections which interfere with placement.

NOTE: FIBERGLASS BATT INSULATION WITH VAPOR BARRIER BACKING MUST BE INSTALLED BY EXTENDING THE EDGES OF THE BACKING NEATLY OVER THE FACE OF THE STUD OR JOIST OR TRUSSES FORMING THE SPACE BEING INSULATED. THESE EDGES SHALL BE NEATLY STRETCHED AND FASTENED TO ALLOW THE INTERIOR FINISH MATERIAL TO "LAY FLAT" OVER THE STUDS AND INSULATION – to be inspected by Architect prior to finishing/covering area.

INSTALLATION OF GENERAL BUILDING INSULATION:

Apply insulation units to substrate by method indicated, complying with manufacturer's recommendations. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

Set vapor retarder faced units with vapor retarder to warm side of construction, except as otherwise indicated. Do not obstruct ventilation spaces, except for firestopping.

Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to surrounding construction to ensure air-tight installation.

Stuff loose glass fiber insulation into miscellaneous voids and cavity spaces around building's exterior walls systems. Compact 40% above normal maximum volume (to a density of approximately 2.5 lbs. per cu. ft.)

PROTECTION:

General: Protect installed insulation and vapor retarders from harmful weather exposures and from possible physical abuses, where possible by nondelayed installation of concealing work or, where that is not possible, by temporary covering or enclosure.

End of SECTION 07200

SECTION 07275 - WEATHER BARRIERS

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings, General Conditions and Supplementary General Conditions and other Division-1 Specification Sections, apply to this Section.

SUMMARY

Section Includes:

Building wrap. "Air Infiltration Barrier" on Drawings.

Related Requirements:

See Section 07200 for insulation specifications.

See Section 07600 for flexible flashing and sheet metal.

ACTION SUBMITTALS

Product Data: For each type of product.

For building wrap, include data on air and water-vapor permeance based on testing according to referenced standards.

PART 2 - PRODUCTS

WATER-RESISTIVE BARRIER

Building Wrap: ASTM E 1677, Type I air barrier; with flame-spread and smoke-developed indexes of less than 10 and 10, respectively, when tested according to ASTM E 84 (Class A); ASTM D 1117 Tear resistance 10 lbs.; ASTM D 882 Tensile Strength 35 lbs./in.; UV stabilized; and acceptable to authorities having jurisdiction.

Products: Subject to compliance with requirements, **provide the following:**

DuPont - **Tyvek CommercialWrap**

Or approved equal by:

Dow Chemical Company

Ludlow Coated Products

Pactiv, Inc.

Reemay, Inc.

Water-Vapor Permeance: Not less than 28 perms per ASTM E 96/E 96M, Desiccant Method (Procedure B).

Air Permeance: Not more than 0.001 cfm/sq. ft. at 75 Pa when tested according to ASTM E 2178.

Allowable UV Exposure Time: Not less than three months.

MISCELLANEOUS MATERIALS

Flashing system (other than that covered under Section 07600), seam tape, fasteners, sealants, adhesives, and primers shall be provided by the selected structural insulating sheathing manufacturer to be installed as a single source system.

PART 3 - EXECUTION

WATER-RESISTIVE BARRIER INSTALLATION

Cover exposed exterior surface of sheathing with water-resistive barrier securely fastened to framing immediately after sheathing is installed.

Cover sheathing with water-resistive barrier as follows:

- Cut back barrier 1/2 inch (13 mm) on each side of the break in supporting members at expansion-or control-joint locations.

- Apply barrier to cover vertical flashing with a minimum 4-inch (100-mm) overlap unless otherwise indicated.

Building Wrap: Comply with manufacturer's written instructions.

- Seal seams, edges, fasteners, and penetrations with tape.

- Extend into jambs of openings and seal corners with tape.

END OF SECTION 07275

SECTION 07530 – THERMOPLASTIC POLYOLEFIN SINGLE PLY ROOFING (TPO)

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings, General Conditions and Supplementary General Conditions and other Division-1 Specification Sections, apply to this Section.

Steel Deck is specified in Division 5.

SUMMARY

This Section includes **fully adhered** attached thermoplastic polyolefin single-ply roofing installed in accordance with drawings and specifications approved by the roofing membrane manufacturer.

Uses: Typical over “sloped” roof metal deck providing ¼” per foot slope for drainage.

Types of roofing systems specified in this section utilizing single ply roofing membranes include the following:

Fully Adhered 60 mil system
on metal roof deck system.

Mechanically Attached rigid board insulation (UL.1256/ FM 4450), where shown as primary layer.

REFERENCES

ASTM D 412 Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension; 1998a (2002)

ASTM D 471 Standard Test Method for Rubber Property – Effect of Liquids

ASTM D 573 Standard Test Method for Rubber Property –Deterioration in an Air Oven

ASTM D 751 Standard Test Method for Coated Fabrics 2000

ASTM D 816 Standard Test Method for Rubber Cements 1982-2001

ASTM D 1149 Standard Test Method for Rubber Deterioration – Surface Ozone Cracking in a Chamber 1999

ASTM D 1204 Standard Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperatures; 2002

ASTM D 2137 Standard Test Method for Rubber Property – Brittleness Point of Flexible Polymers and Coated Fabrics; 1994 – 2000

FM P7825 Approval Guide Factory Mutual Research Corporation, current edition

FED STD 101 Test Procedures for Packaging Materials, Federal Specifications and Standards, Revision C 1980 – Change Noticed 3 1988

UL (FRD) – Fire Resistant Directory, Underwriters Laboratories Inc, current edition

SUBMITTALS

General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

Product data, installation instructions, and general recommendations from manufacturer of the roofing system. Include data substantiating that materials comply with requirements.

Product data sheets for each material required including:

- Membrane
- Flashings
- Adhesive
- Insulation
- Insulation adhesive
- Metal Accessories
- Caulks and sealants
- Unreinforced flashing material
- Performed corners and boots
- Roof hatch and Roof Drains
- Traffic Walk Pads
- And other required materials.

Manufacturer's standard details for each applicable project condition

Manufacturer's installation instructions.

Samples of finished roofing sheets, including T-shaped side/end-lap seam. Also include the following:

Samples of required insulation boards, walkway pad material, membrane adhesive and insulation fasteners.

Shop drawings showing roof configuration, sheet layout, seam locations, colors (as applicable), details at perimeter, and special conditions.

- Method of membrane adhering and seaming
- Indicate layout (if any) of tapered insulation materials.
- Indicate method/pattern of Insulation attachment.
- Base flashings and terminations.

Pre-roofing Conference records.

Test data for pullout resistance of fastening systems.

Sample warranty of standard roofing system warranty stating obligations, remedies, limitations, and exclusions of warranty.

Inspection Report: Copy of roofing system manufacturer's inspection report of completed roofing inspection.

QUALITY ASSURANCE

Installer: Engage an experienced Installer to apply single ply membrane roofing who has specialized in application of roofing systems similar to those required for this project. Installer must be acceptable to or licensed by manufacturer of primary roofing material.

Work associated with single ply membrane roofing, including (but not limited to) insulation, flashing and counterflashing, expansion joints, and joint sealers, is to be performed by Installer of this work.

Pre-Roofing Conference: Prior to installation of roofing and associated work, meet at project site, or other mutually agreed location, with Installer, roofing sheet manufacturer, installers of related work, and other entities concerned with roofing performance, including (where applicable) Owner's insurer, test agencies, governing authorities, Architect, and Owner. Record discussions and agreements and furnish copy to each participant. Provide at least 72 hours advance notice to participants prior to convening pre-roofing conference.

UL Listing: Provide labeled materials that have been tested and listed by UL in "Building Materials Directory" or by other nationally recognized testing laboratory for application indicated, with "Class A" rated materials/system for roof slopes shown.

PROJECT CONDITIONS

Weather: Proceed with roofing work when existing and forecasted weather conditions permit work to be performed in accordance with manufacturers' recommendations and warranty requirements.

Substrate Conditions: Do not begin roofing installation until substrates have been inspected and are determined to be in satisfactory condition.

WARRANTY

Special Project Warranty: Submit two executed copies of 2-year "Roofing Warranty" covering work of this section including roofing membrane, composition flashing, roof insulation, and roof accessories, signed and countersigned by Installer (Roofer) and Contractor.

Manufacturer's Warranty: Submit executed copy of single ply membrane manufacturer's "Limited Service Warranty" agreement including flashing endorsement, signed by an authorized representative of manufacturer. Provide form that was published with product literature as of date of Contract Documents, for the following period of time:

Warranty Period: 20 years NDL after date of Substantial Completion.

The warranty period 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

MANUFACTURER

Acceptable Manufacturer: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to, the following: (Note manufacturer's are included that make their own membrane product)

Ultra ply by Firestone Building Products Co. (Basis of Design)
EverGuard TPO 60 by GAF Materials Corp.
VersiWeld (white, 60 mil reinf TPO) by Versico Roofing Systems
Equals by - Carlisle Syntec Systems. Or Johns Manfield TPO

ROOFING SYSTEM

Provide: **One of the above roofing products** or pre-approved equal.

Classified by Underwriters Laboratories as a Class A roofing material for use in construction of Class A roofing assemblies.

Meet test requirements for FM Class 1A fire and **I-90** wind resistance.

Membrane: Scrim-reinforced, **thermoplastic polyolefin** (TPO) based sheet, bearing UL label on the packaging.

Thickness: **60 mi reinforced.**, nominal when measure in accordance with ASTM D 751

Sheet Length: as required to avoid end seams.

Color: **White.**

Breaking Strength: 225 lbf, when tested in accordance with ASTM D 751, Grab Method.

Elongation: ultimate of unreinforced membrane (ASTM D 412, Die C) 500 percent.

Tear Strength: ASTM D 751 Procedure B (8 x 8 inch sample) 55 lbf

Brittleness Test: ASTM D 2137 at minus 40 deg C – Pass

Dimensional Stability percent change max (ASEM D 1204 B 1 hr at 212 deg F , W; 6hrs at 176 deg F); Black plus/minus .5 percent; white plus/minus .5 percent

Factory seam strength (ASTM D 816 method B) sheet failure

Water Absorption (ASTM D 471) 158 deg F for 7 days; Plus 2 percent max weight change.

Ozone Resistance of unreinforced membrane: No cracking when tested in accordance with ASTM D 1149 for 70 hr at 100 deg F

Weather Resistance (Xenon arch: 4000 hrs, EMMAQUA; 2,000,000 Langleys) Pass.

Puncture Resistance (FED STD 101, Method 2031) 350 lb.

Heat Aging (ASTM D 573) 28 days at 212 deg F; break at 225 lbf; elongation of 500 percent.

MISCELLANEOUS ACCESSORIES

ACCESSORY MATERIALS

Sheet Seaming System: Manufacturer's standard materials for sealing lapped joints, including edge sealer to cover exposed spliced edges as recommended by membrane manufacturer.

Cant Strips, Tapered Edge Strips, and Flashing Accessories: Types recommended by membrane manufacturer, including adhesive tapes, flashing cements, and sealants.

Flashing Material: Manufacturer's standard system compatible with membrane specified here in.

Slip Sheet: Type recommended by membrane manufacturer for protecting membrane from incompatible substrates.

Mechanical Fasteners: Metal plates, caps, battens, accessory components, fastening devices, and adhesives to suit substrate and as recommended by membrane manufacturer.

Bonding Adhesive: Manufacturer's recommended Bonding Adhesive

Perimeter Sheets: as specified here in.

All purpose Sealant: Use for water cut-off mastic, pitch box sealer and to seal membrane to metal.

Cut Edge Sealant: Use toe seal exposed cut edges of reinforced membrane.

Seam Cleaner: Use to remove contaminates from the surface of the membrane where hot air welding is to occur.

Tapered Edge Strips: Non Combustible, High density fiber board.

Walkway Traffic Pads: Reclaimed rubber walkway traffic pads adhered to roof membrane surface as recommended by roofing manufacturer. Traffic walkway pads to be laid around perimeter of all rooftop mechanical units and to provide a path connecting the units to the roof access location.

See drawings for Location of Walk Pads – if required.

INSULATING MATERIALS

General: Provide insulating materials to comply with requirements indicated for materials and compliance with referenced standards in sizes to fit applications indicated, selected from manufacturer's standard thicknesses, widths, and lengths.

Insulation: Extruded Polystyrene (XPS) closed cell, moisture resistant rigid foam board insulation designed for roofing applications.

R-Value: R-5 per 1" thickness – insulation only.

Thickness: min. 5" as indicated on drawings **OR Greater if necessary** to meet required R-Value of R-25 (ci). Rigid insulation shall be installed in a minimum of two 2.5" layers with all joints staggered.

Code requirements for Foam Plastic Insulation (2012 NC Building Code, Section 2603):

Surface Burning: ASTM E 84 or UL 723

Fire-Resistance-rating: ASTM E 119 or UL 263

Thermal Barrier: FM 4880, UL 1040, NFPA 286 or UL 1715.

Potential Heat: NFPA 259

Roof: Class A, B or C roof coverings FM 4450 or UL 1256

All packages and containers of foam plastic insulation shall bear the label of Factory Mutual showing compliance with FM 4450.

AUXILIARY INSULATION MATERIALS

If rigid foam board insulation does not allow for direct adhesion of roofing membrane, contractor shall provide:

Roofing Overlayment "Cover Board": Provide and Install a ½" Glass Fiber Faced Gypsum Board overlayment over the entire roof area.

Overlayment board to be Mechanically fastened with screws long enough to penetrate metal decking with pull out strength as recommended by the manufacturer to meet upfit requirements, over all layers of flat or tapered rigid board insulation and directly under the fully adhered roofing membrane.

Glass Fiber Faced Gypsum Roof Board Acceptable Products/Manufacturer's:

DensDeck, by Georgia-Pacific Gypsum,

Securock Glass-Mat Roof Board, by USG
or equal.

Adhesive for Bonding Insulation: Type recommended by insulation manufacturer and complying with fire resistance and uplift requirements.

Mastic Sealer: Type recommended by insulation manufacturer for bonding edge joints and filling voids.

Mechanical Anchors: Corrosion-resistant type as recommended by insulation manufacturer for deck type and complying with fire and insurance uplift rating requirements.

Provide system tested and approved for I-90 wind uplift rating.

PART 2 - EXECUTION

GENERAL

Do not deviate from this specification without written approval of the manufacturer. Should deviations or changes occur without the manufacturer's approval, the project will not be eligible for warranty coverage.

Do not deviate from this specification without written approval of Ramsay Burgin Smith Architects, Inc.

EXAMINATION

Verify that surfaces to be bonded to are dry, clean and free of debris. Suitable surfaces are smooth, solid masonry wood, and metal, plus insulation board fastened to the specific manufacturer's recommendations for receiving adhered roofing membranes and accepted by Roofing Manufacturer for adhered application.

Verify that positive roof slope exists in all areas.

Verify that rooftop mechanical units are to have their condensation lines piped to drains or off the roof.

Correct unsuitable conditions before proceeding with insulation. Commencing installation signifies acceptance by the installer of the substrate.

SUBSTRATE PREPARATION

Prior to the start of work, make the substrate smooth and free of debris, sharp edges, and other surface irregularities that will be detrimental to the installation.

Correct unevenness and joint gaps greater than ¼ inch in the membrane substrate as they can cause inconsistent membrane welds. When such conditions occur fill with appropriate and properly secured insulation or material approved by manufacturer's technical review department

Nailers: Verify that:

Nailers are pressure-preservative treated (fire-retardant-treated where required; creosote and asphaltic preservatives are not acceptable).

Nailers are anchored with fasteners suitable for the application having a minimum withdrawal resistance of 100 lb. Staggered 6 inches on center within 8 feet of an outside corners and 12 inches on center along other perimeter areas.

Top surfaces of nailers match the top surface of adjacent construction plus/minus ¼ inch, without contributing to ponding.

Flashing Substrates: Verify that the substrate is smooth and free of sharp edges and other surface irregularities that will be detrimental to 100-percent adhesion of the flashing membrane.

ADHESIVES:

Provide adhesive approved for use by both the membrane and insulation suppliers.

INSULATION INSTALLATION

Handle and secure insulation boards so as to not damage or rupture the facer and surface.

General: Extend insulation full thickness in two layers, over entire surface to be insulated, cutting and fitting tightly around obstructions. Form cant strips, crickets, saddles, and tapered areas with additional material as shown and as required for proper drainage of membrane.

Stagger joints in one direction for each course. For multiple layers, stagger joints in both directions between courses with no gaps, to form a complete thermal envelope.

Do not install more insulation each day than can be covered with membrane before end of day or before start of inclement weather.

Secure roof insulation to substrate with bar or other type of mechanical fastening patterns to meet specified wind-uplift spacing but in no case, less than anchorage for field, perimeter and corner uplift resistance as determined by NC Building Code requirements. Tapered insulation at crickets or saddles shall be adhered with ribbons of insulation adhesive as determined by NC Building Code requirements.

MEMBRANE INSTALLATION

Attachment of Membrane: Fully adhere in accordance with manufacturer's standard details and approved submittals.

Perimeter Sheets: Install perimeter sheets and full-sheet in accordance approved shop drawings. Fully adhere along the edge of the membrane through the insulation, and into the roof deck.

Field Sheets: Fully Adhere Membrane with lapped edges in accordance with standard details for Roof Type indicated.

SEALING OF MEMBRANE

Lap Splices: Overlap and hot-air weld membrane without any contaminants (adhesive, dirt, debris, etc.) in the seam.

An automatic hot-air welder and hand-held welder that are functionally in top condition are required.

Use hand-held welders for small work and repairs.

Use automatic hot-air welders for field seaming.

Caulk cut edges by applying Cut-Edge Sealant from a squeeze bottle.

Welding of Membrane After Exposure:

Remove visible dirt and debris with a clean cloth and water. If necessary, use a detergent cleaner (e.g. Fantastik or 409) followed by a water fines.

With a clean scrub pad saturated with Seam Cleaner, aggressively agitate the seaming area. With a clean white cloth, make a final one-swipe pass over the seaming area, being careful not to redeposit contaminants onto the cleaned surface.

Allow Seam Cleaner to completely flash off (membrane should be completely dry).

Follow the standard hot-air welding procedure with an approximate 20 percent reduction in speed.

Final weld strength may not be achieved for several days.

FLASHINGS, EXPANSION JOINTS, DRAINS, AND WALKWAYS

Flashing: Flash perimeters, curbs, vents, drains, and other details as shown by manufacturer's Standard Detail Drawings. Do not cover weep holes or any form of through-wall drainage.

Expansion Joints: Install in accordance with membrane manufacturer's details.

Roof Drains: Install in accordance with membrane manufacturer's details.

Properly secure all bolts to provide 100-percent continuous compression of the clamping ring.

Do not run field seams through drains.

Metal Work:

Install and anchor in a manner that prevents damage from buckling or wind in accordance with SMACNA guidelines or in manner approved by membrane manufacturer.

Seal and waterproof in an acceptable manner to prevent leakage.

Make and install Metal flashing at perimeter in accordance with membrane manufacturer's details.

Roof Walkway Pads: Install pads in accordance with roofing manufacturer's instructions.

Prepare dirty or weathered membrane:

Remove any visible dirt and debris with a clean rag and water.

For heavily contaminated surface, scrubbing with a detergent cleaner (i.e. Fantastik or 409) followed by a water rinse may be necessary.

With a clean scrub pad saturated Seam Cleaner, aggressively agitate the seaming area of the roof membrane surface.

With a clean white rag, follow with a final one-swipe pass being careful not to redeposit any contaminants back onto the cleansed sheet surface.

Allow Seam Cleaner to completely flash off; membrane should be completely dry.

Position walkway pad and cut to desired length.

Whenever possible, do not cover membrane seams with walkway pad. When installed adjacent to a seam, keep the pad a minimum of 2 inches from the edge of the seam on the bottom sheet of the completed lap and a minimum of 6 inches from the edge of the seam when located on the top sheet of a completed lap.

When covering seams is unavoidable, the lap seam should be completed per manufacturer's specifications and thoroughly probed with any deficiencies repaired prior to pad installation.

In circumstances where drainage around the walkway pad is a concern, shorter walkway pad lengths spaced with a 2-inch gap may be desired.

Weld perimeter of walkway pad to the membrane following standard welding procedures. Periodic breaks in the weld of 1 to 2 inches are required on the low slope edge of the pad to prevent the accumulation of water under the pad.

FIELD QUALITY CONTROL

Ensure that metal work shall be secured in a manner approved by roof membrane manufacturer, or in accordance with SMACNA guidelines, to prevent damage from buckling, or wind exposure. All metal work that is part of the waterproofing envelope shall be sealed, structurally sound, and approximately anchored to prevent leakage.

Tests:

Seam Tests: Probe the entire lap edge of each seam with an approved seam-probing tool (cutter-pin extractor) after seam has cooled completely to verify seam consistency. Probing before the seam area has cooled will damage the membrane

Destructive Seam Tests: Test 3-inch wide area of seam weld to verify good peel strength. A properly welded seam will have membrane delamination from scrim prior to weld failure. Perform the following destructive tests on welds:

First seam of each working day.

First seam after the automatic hot-air welder has been allowed to cool down.

After any extreme changes in weather conditions.

Manufacturer's Field Service: Upon completion of the installation, have the manufacturer's representative make an inspection to ascertain that the roofing membrane system has been installed according to manufacturer's approved specifications and details.

Warranty Inspection: Provide manufacturer's inspection for acceptance for warranty.

Rejection of Defective Work: Areas having excessive patching as a result of damage to the membrane or faulty installation may be rejected by membrane manufacturer or the Architect.; replace the membrane completely in these areas.

PROTECTION AND CLEANING

Protect membrane in progress and completed membrane from foot and vehicular traffic.

Clean soiled surfaces, remove trash and debris, and leave project site in a clean condition.

END OF SECTION 07533

SECTION 07600 - FLASHING AND SHEET METAL

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings, General Conditions and Supplementary General Conditions and other Division-1 Specification Sections, apply to this Section.

SUMMARY

This Section includes the following:

- Metal counter flashing and base flashing (prefinished color to be selected by architect).
- Miscellaneous sheet metal accessories.(prefinished color to be selected by architect)
- Miscellaneous sheet metal assessories.
- Metal wall flashings
- Elastic flashing.
- Gutters.
- Downspouts.

Integral masonry flashings are specified as masonry work in sections of Division 4.

Metal Counter flashing at parapet walls shall be as recommended and supplied by Single ply TPO membrane manufacturer.

Roofing accessories, including roof hatch , installed integral with roofing system are specified in this section but shall be part of the roofing system work.

All roof and rain drainage work shall be assigned to the same roofing contractor for single point of responsibility.

Note: All sheet metal flashings, copings shall be designed and installed to meet minimum UL I -90 wind certification.

SUBMITTALS

General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

Product data, Flashing, Sheet Metal, and Accessories: Manufacturer's technical product data, installation instructions and general recommendations for each specified sheet material and fabricated product.

Samples of the following flashing, sheet metal, and accessory items:

8-inch-square color samples of specified sheet materials to be exposed as finished surfaces.

12-inch-long samples of factory/shop -fabricated products exposed as finished work. Provide complete with specified factory finish, including gutters, down spouts, straps, flashings, and gravel stops.

Shop Drawings - Flashing, Sheet Metal, Accessories: Submit shop drawings showing layout, joining, profiles, and anchorage of fabricated work, including major counter flashings, trim/fascia units, gutters, down spouts and expansion joint systems; layouts at 1/4" scale, details at 3" scale.

PROJECT CONDITIONS

Coordinate work of this section with interfacing and adjoining work for proper sequencing of each installation. Ensure best possible weather resistance and durability of work and protection of materials and finishes.

Assign Roofing Installer portions of this section required to provide necessary interface with roofing material to single source responsibility in case of roof leaks for the extent of the roofing warranty.

PART 2 - PRODUCTS

SHEET METAL FLASHING AND TRIM MATERIALS

Aluminum: ASTM B 446, alloy 3003, temper H14, 70% Kynar 500 finish; 0.032" & 0.040" thick (20 & 18 gage) minimum except as otherwise indicated. Treat with asphaltic compound as required against dissimilar materials.

Metal trim/fascia units, counter flashing:	thickness .040" UNO
Gutters:	thickness .032", with <u>1" wide</u> supports at 30" o.c.
Downspouts:	thickness .032"

Downspout Strainers: Where downspouts are connected to underground storm drainage piping, provide and install "wire basket type" strainer formed of heavy expanded aluminum wire. Strainer shall fit snugly in outlet tube. (Contractor's option to provide downspout adapter w/ built-in debris trap and clean out.)

Materials used near or in contact with TPO Membrane Roofing: As directed by Membrane supplier

Extruded Aluminum (reglets): Manufacturer's standard extrusions of sizes and profiles indicated, 6063-T52, mill finish; 0.08" minimum thickness for primary legs of extrusions.

FLEXIBLE SHEET MEMBRANE FLASHING

Elastic Sheet Flashing/Membrane: Nonreinforced flexible, black elastic sheet flashing of 50 to 65 mils' thickness and complying with the following:

- Shore A Hardness (ASTM D 2240): 50 to 70.
- Tensile Strength (ASTM D 412): 1200 psi.
- Tear Resistance (ASTM D 624, Die C): 20 lbs. per linear inch.
- Ultimate elongation (ASTM D 412): 250 percent.
- Low temperature brittleness (ASTM D 746): minus 30 deg F (minus 35 deg C).
- Resistance to ozone aging (ASTM D 1149): no cracks for 10 percent elongated sample for 100 hours in 50 pphm (50.5 mPa) ozone at 104 deg F (70 deg C).
- Resistance to Heat Aging (ASTM D 573): maximum hardness increase of 15 points, elongation reduction of 40 percent, and tensile strength reduction of 30 percent, for 70 hours at 212 deg F (100 deg C).

Acceptable Products:

Neoprene synthetic rubber sheet.
Butyl synthetic rubber sheet.
EPDM synthetic rubber sheet.

MISCELLANEOUS MATERIALS AND ACCESSORIES:

Solder: For use with steel or copper, provide 50 - 50 tin/lead solder (ASTM B 32), with rosin flux.

Fasteners: Same metal as flashing/sheet metal or other non-corrosive metal as recommended by sheet manufacturer. Match finish of exposed heads with material being fastened.

Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, non-drying, nonmigrating sealant or, if in contact with roof membrane, as recommended by single-ply roof membrane manufacturer for its intended use.

Elastomeric Sealant: Generic type recommended by manufacturer of metal and fabricator of components being sealed and complying with requirements for joint sealants as specified in Division 7 Section "Joint Sealers."

Epoxy Seam Sealer: 2-part noncorrosive metal seam cementing compound, recommended by metal manufacturer for exterior/interior nonmoving joints including riveted joints.

Adhesives: Type recommended by flashing sheet manufacturer for waterproof/weather-resistant seaming and adhesive application of flashing sheet.

Paper Slip Sheet: 5-lb. rosin-sized building paper.

Reglets: Metal units of type and profile indicated, compatible with flashing indicated, noncorrosive.

Metal Accessories: Provide sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of work, matching or compatible with material being installed, noncorrosive, size and gage required for performance.

Elastic Flashing Filler: Closed-cell polyethylene or other soft closed-cell material recommended by elastic flashing manufacturer as filler under flashing loops to ensure movement with minimum stress on flashing sheet.

Roofing Cement: ASTM D 2822, asphaltic or, if in contact with roof membrane, as recommended by single-ply manufacturer for intended use. (NOT ALLOWED IN CONTACT with PVC ROOFING MEMBRANE)

FABRICATED UNITS

General Metal Fabrication: Shop-fabricate work to greatest extent possible. Comply with details shown and with applicable requirements of SMACNA "Architectural Sheet Metal Manual" and other recognized industry practices. Fabricate for waterproof and weather-resistant performance, with expansion provisions for running work, sufficient to permanently prevent leakage, damage, or deterioration of the work. Form work to fit substrates. Comply with material manufacturer instructions and recommendations for forming material. Form exposed sheet metal work without excessive oil-canning, buckling, and tool marks, true to line and levels indicated, with exposed edges folded back to form hems.

Seams: Fabricate nonmoving seams in sheet metal with flat-lock seams. For metal other than aluminum, tin edges to be seamed, form seams, and solder. Form aluminum seams with epoxy seam sealer; rivet joints for additional strength where required.

Expansion Provisions: Where lapped or bayonet-type expansion provisions in work cannot be used or would not be sufficiently water/weatherproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

Gutter Expansion Joints: Expansion joints shall be "butt-type" expansion joints per SMACNA Architectural Sheet Metal Manual, Figure 1-7. Gutter Joints shall be **spaced equally** at a maximum of 30 foot intervals. (Note that gutter submittals -shop drawings- should indicate these joint locations.)

Sealant Joints: Where movable, nonexpansion type joints are indicated or required for proper performance of work, form metal to provide for proper installation of elastomeric sealant, in compliance with SMACNA standards.

Separations: Provide for separation of metal from noncompatible metal or corrosive substrates by coating concealed surfaces at locations of contact, with bituminous coating or other permanent separation as recommended by manufacturer/fabricator.

Aluminum Extrusion Units: Fabricate extruded aluminum running units with formed or extruded aluminum joint covers for installation behind main members where possible. Fabricate mitered and welded corner units.

PART 3 - EXECUTION

INSTALLATION REQUIREMENTS

General: Except as otherwise indicated, comply with manufacturer's installation instructions and recommendations and with SMACNA "Architectural Sheet Metal 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 as indicated. Install work with laps, joints, and seams that will be permanently watertight and weatherproof.

Isolation: Where metal surfaces of units are installed in contact with dissimilar metal or corrosive substrates, including wood, apply bituminous coating on concealed metal surfaces, or provide other permanent separation as recommended by aluminum producer

Bed flanges of work in a thick coat of bituminous roofing cement where required for waterproof performance.

Install reglets to receive counterflashing in manner and by methods indicated. Where shown in concrete, furnish reglets to trades of concrete work for installation as work of Division 3 sections. Where shown in masonry, furnish reglets to trades of masonry work, for installation as work of Division 4 sections.

Install counterflashing in reglets, either by snap-in seal arrangement or by welding in place for anchorage and filling reglet with mastic or elastomeric sealant, as indicated and depending on degree of sealant exposure.

Base and Counter Flashing Systems installation methods for flashing the junction of a sloping roof and a masonry wall shall be per SMACNA, Figure 4-8. Two-piece counter flashing installation methods shall be per SMACNA, Figure 4-4C and D.

Install elastic flashing in accordance with manufacturer's recommendations. Where required, provide for movement at joints by forming loops or bellows in width of flashing. Locate cover or filler strips at joints to facilitate complete drainage of water from flashing. Seam adjacent flashing sheets with adhesive, seal and anchor edges in accordance with manufacturer's recommendations.

Nail flanges of expansion joint units to curb nailers, at maximum spacing of 6 inches o.c. Fabricate seams at joints between units with minimum 3-inch overlap, to form a continuous, waterproof system.

CLEANING AND PROTECTION

Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.

Protection: Advise Contractor of required procedures for surveillance and protection of flashings and sheet metal work during construction to ensure that work will be without damage or deterioration other than natural weathering at time of Substantial Completion.

END OF SECTION 07600

SECTION 07900 - JOINT SEALERS

PART 1 - GENERAL

RELATED DOCUMENTS:

Drawings, General Conditions and Supplementary General Conditions and other Division-1 Specification Sections, apply to this Section.

DESCRIPTION OF WORK:

Extent of each form and type of joint sealer is indicated on drawings and described in this section.

Refer to Division-8 Section "Tile" for joint sealers in tile work; not work of this section.

Refer to Division-8 sections for glazing requirements; not work of this section.

SYSTEM PERFORMANCES:

Provide joints sealers that have been produced and installed to establish and maintain watertight and airtight continuous seals.

QUALITY ASSURANCE:

Single Source Responsibility for Joint Sealer Materials: Obtain joint sealer materials from a single manufacturer for each different product required.

SUBMITTALS:

Product Data: Submit manufacturer's technical data for each joint sealer product required, including instructions for joint preparation and joint sealer application and range of manufacturer's standard color selection.

DELIVERY, STORAGE, AND HANDLING:

Deliver materials to project site in original unopened containers or bundles with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time and mixing instructions for multi-component materials.

Store and handle materials to prevent their deterioration or damage due to moisture, temperature change, contaminants, or other causes.

PROJECT CONDITIONS:

Environmental Conditions: Do not proceed with installation of joint sealers under the following conditions:

When ambient and substrate temperature conditions are outside the limits permitted by joint sealer manufacturer or below 40 degrees F (4.4 degrees C).

When joint substrates are wet due to rain, frost, condensation or other causes.

Joint Width Conditions: Do not proceed with installation of joint sealers when joint widths are less than allowed by joint sealer manufacturer for application indicated.

PART 2 - PRODUCTS

MATERIALS, GENERAL:

Compatibility: Provide joint sealers, 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 testing and field experience.

Colors: Provide color of exposed joint sealer indicated or, if not otherwise indicated, as selected by Architect from manufacturer's standard colors.

ELASTOMERIC JOINT SEALANTS:

Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing, elastomeric sealant of base polymer indicated which complies with ASTM C 920 requirements, including those for Type, Grade, Class and Uses.

Multi-Part Nonsag Urethane Sealant: Type M, Grade NS, Class 25, and complying with the following requirements for uses:

Uses NT, M, G, A and, as applicable to joint substrates indicated, O.

Applications: Typical exterior building joints horizontal and vertical between similar and dissimilar materials closing all potential water, air and light leaks.

One-Part Pourable Urethane Sealant: Type S, Grade P; Class 25; Uses T, M, and, as applicable to joint substrates indicated, O.

Applications: Typical all exterior building joints over expansion joints in concrete walkways.

One-Part Mildew-Resistant Silicone Sealant: Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide for sealing interior joints with nonporous substrates around ceramic tile, showers, sinks and plumbing fixtures.

Applications: Typical all caulking in toilets, kitchens, shower rooms, labs and similar wet areas. Apply as required to seal all light and air leaks, between counter backsplashes and walls, around door frames, around perimeter of fixtures at walls, etc. whether or not specifically shown on drawings.

Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:

Multi-Part Nonsag Urethane Sealant for Uses NT, M, G, A, and O:

"Chem-Calk 500"; Bostik Construction Products Div.

"Dynatrol II"; Pecora Corp.

"Sikaflex 2c NS"; Sika Corp.

"Sonolastic NP 2"; Sonneborn Building Products Div., Rexnord Chem. Prod. Inc.

One-Part, Pourable, Urethane Sealant:

"Vulkem 45"; Mameco International, Inc.

"NR-201 Urexpam"; Pecora Corp.

"Sonolastic SL-1"; Sonneborn B.P.Div., Rexnord Chem Prod. Inc.

One-Part Mildew-Resistant Silicone Sealant:

"Dow-Corning 786"; Dow Corning Corp.

"SCS 1702"; General Electric Co.

"863 #345 White"; Pecora Corp.

"Proglaze White"; Tremco Corp.

LATEX JOINT SEALANTS:

Acrylic-Emulsion Sealant: Manufacturer's standard, one part, nonsag, acrylic, mildew-resistant, acrylic-emulsion sealant complying with ASTM C 834, formulated to be painted and recommended for exposed applications on interior and on protected exterior exposures involving joint movement of not more than ± 7.5 percent.

Applications: Typical interior building joints horizontal and vertical between similar and dissimilar materials closing all potential water, air and light leaks.

Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:

"Chem-Calk 600"; Bostik Construction Products Div.

"AC-20"; Pecora Corp.

"Sonolac"; Sonneborne Building Products Div.; Rexnord Chem. Prod., Inc.

"Tremco Acrylic Latex Caulk"; Tremco Inc.

JOINT FILLERS FOR CONCRETE PAVING:

General: Provide joint fillers of thickness and widths indicated or if not indicated 1/2" thick.

Bituminous Fiber Joint Filler: Preformed strips of composition below, complying with ASTM D 1751:

Asphalt saturated fiberboard.

JOINT SEALANT BACKING:

General: Provide sealant backings of material and type which are non-staining; 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.

Plastic Foam Joint Fillers: Preformed, compressible, resilient, non-waxing, non-extruding strips of plastic foam of material indicated below, and of size, shape and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

Elastomeric Tubing Joint-Fillers: Neoprene, butyl or EPDM tubing complying with ASTM D 1056, non absorbent to water and gas, capable of remaining resilient at temperatures down to -26 degrees F (-15 degrees 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.

Expanding Foam Sealant Backing: (to provide secondary seal at exterior masonry joints) 100 percent acrylic, water-based impregnated expanding foam sealant. Material to be supplied in rolls, precompressed to less than joint size at mean temperature for installation, with pressure-sensitive mounting adhesive on one side of the material.

Product similar to: Backerseal by Emseal Corp. (or approved equal)

Bond-Breaker Tape: Polyethylene tape or other plastic tape as recommended by sealant manufacturer for preventing bond between sealant and joint filler or other materials at back (3rd) surface of joint. Provide self-adhesive tape where applicable.

MISCELLANEOUS MATERIALS:

Primer: Provide type recommended by joint sealer manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint sealer substrate and field tests.

Cleaners for Nonporous Surfaces: Provide non-staining, chemical cleaner of type acceptable to manufacturer of sealant and sealant backing materials which are not harmful to substrates and adjacent nonporous materials.

PART 3 - EXECUTION

INSPECTION:

Require installer to inspect joints indicated to receive joint sealers for compliance with requirements for joint configurations, installation tolerances and other conditions affecting joint sealer performance. Obtain Installer's written report listing any conditions detrimental to performance of joint sealer work. Do not allow joint sealer to proceed until unsatisfactory conditions have been corrected.

PREPARATION:

Surface Cleaning of Joints: Clean out joints immediately before installing joint sealers to comply with recommendations of joint sealer manufacturers and the following requirements:

Remove all foreign material from joint substrates which could interfere with adhesion of joint sealer, including dust; paints, except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer; oil; grease; waterproofing; water repellants; water; surface dirt and frost.

Clean concrete, masonry, unglazed surfaces of ceramic tile and similar porous joint substrate surfaces, by brushing, grinding, blast cleaning, mechanical abrading, acid washing or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint

sealers. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.

Remove laitance and form release agents from concrete.

Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile and other non-porous surfaces by chemical cleaners or other means which are not harmful to substrates or leave residues capable of interfering with adhesion of joint sealers.

Joint Priming: Prime joint substrates where recommended by joint sealer manufacturer based on prior experience. Apply primer to comply with joint sealer manufacturer's recommendations. Confine primers to areas of joint sealer bond, do not allow spillage or migration onto adjoining surfaces.

Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces which 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.

INSTALLATION OF JOINT SEALERS:

General: Comply with joint sealer manufacturers' printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.

Elastomeric Sealant Installation Standard: Comply with recommendations of ASTM C 962 for use of joint sealants as applicable to materials, applications and conditions indicated.

Latex Sealant Installation Standard: Comply with requirements of ASTM C 790 for use of latex sealants.

Installation of Sealant Backings: Install sealant backings to comply with the following requirements:

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 which allow optimum sealant movement capability.

Do not leave gaps between ends of joint-fillers.

Do not stretch, twist, puncture or tear joint fillers.

Remove absorbent joint-fillers which have become wet prior to sealant application and replace with dry material.

Install bond breaker tape between sealants and joint-fillers, compression seals or back of joints where required to prevent third side adhesion of sealant to back of joint.

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 which allow optimum sealant movement capability.

Tooling of Nonsag Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of concave configuration, 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 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.

Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealers and of products in which joints occur.

End of SECTION 07900

SECTION 08110 - STEEL DOORS AND FRAMES

PART 1 - GENERAL

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

DESCRIPTION OF WORK:

Extent of standard steel doors and frames is indicated and scheduled on drawings.

Finish hardware is specified elsewhere in Division 8.

Building in of anchors and grouting of frames in masonry construction is specified in Division 4.

QUALITY ASSURANCE:

Provide doors and frames complying with Steel Door Institute "Recommended Specifications: Standard Steel Doors and Frames" (SDI-100) and as herein specified.

Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated or required, provide fire-rated door and frame assemblies that comply with NFPA 80 "Standard for Fire Doors and Windows", and have been tested, listed, and labeled in accordance with ASTM E 152 "Standard Methods of Fire Tests of Door Assemblies" by a nationally recognized independent testing and inspection agency acceptable to authorities having jurisdiction.

Comply with UL 10C requirements for Positive Pressure Fire Testing.

Provide fixed metal label at each fire assembly component.

SUBMITTALS:

Product Data: Submit manufacturer's technical product data substantiating that products comply with requirements.

Shop Drawings: Submit for 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 finish hardware and reinforcements, and details of joints and connections. Show anchorage and accessory items.

Provide schedule of doors and frames using same reference numbers for details and openings as those on contract drawings.

Indicate coordination of glazing frames and stops with glass and glazing requirements.

DELIVERY, STORAGE AND HANDLING:

Deliver hollow metal work cartoned or crated to provide protection during transit and job storage. Provide additional sealed plastic wrapping for factory-finished doors.

Inspect hollow metal work upon delivery for damage. Minor damages may be repaired provided refinished items are equal in all respects to new work and acceptable to Architect; otherwise, remove and replace damaged items as directed.

Store doors and frames at building site under cover. Place units on minimum 4 inches high wood blocking. Avoid use of non-vented plastic or canvas shelters that could create humidity chamber. If cardboard wrapper on door becomes wet, remove carton immediately. Provide 1/4 inches spaces between stacked doors to promote air circulation.

PART 2 - PRODUCTS

ACCEPTABLE MANUFACTURERS:

Manufacturer: Subject to compliance with requirements, provide steel doors and frames by one of the following:

Steel Doors and Frames, (General):

Allied Steel Product, Inc.
Amweld/Div. American Welding & Mfg. Co.
Ceco Corp.
D& D Specialties
Pioneer Bldrs. Products Corp./Div. CORE Industries, Inc.
Steelcraft/Div. American Standard Co.
Republic Builders Products Corp./Subs. Republic Steel.

MATERIALS:

Hot-Rolled Steel Sheets and Strip: Commercial quality carbon steel, pickled and oiled, complying with ASTM A 569 and ASTM A 568.

Cold-Rolled Steel Sheets: Commercial quality carbon steel, complying with ASTM A 366 and ASTM A 568.

Galvanized Steel Sheets: Zinc-coated carbon steel sheets of commercial quality, complying with ASTM A 526, or drawing quality, ASTM A 642, hot dipped galvanized in accordance with ASTM A 525, with A60 or G60 coating designation, mill phosphatized.

Supports and Anchors: Fabricate of not less than 18- gage galvanized sheet steel.

Inserts, Bolts and Fasteners: Manufacturer's standard units, except hot-dip galvanized items to be built into exterior walls, complying with ASTM A 153, Class C or D as applicable.

Shop Applied Paint:

Primer: Rust-inhibitive enamel or paint, either air-drying or baking, suitable as a base for specified finish paints.

STANDARD STEEL DOORS:

Provide metal doors of types and styles indicated on drawings or schedules.

Interior Doors: ANSI/SDI-100, Grade II, heavy-duty, Model 3 or 4, minimum 18-gage cold-rolled sheet steel faces.

Exterior Doors: ANSI/SDI-100, Grade III, rigid foam insulated, extra heavy-duty, Model 2, minimum 16-gage galvanized steel faces.

STANDARD STEEL FRAMES:

Provide metal frames for doors, transoms, sidelights, borrowed lights, and other openings, of types and styles as shown on drawings and schedules. Conceal fastenings, unless otherwise indicated. Fabricate frames of minimum 16-gage cold-rolled furniture steel.

Fabricate frames with mitered corners, **WELDED construction for exterior and interior applications typical unless noted otherwise.**

Removable mullions: Provide double rabbet removable mullion assembly (with UL rating same as frame where indicated) complete with fittings as required for field attachment.

Door Silencers: Except on weather-stripped frames, drill stops to receive 3 silencers on strike jambs of single-swing frames and 2 silencers on heads of double-swing frames.

Plaster Guards: Provide 26-gage steel plaster guards or mortar boxes, welded to frame, at back of finish hardware cutouts where mortar or other materials might obstruct hardware operation and to close off interior of openings.

FABRICATION, GENERAL:

Fabricate steel door and frame units to be rigid, neat in appearance and free from defects, warp or buckle. Wherever practicable, 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 SDI-100 requirements as follows:

Internal Construction: Manufacturer's standard honeycomb, polyurethane, polystyrene, unitized steel grid, vertical steel stiffeners, or rigid mineral fiber core with internal sound deadener on inside of face sheets where appropriate in accordance with SDI standards.

Clearances: Not more than 1/8 inch at jambs and heads except between non-fire-rated pairs of doors not more than 1/4 inch. Not more than 3/4 inch at bottom.

Fabricate exposed faces of doors and panels, including stiles and rails of nonflush units, from only cold-rolled steel.

Fabricate frames, concealed stiffeners, reinforcement, edge channels, louvers and moldings from either cold-rolled or hot-rolled steel (at fabricator's option).

Fabricate exterior doors, panels, and frames from galvanized sheet in accordance with SDI-112. Close top and bottom edges of exterior doors as integral part of door construction or by addition of minimum 16-gage inverted steel channels.

Exposed Fasteners: Unless otherwise indicated, provide countersunk flat Phillips heads for exposed screws and bolts.

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 in accordance with ASTM C 236 or ASTM C 976 on fully operable door assemblies.

Unless otherwise indicated, provide thermal-rated assemblies with U factor of 0.157 Btu/(hr x sq ft x deg F.) or R value of 6.37 or better.

Finish Hardware Preparation: Prepare doors and frames to receive finish hardware in accordance with final Finish Hardware Schedule and templated provided by hardware supplier. Comply with applicable requirements of ANSI A115 series specifications for door and frame preparation for hardware.

Reinforce doors and frames to receive surface-applied hardware.

Locate finish hardware as indicated on final shop drawings or, if not shown, in accordance with "Recommended Locations for Builder's Hardware," published by Door and Hardware Institute.

Shop Painting:

Clean steel surfaces of mill scale, rust, oil, grease, dirt, and other foreign materials before application of paint.

Apply shop coat of prime paint of even consistency to provide a uniformly finished surface ready to receive finish paint.

Glazing Stops: Minimum 20 gage steel .

Provide non-removable stops on outside of exterior doors and on secure side of interior doors for glass, louvers, and other panels in doors.

Provide screw applied removable glazing beads on inside of glass, louvers, and other panels in doors.

PART 3 - EXECUTION

INSTALLATION:

General: Install standard steel doors, frames, and accessories in accordance with final shop drawings, manufacturer's data, and as herein specified.

Placing Frames: Comply with provisions of SDI-105 "Recommended Erection Instructions for Steel Frames", unless otherwise indicated.

Except for frames located at in-place concrete or masonry and at drywall installations, place frames prior to construction at enclosing walls and ceilings. 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.

In masonry construction, locate 3 wall anchors per jamb at hinge and strike levels.

At in-place concrete or masonry construction, set frames and secure to adjacent construction with machine screws and masonry anchorage devices.

Install fire-rated frames in accordance with NFPA Std. No. 80.

Door Installation:

Fit hollow metal doors accurately in frames, within clearances specified in SDI-100.

Place fire-rated doors with clearances as specified in NFPA Standard No. 80.

ADJUST AND CLEAN:

Prime Coat Touch-up: Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touch-up of compatible air-drying primer.

Protection Removal: Immediately prior to final inspection, remove protective plastic wrappings from prefinished doors.

Final Adjustments: Check and readjust operating finish hardware items, leaving steel doors and frames undamaged and in complete and proper operating condition.

END OF SECTION 08110

SECTION 08211 - FLUSH WOOD DOORS

PART 1 - GENERAL

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to of this section.

SUMMARY:

Extent and location of each type of flush wood door is indicated on drawings and in schedules.

Types of doors required include the following:

Solid core flush wood doors with wood veneer faces.

SUBMITTALS:

Product Data: Door manufacturer's technical data for each type of door, including details of core and edge construction, trim for openings and louvers, and factory-finishing specifications.

Shop Drawings: Submit 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 factory finishing and other pertinent data.

QUALITY ASSURANCE:

Quality Standards: Comply with the following standards:

NWWDA Quality Standard: I.S.1 "Industry Standard for Wood Flush Doors", of National Wood Window and Door Association (NWWDA).

AWI Quality Standards: "Architectural Woodwork Quality Standards", including Section 1300 "Architectural Flush Doors", of Architectural Woodwork Institute (AWI) for grade of door, core construction, finish and other requirements exceeding those of NWWDS quality standard.

NWWDA Quality Marking: Mark each wood door with NWWDA Wood Flush Door Certification Hallmark certifying compliance with applicable requirements of NWWDA I.S. 1 Series.

Fire-Rated Wood Doors: Provide wood doors that are identical in materials and construction to units tested in door and frame assemblies per ASTM E 152 and which are labeled and listed for ratings indicated by UL or other inspection agency acceptable to authorities having jurisdiction.

Manufacturer: Obtain doors from a single manufacturer to insure uniformity in quality of appearance and construction, unless otherwise indicated.

PRODUCT DELIVERY, STORAGE, AND HANDLING:

Protect doors during transit, storage and handling to prevent damage, soiling and deterioration. Comply with requirements of referenced standards and recommendations of NWWDA pamphlet "How to Store, Handle, Finish, Install, and Maintain Wood Doors", as well as with manufacturer's instructions.

Identify each door with individual opening numbers which correlate with designation system used on shop drawings for door, frames and hardware, using temporary, removable or concealed markings.

PROJECT CONDITIONS:

Conditioning: Do not deliver or install doors until conditions for temperature and relative humidity have been stabilized and will be maintained in storage and installation areas during remainder of construction period to comply with the following requirements applicable to project's geographical location:

Referenced AWI quality standard including Section 100-S-3 "Moisture Content".

WARRANTY:

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 which have warped (bow, cup or twist) or that show telegraphing of core construction in face veneers, or do not conform to tolerance limitations of referenced quality standards.

Warranty shall also include reinstallation which may be required due to repair or replacement of defective doors where defect was not apparent to hanging.

Warranty shall be in effect during following period of time after date of Substantial Completion.

Solid Core Interior Doors:

Life of installation.

Contractor's Responsibilities: Replace or refinish doors where Contractor's work contributed to rejection or to voiding of manufacturer's warranty.

PART 2 - PRODUCTS

MANUFACTURERS:

Available Manufacturers: Subject to compliance with requirements, manufacturers offering door which may be incorporated in the work include, but are not limited to, the following:

Solid Core Doors with Wood Veneer Faces (Field Finish or Factory Prefinished):

Algoma Hardwoods, Inc.
Cal-Wood Door Div., Timberland Industries, Inc.
Eggers Industries, Architectural Door Division.
Glen-Mar Door Mfg. Co.
Graham Manufacturing Corp.
Mohawk Doors
Weyerhaeuser Company.
VT Industries

INTERIOR FLUSH WOOD DOORS:

Solid Core Doors for Stained Finish: Comply with the following requirements:

Grade: Premium, with Grade AA faces.

Species: Select White Maple, plain sliced. (TYPICAL).

AWI Grade: Custom (for staining).

Core Construction: PC-5 or PC-7 (Particleboard core, 5- or 7- ply)

IF providing Factory finished doors – Coordinate range color selections with Architect.

Factory finish doors in accordance with AWI Quality Standards Section 1500. Factory finish to be water based stain and Class “A” Flame retardant ultraviolet (UV) cured polyurethane sealer to comply with EPA Title 5 guidelines for VOC emission limitations.

Fire-Rated Solid Core Doors: Comply with the following requirements:

Faces and AWI Grade: Provide faces and grade to match non-rated doors in same area of building, unless otherwise indicated.

Construction: Manufacturer's standard core construction as required to provide fire-resistance rating indicated.

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. Edge veneer to match wood species of door face veneer.

Pairs: Furnish formed steel edges and astragals for pairs of fire-rated doors, unless otherwise indicated.

Provide fire-rated pairs with fire-retardant stiles that are labeled and listed for kinds of applications indicated without formed steel edges and astragals.

LOUVERS AND LIGHT FRAMES:

Wood Louvers: Door's manufacturer's standard solid birch louvers, unless otherwise indicated, and of size indicated.

Wood Beads for Light Openings in Fire Doors: Manufacturer's standard fire-rated wood veneer beads matching veneer species of door faces. Standard square edge stops.

FABRICATION:

Fabricate flush wood doors to produce doors complying with following requirements:

In sizes indicated for job-site fitting.

Transom and Side Panels: Fabricate matching panels with same construction, exposed surfaces and finish as specified for associated doors.

Fixed and Sidelight Transom Panels: Fabricate fixed panels with solid lumber transom bottom rail and door top rail, both rabbeted as indicated, and factory-installed spring bolts for concealed attachment into jambs of metal door frames.

Openings: Cut and trim openings through doors to comply with applicable requirements of referenced standards for kind(s) of doors required.

Light Openings: Trim openings with moldings of material and profile indicated.

Louvers: Factory install louvers in prepared openings.

PART 3 - EXECUTION

EXAMINATION:

Examine installed door frames prior to hanging door:

Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with plumb jambs and level heads.

Reject doors with defects.

Do not proceed with installation until unsatisfactory conditions have been corrected.

INSTALLATION:

Hardware: For installation see Division-8 "Finish Hardware" section of these specifications.

Manufacturer's Instructions: Install wood doors to comply with manufacturer's instructions and of referenced AWI standard and as indicated.

Install fire-rated doors in corresponding fire-rated frames in accordance with requirements of NFPA No. 80.

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.

Fitting Clearances for Non-Rated Doors: Provide 1/8" at jambs and heads; 1/16" per leaf at meeting stiles for pairs of doors; and 1/8" from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 1/4" clearance from bottom of door to top of threshold.

Fitting Clearances for Fire-Rated Doors: Comply with NFPA 80.

Prefit Doors: Fit to frames for uniform clearance at each edge.

ADJUSTING AND PROTECTION:

Operation: Rehang or replace doors that do not swing or operate freely.

Finished Doors: Refinish or replace doors damaged during installation.

Protect doors as recommended by door manufacturer to assure that wood doors will be without damage or deterioration at time of Substantial Completion.

End of SECTION 08211

SECTION 08361 - SECTIONAL OVERHEAD DOORS

PART 1 - GENERAL

RELATED DOCUMENTS:

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

SUMMARY:

This Section includes the following types of sectional overhead doors:

- Steel Sectional Door formed with hinged sections.
- Tracks configured for the following lift types: Standard
- (See Drawings for quantity, size and location)

Provide complete operating door assemblies including door curtains, guides, counterbalance mechanism, hardware, operators, and installation accessories.

Miscellaneous steel supports are specified in Division 5.

Field painting of track and misc. metal items are specified in Division 9.

DEFINITIONS:

Operation Cycle: One complete cycle of a door begins with the door in the closed position. The door is then moved to the open position and back to the closed position.

PERFORMANCE REQUIREMENTS:

Structural Performance: Provide sectional overhead doors capable of withstanding the effects of gravity loads and the following loads and stresses without evidencing permanent deformation of door components:

- Wind Load: Uniform pressure (velocity pressure) of 20 lbf/sq. ft., acting inward and outward.
- Basic Wind Speed: 90 mph.
- Importance Factor: 1.0.
- Exposure Category: C.

Operation-Cycle Requirements: Design sectional overhead door components and operator to operate for not less than **100,000** cycles.

SUBMITTALS:

Product Data: For each type and size of sectional overhead door and accessory. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes. Provide roughing-in diagrams, operating instructions, and maintenance information. Include the following:

Setting drawings, templates, and installation instructions for built-in or embedded anchor devices.

~~Motors: Show nameplate data and ratings; characteristics; mounting arrangements; size and location of winding termination lugs, conduit entry, and grounding lug; and coatings.~~

Shop Drawings: For special components and installations not dimensioned or detailed in manufacturer's data sheets.

~~Wiring Diagrams: Detail wiring for power, signal, and control systems. Differentiate between manufacturer installed and field installed wiring and between components provided by door manufacturer and those provided by others.~~

QUALITY ASSURANCE:

Installer Qualifications: Engage an experienced installer who is an authorized representative of the sectional overhead door manufacturer for both installation and maintenance of units required for this Project.

Manufacturer Qualifications: Engage a firm experienced in manufacturing sectional overhead doors similar to those indicated for this Project and with a record of successful in-service performance.

Source Limitations: Obtain sectional overhead doors through one source from a single manufacturer.

Obtain operators and controls from the sectional overhead door manufacturer.

Product Options: Drawings indicate size, profiles, and dimensional requirements of sectional overhead doors and accessories and are based on the specific system indicated. Other manufacturers' systems with equal performance and dimensional characteristics may be considered. Refer to Division 1 Section "Substitutions."

Listing and Labeling:

PART 2 – PRODUCTS

MANUFACTURERS:

Provide Insulated Steel Sectional Overhead Door – 470 Series by Overhead Door Corp or Equal product by Clopay Door Company or CHI Commercial Door Co.

STEEL SECTIONS:

Steel Sections: Zinc-coated (galvanized) steel sheet with (G60) zinc coating.

Insulated Steel Sectional Overhead Door:

Door Assembly: Rigid steel construction; fully insulated on the inside face with continuous steel backing on the inside face. Fabricated with steel end stiles and tongue and groove sections.

Panel Thickness: 2 inches (51 mm).

Exterior Surface: Ribbed.

Exterior Steel: 26 gauge, hot-dipped galvanized with an embossed simulated wood grain texture.

Interior Steel: 29 gauge, hot-dipped galvanized

Insulation: Polystyrene.

Thermal Values: Polystyrene - R-value of 9.83; U-value of 0.102.

Finish and Color: Two coat baked-on polyester. (color to be selected from Standard Range of Colors)

Weatherstripping:

- a. Flexible bulb-type strip at bottom section.
- b. Flexible Jamb seals.
- c. Flexible Header seal.

TRACKS, SUPPORTS, AND ACCESSORIES:

Tracks: Provide manufacturer's standard, galvanized steel track system, sized for door size and weight, designed for lift type indicated and clearances shown, and complying with ASTM A 653, for minimum G60 zinc coating. Provide complete track assembly including brackets, bracing, and reinforcement for rigid support of ball-bearing roller guides for required door type and size. Slot vertical sections of track at 3 inches o.c. for door-drop safety device. Slope tracks at proper angle from vertical or otherwise design to ensure tight closure at jambs when door unit is closed. Weld or bolt to track supports.

Track Reinforcement and Supports: Provide galvanized steel track reinforcement and support members, complying with ASTM A 36 and ASTM A 123. Secure, reinforce, and support tracks as required for door size and weight to provide strength and rigidity without sag, sway, and vibration during opening and closing of doors.

Support and attach tracks to opening jambs with continuous angle welded to tracks and attached to wall. Support horizontal (ceiling) tracks with continuous angle welded to track and supported by laterally braced attachments to overhead structural members at curve and end of tracks.

Weatherseals: Provide replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom and at top of overhead door.

Provide motor-operated doors with combination bottom weatherseal and sensor edge.

In addition, provide continuous flexible seals at door jambs for a weathertight installation.

HARDWARE:

General: Provide heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless-steel, or other corrosion-resistant fasteners, to suit door type.

Hinges: Provide heavy-duty galvanized steel hinges, of not less than 0.0747-inch- thick uncoated steel, at each end stile and at each intermediate stile, per manufacturer's written recommendations for door size. Attach hinges to door sections through stiles and rails with bolts and lock nuts or lock washers and nuts. Use rivets or self-tapping fasteners where access to nuts is not possible. Provide double-end hinges, where required, for doors exceeding 16 feet in width, unless otherwise recommended by door manufacturer.

Rollers: Provide heavy-duty rollers, with steel ball bearings in case-hardened steel races, mounted with varying projections to suit slope of track. Extend roller shaft through both hinges where double hinges are required. Provide 3-inch-diameter roller tires for 3-inch track, 2-inch-diameter roller tires for 2-inch track, and as follows:

Case-hardened steel tires.

Locking: Slide Bolt: Fabricate with side locking bolts to engage through slots in tracks for locking by padlock, located on single-jamb side, operable from inside only.

MANUAL DOOR OPERATORS

Retain this article for manual door operators, not including electric door operators' emergency manual operation.

Retain requirements in this article to suit Project. If retaining multiple requirements for different doors and to identify optional requirements for a single door, revise requirements below and insert options as needed in "Door Assembly" Article.

General: Equip door with manual door operator by door manufacturer.

Chain-Hoist Operator: Consisting of endless steel hand chain, chain-pocket wheel and guard, and gear-reduction unit with a maximum [25-lbf (111-N)] force for door operation. Provide alloy-steel hand chain with chain holder secured to operator guide.

COUNTERBALANCING MECHANISM:

Torsion Spring: Operation by torsion-spring counterbalance mechanism consisting of adjustable-tension torsion springs, fabricated from oil-tempered-steel wire complying with ASTM A 229, Class II, mounted on a cross-header tube or steel shaft. Connect to door with galvanized aircraft-type lift cables with cable safety factor of at least 5 to 1. Provide springs calibrated for **100,000 cycles minimum**.

Cable Drums: Provide cast-aluminum or gray-iron casting cable drums grooved to receive cable. Mount counterbalance mechanism with manufacturer's standard ball-bearing brackets at each end of shaft. Provide 1 additional midpoint bracket for shafts up to 16 feet long and 2 additional brackets at one-third points to support shafts more than 16 feet long, unless closer spacing is recommended by door manufacturer.

Cable Safety Device: Include a spring-loaded, steel or bronze cam mounted to bottom door roller assembly on each side, designed to automatically stop door if either cable breaks.

Bracket: Provide anchor support bracket, as required to connect stationary end of spring to the wall, to level shaft and prevent sag.

Provide a spring bumper at each horizontal track to cushion door at end of opening operation.

PART 3 – EXECUTION

EXAMINATION:

Examine wall and overhead areas, including opening framing and blocking, with Installer present, for compliance with requirements for installation tolerances, clearances, and other conditions affecting performance of Work of this Section.

Proceed with installation only after unsatisfactory conditions have been corrected.

INSTALLATION:

General: Install door, track, and operating equipment complete with necessary hardware, jamb and head mold strips, anchors, inserts, hangers, and equipment supports according to Shop Drawings, manufacturer's written instructions, and as specified.

Fasten vertical track assembly to framing at not less than 24 inches o.c. Hang horizontal track from structural overhead framing with angle or channel hangers welded and bolt fastened in place. Provide

sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.

ADJUSTING:

Lubricate bearings and sliding parts; adjust doors to operate easily, free from warp, twist, or distortion and fitting weathertight for entire perimeter.

Adjust belt-driven motors as follows:

Use adjustable motor-mounting bases for belt-driven motors.

Align pulleys and install belts.

Tension belt according to manufacturer's written instructions.

DEMONSTRATION:

Startup Services: Engage a factory-authorized service representative to perform startup services and to train Owner's maintenance personnel as specified below:

Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.

Review data in the maintenance manuals. Refer to Division 1 Section "Project Closeout."

Schedule training with Owner with at least 7 days' advance notice.

END OF SECTION 08361

SECTION 08410 - ALUMINUM ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

Finish Hardware Section 08710.

DESCRIPTION OF WORK:

Extent of aluminum entrances and storefronts is shown on drawings and schedules.

Types of aluminum entrances and storefronts required include the following:

Exterior aluminum entrance doors and framing.
Fixed aluminum window type.

Refer to and coordinate with Glazed Unitized Aluminum Curtain Wall system Section 08413 for **single source requirements**.

Glazing: Refer to "Glass and Glazing" section of Division 8 for glazing requirements for aluminum entrances and storefronts.

Hardware: Reference 08710 Door Hardware – Storefront Supplier To Coordinate With HW Supplier.

SYSTEM PERFORMANCES:

General: Provide exterior entrance and storefront assemblies that have been designed and fabricated to comply with requirements for system performance characteristics listed below as demonstrated by testing manufacturer's corresponding stock systems according to test methods designated.

Thermal Movement: Allow for expansion and contract resulting from ambient temperature range of 180 degrees F (100 degrees C) without buckling, failure of joint seals, undue stress on structural elements, damaging loads on fasteners, reduction of performance, stress on glass, or other detrimental effects.

Wind Loading: Provide aluminum entrance and storefront assemblies capable to withstand loading indicated below, tested per A23 STM E 330.

Uniform pressure of 25 pounds per square foot inward and 25 pounds per square foot outward, and to withstand 90 MPH wind design criteria for Rowan County, North Carolina.

Air infiltration: maximum 0.37 cfm per foot of crack length at 6.24 psf pressure differential when tested in accordance with ASTM E283.

Water resistance: No uncontrolled water leakage 8.00 psf pressure differential with water rate of 5 gallon/hr. when tested in accordance with ASTM E331.

QUALITY ASSURANCE:

Drawings are based on one manufacturer's standard aluminum entrance and storefront system. Another standard system of a similar and equivalent nature will be acceptable when differences do not materially detract from design concept or intended performances, as judged solely by Architect.

SUBMITTALS:

Product Data: Submit manufacturer's specifications, standard details, and installation recommendations for components of aluminum entrances and storefronts required for project, including test reports certifying that products have been tested and comply with performance requirements.

Shop Drawings: Submit shop drawings for fabrication and installation of aluminum entrances and storefronts, including elevations, detail sections of typical composite members, hardware mounting heights, anchorages, reinforcement, expansion provisions, and glazing.

Samples of Initial Color Selection: Submit pairs of samples of each specified color and finish on 12 inch long sections of extrusions or formed shapes. Where normal color variations are anticipated, include 2 or more units in each set of samples indicating extreme limits of color variations.

WARRANTY

Warranty: Submit a written warranty, executed by the manufacturer, agreeing to repair or replace units that fail in materials or workmanship within the specified warranty period. Failures include, but are not necessarily limited to:

Structural failures including excessive deflection, excessive leakage or air infiltration.

Faulty operation.

Deterioration of metals, metal finishes and other materials beyond normal weathering.

Warranty Period: 3 years after the date of Substantial Completion.

The warranty shall not deprive the Owner of other rights or remedies the Owner may have under provisions of the Contract Documents, and is in addition to and runs concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS

ACCEPTABLE MANUFACTURERS:

Available Manufacturers: Subject to compliance with requirements, manufacturers offering products, which may be incorporated in the work, include, but are not limited to, the following:

YKK America, Inc.

Arch / Amarlite Architectural Products

Efco Aluminum Series (Basis of Design)

Kawneer Company, Inc.

Vistawall Architectural Products.

United States Aluminum Corp.

COMPONENTS:

Storefront Framing System: (Coordinate with Glazed Unitized Curtain Wall) Provide storefront and entrance framing systems fabricated from extruded aluminum members of size and profile indicated. Include sub frames and other reinforcing members of the type indicated. Provide for flush glazing storefront from the exterior on all sides without projecting stops. Shop fabricate and preassemble frame components where possible. Provide storefront frame sections without exposed seams.

Mullion Configurations: Provide pockets at the inside glazing face to receive resilient elastomeric glazing. Mullions and horizontals shall be one piece. Make provisions to drain moisture accumulation to the exterior.

Storefront Framing 2" x 4-1/2" (for 1" exterior glass and +/- 9/16" Security Impact glass)

Storefront Framing 2" x 4-1/2" (1/4" glazing at interior glass.)

Generally, center glazed framing system shall provide for flush glazing on all sides with no projecting stops. Vertical and horizontal framing members shall have a **nominal face dimension of 2"**. Overall **depth shall be 4-1/2"** with a glass pocket width to accommodate **1" glazing**. All Exterior Window Framing shall be thermally broken. Entrance framing members shall be compatible with glass framing in appearance. Provide sub-frame as indicated on the drawings.

STILE-AND-RAIL TYPE ALUMINUM DOORS:

Frame: Provide tubular frame members, fabricated with mechanical joints using heavy inserted reinforcing plates and concealed tie-rods or j-bolts, or fabricate with structurally welded joints, at manufacturer's option.

Design: Provide doors 1-3/4" thick and of design indicated on the drawings.

<u>Wide stile:</u>	5-1/2" nominal width.
<u>Top Rail:</u>	5-1/2" nominal height.
<u>Top & Middle Rail:</u>	10" nominal height.

Glazing: Fabricate doors to facilitate replacement of glass or panels, without disassembly of door stiles and rails. Provide snap-on extruded aluminum glazing stops, with exterior stops anchored for non-removal.

MATERIALS AND ACCESSORIES:

Aluminum Members: Alloy and temper recommended by manufacturer for strength, corrosion resistance, and application of required finish; ASTM B 221 for extrusions, ASTM B 209 for sheet/plate, and ASTM B 211 for aluminum bars, rods, and wire.

Carbon steel reinforcement of aluminum framing members shall comply with ASTM A 36 for structural shapes, plates and bars, ASTM A 611 for cold rolled sheet and strip, or ASTM A 570 for hot rolled sheet and strip.

Fasteners: Aluminum, non-magnetic stainless steel, or other materials warranted by manufacturer to be noncorrosive and compatible with aluminum components.

Do not use exposed fasteners except where unavoidable for application of hardware. Match finish of adjoining metal.

Provide Phillips flat-head machine screws for exposed fasteners.

Concealed Flashing: Dead-soft stainless steel, 26 gage minimum, or extruded aluminum, 0.026" minimum, of an alloy and type selected by manufacturer for compatibility with other components.

Brackets and Reinforcements: Manufacturer's high-strength aluminum units where feasible; otherwise, nonmagnetic stainless steel or hot-dip galvanized steel complying with ASTM A 123.

Concrete/Masonry Inserts: Cast iron, malleable iron, or hot-dip galvanized steel complying with ASTM A 123.

Bituminous Coatings: Cold-applied asphalt mastic complying with SSPC - PS 12, compounded for 30-mil thickness per coat.

Compression Weather-stripping: Manufacturer's standard replaceable stripping of either molded neoprene gaskets complying with ASTM D 2000 or molded PVC gaskets complying with ASTM D 2287.

Sliding Weather-stripping: Manufacturer's standard replaceable stripping of wool, polypropylene, or nylon woven pile, with nylon fabric or aluminum strip backing, complying with AAMA 701.2.

Glass and Glazing Materials: Provide glass and glazing materials which comply with requirements of "Glass and Glazing" section of these specifications.

STOREFRONT DOOR HARDWARE: SEE DOOR HARDWARE 08710

Provide any and all hardware (in addition to pieces specified in 08710 for each door if necessary) that is required to provide full complete functioning doors for the use they were intended.

FABRICATION:

General:

Sizes and Profiles: Required sizes for door and frame units, including profile requirements, are indicated on drawings. Any variable dimensions are indicated, together with maximum and minimum dimensions required to achieve design requirements and coordination with other work.

Prefabrication: To greatest extent possible, complete fabrication, assembly, finishing, hardware application, and other work before shipment to project site. Disassemble components only as necessary for shipment and installation.

Perform fabrication operations, including cutting, fitting, forming, drilling and grinding of metal work in manner which prevents damage to exposed finish surfaces. For hardware, perform these operations prior to application of finishes.

Sequence: Complete cutting, fitting, forming, drilling, and grinding of metal work prior to cleaning, finishing, surface treatment, and application of finishes. Remove arises from cut edges and ease edges and corners to radius of approximately 1/64".

Welding: Comply with AWS recommendations to avoid discoloration; grind exposed welds smooth and restore mechanical finish.

Reinforcing: Install reinforcing as necessary for performance requirements; separate dissimilar metals with bituminous paint or other separator, which will prevent corrosion.

Continuity: Maintain accurate relation of planes and angles, with hairline fit of contacting members.

Fasteners: Conceal fasteners wherever possible.

Weather-stripping: For all aluminum door applications at exterior and wet areas, provide compression weather-stripping against fixed stops; at other edges, provide sliding weather-stripping retained in adjustable strip mortised into door edge.

Provide EPDM/vinyl blade gasket weather-stripping in bottom door rail, adjustable for contact with threshold.

ALUMINUM FINISHES

General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.

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.

Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.

Class I, Color Anodic Finish: AA-M12C22A42/A44 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 606.1 or AAMA 608.1.

Color: Finish to be color "Clear Anodized".

(Class II Clear Anodized Finish: is not acceptable.)

PART 3 - EXECUTION

PREPARATION:

Field Measurement: Wherever possible, take field measurements prior to preparation of shop drawings and fabrication, to ensure proper fitting of work. However, proceed with fabrication and coordinate installation tolerances as necessary when field measurements might delay work.

INSTALLATION:

Comply with manufacturer's instructions and recommendations for installation of aluminum entrances and storefronts.

Set units plumb, level, and true to line, without warp or rack of framing members, doors, or panels. Anchor securely in place, separating aluminum and other corrodible metal surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

Drill and tap frames and doors and apply surface-mounted hardware items, complying with hardware manufacturer's instructions and template requirements. Use concealed fasteners wherever possible.

Set sill members and other members in bed of sealant as indicated, or with joint fillers or gaskets as shown to provide weather tight construction. Comply with requirements of Division 7 for sealants, fillers, and gaskets.

Refer to "Glass and Glazing" section of Division 8 for installation of glass and other panels shown to be glazed into doors and framing, and not pregazed by manufacturer.

ADJUST AND CLEAN:

Adjust operating hardware to function properly, without binding, and to provide tight fit at contact points and weather-stripping.

Clean completed system, inside and out, promptly after erection and installation of glass and sealants. Remove excess glazing and joint sealants, dirt, and other substances from aluminum surfaces.

Remove protective coating when completion of construction activities no longer requires its retention.

Institute protective measures and other precautions required to assure that aluminum entrances and storefronts will be without damage or deterioration, other than normal weathering, at time of acceptance.

End of SECTION 08410

SECTION 08413 – GLAZED UNITIZED ALUMINUM CURTAIN WALLS

PART 1 – GENERAL

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

Single Source Requirement: **Section 08410, Exterior aluminum entrance doors and framing.**
 Section 08410, Fixed aluminum window type.

Glazing: Refer to "Glass and Glazing" section of Division 8 for glazing requirements for aluminum entrances and storefronts.

Sealants: Refer to Division 7 for sealant requirements.

DESCRIPTION OF WORK:

Extent of glazed unitized (*thermally broken*) **curtain walls** as shown on drawings and schedules.

SYSTEM PERFORMANCES:

Performance Requirements: Provide aluminum curtain wall systems that comply with performance requirements indicated, as demonstrated by testing manufacturer's assemblies in accordance with test method indicated.

Wind Loads: Completed curtain wall system shall withstand wind pressure loads normal to wall plane indicated:

Basic Wind Speed = 90 mph
Exposure Category = C
Importance Factor = 1.0
Directionality Factor = 1.0 (Non ASCE 7 load factors)
Walls: Negative Zone 4: -22.1 psf & Negative Zone 5: -27.2 psf
Walls: Positive Zone 4 & 5: 20.4 psf

Deflection: Maximum allowable deflection in any member when tested in accordance with ASTM E 330 with allowable stress in accordance with AA Specifications for Aluminum Structures.

For spans less than 13'-6" (4.1m): L/175 or 3/4" (19.1mm) maximum.

For spans greater than 13'-6" (4.1m) but less than 40'-0" (12.2m): L/175 or L/240 + 1/4" (6.4mm).

Thermal Movement: Provide for thermal movement caused by 180 degrees F. (82.2 degrees C.) surface temperature, without causing buckling stresses on glass, joint seal failure, undue stress on structural elements, damaging loads on fasteners, reduction of performance, or detrimental effects.

Air Infiltration: Completed curtain wall systems shall have 0.06 CFM/FT² (1.10 m³/h·m²) maximum allowable infiltration when tested in accordance with ASTM E 283 at differential static pressure of 6.24 PSF (299 Pa).

Water Infiltration:

No **uncontrolled water** on indoor face of any component when tested in accordance with ASTM E 331 at a static pressure of 20 PSF (957 Pa).

No **uncontrolled water** on indoor face of any component when tested in accordance with AAMA 501.1 at a dynamic pressure of 20 PSF (957 Pa).

Thermal Performance for when tested in accordance with AAMA 1503.1 and NFRC 102:

Condensation Resistance Factor (CRF_f): A minimum of 71.

Thermal Transmittance U Value: 0.42 BTU/HR/FT²/°F or less.

Note: Performance based on lab testing and will vary by glass type; see actual test reports.

Optional Incidental Water Management: Head member shall be capable of directing condensation from the wall cavity above the curtain wall to the exterior of the system.

Acoustical Performance: When tested in accordance with ASTM E 1425:

a. Sound Transmission Class (STC) shall not be less than 37.

b. Outdoor-Indoor Transmission Class (OITC) shall not be less than 30.

Seismic Movement: When tested in accordance with AAMA 501.4:

a. Inter-story Differential Lateral Movement Test: Passed with design displacement of 0.010 times the story height and meets the performance criteria for a Highest Occupancy Assembly (Group III in NEHRP Provisions).

b. Seismic Movement Test: Passed at 1.5 times design displacement.

Note: Performance based on lab testing and will vary by glass type; see actual test reports.

SUBMITTALS:

Product Data: Submit manufacturer's specifications, standard details, and installation recommendations for components of aluminum entrances and storefronts required for project, including test reports certifying that products have been tested and comply with performance requirements.

Shop Drawings: Submit shop drawings for fabrication and installation of aluminum entrances and storefronts, including elevations, detail sections of typical composite members, hardware mounting heights, anchorages, reinforcement, expansion provisions, and glazing.

Samples of Initial Color Selection: Submit pairs of samples of each specified color and finish on 12 inch long sections of extrusions or formed shapes. Where normal color variations are anticipated, include 2 or more units in each set of samples indicating extreme limits of color variations.

QUALITY ASSURANCE:

Installer Qualifications: Installer experienced (as determined by contractor) to perform work of this section who has specialized in the installation of work similar to that required for this project. If requested by Owner, submit reference list of completed projects.

Manufacturer Qualifications: Manufacturer capable of providing field service representation during construction process.

Mock-Ups (Field Constructed): Install at project site a job mock-up using acceptable products and manufacturer approved installation methods. Obtain Owner's and Architect's acceptance of finish color, and workmanship standard.

1. Mock-Up Size: 5 ft x 5 ft ...or as required to be incorporated into final system.

2. Maintenance: Maintain mock-up during construction for workmanship comparison; remove and legally dispose of mock-up when no longer required.

3. Incorporation: Mock-up may be incorporated into final construction upon Owner's approval.

Pre-Installation Meetings: Conduct pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions, and manufacturer's warranty requirements.

PROJECT CONDITIONS / SITE CONDITIONS

Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements, fabrication schedule with construction progress to avoid construction delays.

WARRANTY

Warranty: Submit a written warranty, executed by the manufacturer, agreeing to repair or replace units that fail in materials or workmanship within the specified warranty period. Failures include, but are not necessarily limited to:

Structural failures including excessive deflection, excessive leakage or air infiltration.

Faulty operation.

Deterioration of metals, metal finishes and other materials beyond normal weathering.

Warranty Period: 3 years after the date of Substantial Completion.

The warranty shall not deprive the Owner of other rights or remedies the Owner may have under provisions of the Contract Documents, and is in addition to and runs concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS

ACCEPTABLE MANUFACTURERS:

Available Manufacturers: Subject to compliance with requirements, manufacturers offering products, which may be incorporated in the work, include, but are not limited to, the following:

Manufacturer: Kawneer,
YKK AP America Inc. - or approved equal.

Curtain Wall System: 1600 Wall System-3 by Kawneer.

YCU 750 TU by YKK AP

5600 Duracast Series CW (Thermally Broken 2.5" x 7.5") by EFCO

Series SB750 Pressure Plate (Thermally Broken 2.5" x 7.5") by TRULITE

- or approved equal system.

Description: Framing shall be thermally broken. Horizontal and vertical framing members shall have a nominal face dimension of 2 inches. Depth as indicated on drawings.

MATERIALS:

Extrusions: ASTM B 221 (ASTM B 221M), 6063-T5 and 6063-T6 Aluminum Alloys.

Aluminum Sheet: Anodized Finish: ASTM B 209 (ASTM B 209M), 5005-H14 Aluminum Alloy, 0.050" (1.27 mm) minimum thickness.

ACCESSORIES

Manufacturer's Standard Accessories:

Fasteners: Zinc plated steel concealed fasteners; Hardened aluminum alloys or AISI 300 series stainless steel exposed fasteners, countersunk, finish to match aluminum color.

Sealant: Non-skinning type, AAMA 803.3

Glazing: Setting blocks, edge blocks, and spacers in accordance with ASTM C 864, shore durometer hardness as recommended by manufacturer; Glazing gaskets in accordance with ASTM C 864.

Glass: Refer to Division 8 Glass and Glazing Section for glass materials.

FABRICATION

Shop Assembly: Fabricate and assemble units with joints only at intersection of aluminum members with hairline joints; rigidly secure, and sealed in accordance with manufacturer's recommendations.

General:

Sizes and Profiles: Required sizes for frame units, including profile requirements, are indicated on drawings. Any variable dimensions are indicated, together with maximum and minimum dimensions required to achieve design requirements and coordination with other work.

Prefabrication: To greatest extent possible, complete fabrication, assembly, finishing, and other work before shipment to project site. Disassemble components only as necessary for shipment and installation.

Perform fabrication operations, including cutting, fitting, forming, drilling and grinding of metal work in manner which prevents damage to exposed finish surfaces. For hardware, perform these operations prior to application of finishes.

Sequence: Complete cutting, fitting, forming, drilling, and grinding of metal work prior to cleaning, finishing, surface treatment, and application of finishes. Remove arises from cut edges and ease edges and corners to radius of approximately 1/64".

Welding: Comply with AWS recommendations to avoid discoloration; grind exposed welds smooth and restore mechanical finish.

Reinforcing: Install reinforcing as necessary for performance requirements; separate dissimilar metals with bituminous paint or other separator, which will prevent corrosion.

Continuity: Maintain accurate relation of planes and angles, with hairline fit of contacting members.

Fasteners: Conceal fasteners wherever possible.

ALUMINUM FINISHES

General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.

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.

Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.

Class I, Color Anodic Finish: AA-M12C22A42/A44 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 606.1 or AAMA 608.1.

Color: Finish to be color "Clear Anodized".

(Class II Clear Anodized Finish: is not acceptable.)

PART 3 - EXECUTION

MANUFACTURER'S INSTRUCTIONS / RECOMMENDATIONS

Compliance: Comply with manufacturer's product data, including product technical bulletins, installation instructions, and product carton instructions.

EXAMINATION

Site Verification of Conditions: Verify substrate conditions (which have been previously installed under other sections) are acceptable for product installation in accordance with manufacturer's instructions.

PREPARATION

Adjacent Surfaces Protection: Protect adjacent work areas and finish surfaces from damage during product installation.

INSTALLATION

General: Install manufacturer's system in accordance with shop drawings, and within specified tolerances.

Protect aluminum members in contact with masonry, steel, concrete, or dissimilar materials using nylon pads or bituminous coating.

Shim and brace aluminum system before anchoring to structure.

Verify curtain wall system allows water entering system to be collected in gutters and wept to the exterior. Verify weep holes are open, and metal joints are sealed in accordance with manufacturers installation instructions.

Seal metal to metal curtain wall system joints using sealant recommended by system manufacturer.

FIELD QUALITY CONTROL

Manufacturer's Field Services: Upon request, provide manufacturer's field service consisting of site visit for inspection of product installation in accordance with manufacturer's instructions.

Field Test: Conduct field test to determine watertightness of curtain wall system. Conduct test in accordance with AAMA 501.2.

ADJUSTING AND CLEANING

Adjusting: Adjust operating items as recommended by manufacturer.

Cleaning: The General Contractor shall clean installed products in accordance with manufacturer's instructions prior To Owner's acceptance, and remove construction debris from project site. Legally dispose of debris.

Protection: The General Contractor shall protect installed product's finish surfaces from damage during construction.

END OF SECTION

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

SECTION INCLUDES

Work under this section includes furnishing and the installation of finish and security hardware specified herein and noted on drawings for a complete and operational system, including any electrified door hardware components including finish and security hardware and auto operators for entrance doors.

Items include, but are not limited to:

- Hinges/Continuous Hinges
- Flush Bolts
- Exit Devices
- Locksets and Cylinders
- Push Plates - Pulls
- Closers/ADA Operators
- Kick, Mop and Protection Plates
- Stops, Wall Bumpers, Overhead Controls
- Thresholds, Gasketing and Door Bottoms
- Silencers
- Miscellaneous Trim and Accessories
- Electrified Hardware Items, Controls and Power Supplies

RELATED SECTIONS:

- Division 06 – Carpentry
- Section 08110 – Metal Doors and Frames
- Section 08211 – Flush Wood Doors
- Section 08410 – Entrances and Storefronts
- Division 16 – Electrical

REFERENCES

The following references are used in this section.

- NFPA 80 – Standard for Fire Doors, 2007.
- Installation Guide for Doors and Hardware, DHI, 1984.
- ANSI / BHMA A156.18, Materials and Finishes, 2006.

GENERAL REQUIREMENTS

Provide items, articles, materials, operations and methods listed, mentioned or scheduled herein or on drawings, in quantities as required to complete project. Provide hardware that functions properly. Prior to furnishing hardware, advise Architect of items that will not operate properly, are improper for conditions, or will not remain permanently anchored.

SUBMITTALS

Hardware Schedule: Submit 5 copies of hardware schedule in vertical format as illustrated by the Sequence of Format for the Hardware Schedule as published by the Door and Hardware Institute. Schedules which do not comply will be returned for correction before checking.

Hardware schedule shall clearly indicate architect's hardware group and manufacturer of each item proposed.

The schedule shall be reviewed prior to submission by a certified Architectural Hardware Consultant (AHC), who shall affix his or her seal attesting to the completeness and correctness of the schedule.

- Provide 2 copies of illustrations from manufacturer's catalogs and data in brochure form.
- Check specified hardware for suitability and adaptability to details and surrounding conditions. Indicate unsuitable or incompatible items and proposed substitutions in hardware schedule.
- Provide listing of manufacturer's template numbers for each item of hardware in hardware schedule.

Furnish other Contractors and Subcontractors concerned with copies of final approved hardware schedule. Submit necessary templates and schedules as soon as possible to hollow metal, wood door, and aluminum door fabricators in accordance with schedule they require for fabrication.

Samples: Lever design or finish sample: Provide 3 samples if requested by architect.

Wiring Diagrams: Provide complete and detailed system operation and elevation diagrams specially developed for each opening requiring electrified hardware, except openings where only magnetic hold-opens or door position switches are specified. Provide these diagrams with hardware schedule submittal for approval. Provide detailed wiring diagrams with hardware delivery to jobsite.

Installation Instructions: Provide manufacturer's written installation and adjustment instructions for finish hardware. Send installation instructions to site with hardware.

Templates: Submit templates and "reviewed Hardware Schedule" to door and frame supplier and others as applicable to enable proper and accurate sizing and locations of cutouts and reinforcing.

Contract Closeout Submittals: Comply with Section 01700 including specific requirements indicated below.

Operating and maintenance manuals: Submit 3 sets containing the following:

Complete information in care, maintenance, and adjustment, and data on repair and replacement parts, and information on preservation of finishes.

Catalog pages for each product.

Name, address, and phone number of local representative for each manufacturer.

Parts list for each product.

Copy of final approved hardware schedule, edited to reflect "As installed".

Copy of final keying schedule.

As installed "Wiring Diagrams" for each opening connected to power, both low voltage and 110 volts.

One complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

QUALITY ASSURANCE

General Contractor's Investigation: Prior to Contract Execution, the General Contractor shall have thoroughly investigated the entities that will be performing work or supplying materials, products, equipment, or systems for this project, to ensure that they comply with all of the qualifications and requirements mentioned or implied in the Contract Documents. If it is later determined that any of the previously mentioned entities do not comply with the qualifications and requirements specified in the Contract Documents, the General Contractor will be required to replace that entity with a qualified entity at no increase in Contract Sum or Contract Time.

Manufacturer: Obtain each type of hardware (ie. latch and locksets, hinges, closers) from single manufacturer, although several may be indicated as offering products complying with requirements.

Qualifications of the Hardware Supplier: A recognized architectural door hardware supplier, with warehousing facilities, who has been furnishing hardware and installation in the Project's vicinity for a period of not less than 4 years. The supplier shall be, or shall employ, an Architectural Hardware Consultant (AHC) who is available, at reasonable times during the course of the work, for consultation about the Project's hardware requirements, to the Owner, Architect, and Contractor. An Architectural Hardware Consultant (AHC) shall prepare all hardware and access control schedules. This Supplier shall be responsible for proper coordination of all finish hardware items and access control items with related sections to insure compatibility of products.

Hardware supplier must be an authorized, direct factory distributor of all door hardware products specified herein to insure compliance and service of these products.

Require supplier to meet with Owner to finalize keying requirements and to obtain final instructions in writing.

Qualifications of Installer: The hardware installer shall have documented experience in the installation of hardware of similar quantities and types as required for this project. The installer's qualifications shall be submitted to the architect, in writing, for approval by the architect before any work shall commence.

Substitutions: All substitution requests are required to be submitted prior to the bid date and complying with the procedures and time frame as outlined in Division 01, General Requirements. Approval of submitted products is at the discretion of the architect and his hardware consultant.

At the Project's Completion, the Owner's Representative shall accompany the Architect and General Contractor during the Door Hardware and Access Control Items punch list phase of the project close-out, insuring the Owner's Representative is familiar with all applications and systems, as installed. Refer to additional requirements under 3.0 EXECUTION.

Pre-Installation Meeting: Prior to door hardware installation, the General Contractor / Construction Manager shall request a hardware installation meeting to be held at the project location. This meeting shall convene prior to the hardware's installation. The types of hardware this meeting shall include are: locksets, exit devices, and door closers. The manufacturer's representatives of the above listed products, in conjunction with the hardware supplier for this project, shall conduct the installation training. All hardware installers shall be required to attend this meeting to receive certificate of authorized training. This meeting shall serve as door openings coordination and review of all shop drawings from related trades prior to the hardware installation. The Hardware Supplier shall include any related meeting costs in their proposal.

Electrified Hardware and Security Hardware Systems: Prior to ordering the electrified hardware, the General Contractor shall request a coordination meeting. This meeting shall convene prior to or after the Door Hardware Schedule and the wiring diagrams have been submitted to the General Contractor. All related trades shall be represented at this meeting, which shall also include the architect, the Owner's representative, the hardware supplier, and the hardware manufacturer's representative as requested. This meeting shall serve as a review and coordination of all electrified hardware, wiring, connections, location for power supplies, and remote switches, and door functions. All related trades shall make any required changes, and resubmit schedules, diagrams, and any other required data, no later than one (1) week following this meeting.

DELIVERY, STORAGE AND HANDLING

Tag each item or package separately with identification related to final hardware schedule, and include basic installation instructions with each item or package.

Packaging of door hardware is the responsibility of the supplier. As material is received by the hardware supplier from various manufacturers, sort and repack in containers clearly marked with appropriate hardware set numbers to match the set numbers of the approved hardware schedule. Two or more identical sets may be packed in the same container.

The door hardware supplier shall deliver all individually packaged hardware items in a timely fashion to the place of installation (Shop or Project Site); direct factory shipments are not acceptable unless agreed upon beforehand. Hardware supplier shall coordinate delivery times and schedules with the contractor.

The General Contractor, door hardware supplier, access control supplier, and installers shall count, coordinate, and store all door hardware and access control items herein, verifying complete counts of all items scheduled and furnished. The contractor must report all shortages (discrepancies with shipping documents) within five (5) working days. The manufacturers' and Owner's representatives will inspect the installation of the door hardware and access control items during that phase of construction. Any deficiencies in installation of all materials included herein shall be corrected before installation continues.

The General Contractor shall provide a secure lock-up for the door hardware and security equipment delivered to the Project, but not yet installed. Control handling and installation of the hardware items that are not immediately replaceable, so that completion of the work will not be delayed by hardware losses, both before and after installation.

WARRANTY

All materials must be warranted against defects in workmanship and materials for a period of one (1) year from date of acceptance of this project, unless otherwise noted. Any evidence of misuse or abuse voids all warranties. These warranties shall be each manufacturers' standard written warranty.

Special Warranties:

Continuous Geared Hinges: Life of the Door Opening.

Mortise Latchsets and Locksets: Three (3) Year Period.

Exit Devices: Three (3) Year Period.

Door Closers: Thirty (30) Year Period.

Saddle Thresholds, Bumper Thresholds, Door Sweeps, Self-Adhesive Gasketing, Perimeter Seals, Astragal Seals, Self-Adhesive Astragal Gasketing, Mullion Seals, Interlocking Seals, and Drip Strips: Five (5) Year Period.

Any manufacturer whose standard written warranty does not equal or exceed the requirements listed above must provide a letter stating that they will extend their warranty to comply with the requirements of this specification.

All of the manufacturer's fasteners and attachments supplied with each hardware item must be installed to maintain the manufacturer's fire listing and/or warranty.

Refer to Section 01 - Closeout Procedures for additional warranty requirements.

MAINTENANCE

Maintenance Tools and Instructions: General Contractor shall furnish a complete set of specialized tools and maintenance instructions as needed for the Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

BUTTS AND HINGES

Acceptable Manufacturers:

Ives	Bommer	Stanley
5BB1	BB5000	FBB179
5BB1HW	BB5004	FBB168

Application:

Provide NRP (non-removable pins) at out-swinging lockable doors.

Quantity:

Two hinges per leaf for openings through 60 inches high.

One additional hinge per leaf for each additional 30 inches in height or fraction thereof.

Four hinges for Dutch doors up to 90 inches in height.

CONTINUOUS GEARED HINGES

Acceptable manufacturers:

Ives	Stanley	Select
224HD	662HD	SL24HD

Provide electric power transfer (EPT) cutouts, or electric through-wire options as specified in hardware groups.

ELECTRIC POWER TRANSFER

Acceptable manufacturers:

Von Duprin	Security Door Controls	Securitron
EPT-10	PTM-10	CEPT

Provide power transfer sufficient for number and gage of wires to accommodate electric function of specified hardware.

Electric power transfer is to be located per manufacturer's template and UL requirements, unless interference with operation of door or other hardware items.

FLUSH BOLTS AND DUSTPROOF STRIKES

Acceptable manufacturers:

Ives	Trimco	Burns
FB458	3915	590
DP2	3910	545

Provide automatic and manual flush bolts with forged bronze face plates, extruded brass levers, and with wrought brass guides and strikes. Provide 12 inch steel or brass rods at doors up to 90 inches in height. Top rods at manual flush bolts for doors over 90 inches in height shall be increased by 6 inches for each additional 6 inches of door height. Provide dust-proof strikes at each bottom flush bolt.

LOCKSETS – CYLINDRICAL – GRADE 1

Acceptable Manufacturer and Series:

Schlage	Corbin	Best
ND Series x ATH	CL3300 x AZD	93K x 16D

Provide lock functions specified in Hardware Groups, with following provisions:

Cylinders: Refer to “KEYING” article, herein.

Locks shall meet UL A label; to have a minimum listing for single doors 4' x 8'.

Locks shall have the ability to incorporate either a rigid or free-wheeling lever when in a locked mode.

Levers shall be bi-directional.

Levers shall be solid. Manufacturers utilizing lever fillers are not acceptable.

Furnish “Knurled” or “Tactile” outside levers as indicated in the door Hardware Sets. “Abrasive” outside levers shall not be acceptable.

Lockset adjustment plate shall be threaded for door thickness adjustment for doors 1 5/8” to 2 1/8” thickness. The adjustment plate shall have visual chassis marking for doors 1 3/4” thick.

Locks shall have field reversible handing.

Latchbolt to be steel with minimum 1/2” throw latch; 3/4” throw latch on pairs of fire rated doors.

Strikes shall have curved lip of sufficient length to clear trim.

EXIT DEVICES

Acceptable Manufacturers:

Von Duprin	Detex	Precision
98/99 Series	Advantex Series	Apex Series

Provide exit device series and functions as specified in Hardware Groups. Von Duprin product numbers are referenced in the Hardware Groups.

All exit devices shall be UL listed for panic. Exit devices for labeled doors shall be UL listed as "Fire Exit Hardware".

Where lever trim is specified, provide lever design to match lockset levers.

Provide lever trim with breakaway feature.

Provide cylinders for exit devices with locking trim and cylinder dogging.

Provide exit devices with stainless steel touch bars. Load bearing plastic parts are not acceptable.

Provide exit devices with cast metal, flush end caps.

Provide deadlocking latchbolt feature for exit devices.

Provide roller strikes on all rim exit devices.

KEYING

Master key or Grand master key cylinders and key in groups, unless otherwise specified.

Provide 6 masterkeys for each masterkey set. Provide 3 change keys for each lock. Stamp keys "DO NOT DUPLICATE."

Submit proposed keying schedule to Architect. If requested, meet with Owner and Architect to review schedule.

DOOR TRIM

Acceptable Manufacturers and Types:

Ives	Trimco	Burns
8200	1001-9	56
8303	1018-3B	5426C
8190	1191-3	29C

Push Plates:

Ives type 8200 6 inches by 16 inch unless otherwise indicated.

Where width of door stile prevents use of 6 inch wide plate, provide push plate one inch less than width of stile but not less than 4 inches wide.

Pull Plates:

Ives type 8303 6 inches by 16 inches unless otherwise indicated.

Pulls:

Ives Series 8190, unless otherwise indicated.

Where required, mount back to back with push bars.

Kick Plates and Armor Plates: Ives 8400 Series, minimum of 0.050 inch thick, beveled 4 edges.

At single doors provide width two inches less than door width on stop side and one inch less than door width on pull side.

At pairs of doors provide width one inch less than door width on both sides.

Height of 10 inches, unless otherwise indicated.

Provide plates with countersunk screw holes.

DOOR CLOSERS

Acceptable Manufacturers and Types of Exposed Closers:

LCN	Sargent	Corbin
4011 / 4111	281 / 281-P10	DC8200 / DC8210 x A3
1460 Series	281 / 281-P10	DC6200 / DC6210

Closers shall have fully hydraulic, full rack and pinion action with a high strength cast iron cylinder.

Provide non-sized closers, continuously adjustable over the full range of closer sizes, and allow for reduced opening force to meet opening force requirements of ANSI A117.1

Hydraulic regulation shall be by tamper-proof, non-critical valves. Closers shall have separate adjustment for latch speed, swing speed, and back check.

Provide closers with solid forged steel main arms (and forearms for parallel arm closers) and where specified to have a cast-in solid stop on the closer shoe ("CUSH"). Parallel arm mounted closers shall have "EDA" type arms or, where specified, "CUSH" or "SCUSH" type arms.

Surface closers shall be certified to exceed ten million full load cycles by a recognized independent testing laboratory.

Provide drop plates, brackets, or adapters for arms as required to suit details.

Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.

Provide back-check for closers.

Provide hold-open arms where indicated.

Provide closers for doors as noted in Hardware Groups and, in addition, provide closers for labeled doors whether or not specifically noted in group.

Provide closers meeting the requirements of UBC 7-2, 1997 and UL 10C positive pressure tests.

Pressure relief valves (PRV's) shall not be permitted.

AUTOMATIC OPERATORS

Acceptable Manufacturers:

LCN	Horton	Dorma
9500 Series	4000 Series	ED400LE

Provide automatic operators as specified in hardware groups. Provide complete with drop plates, brackets, or adapters for arms as required to suit details.

Provide wall-mounted actuator switches by the same manufacturer as the operator. Actuators shall be weather-resistant type at exterior applications.

ADA PEDESTAL FOR HANDICAP ACCESS ACTUATORS, CARD READERS, KEY PADS, ETC.

Provide pedestal / post for power operated door – as necessary and only as indicated on plans.
48" Tall ADA Stainless Tower (Steel Tube 6"x4") built from .120" wall #304 stainless steel material and brushed to ornamental finish. Precut hole on front to flush mount any single gang device (Baseplate 6"x4") and a large precut access hole (with cover panel) on the backside for mounting / wiring access.

Basis of Design: PedestalCEO model No. ADA-Stainless-Tower www.PedestalCEO.com

OVERHEAD STOPS

Acceptable Manufacturers

Glynn Johnson	Rixson	Sargent
90	9 Series	590 Series

Provide overhead stops for interior doors equipped with regular arm surface type closer for doors that open against equipment, casework, sidelights, other objects that would make wall stops inappropriate.

Provide sex bolt attachments for mineral core door application.

WALL STOPS AND HOLDERS

Acceptable Manufacturers and Types:

Ives	Trimco	Door Controls
WS406/407CCV	1270WVP	3211T

Provide WS406/407CCV Series wall stop for each door leaf unless otherwise specified, or where conditions require the use of an overhead stop.

Floor or base stops shall be used only where definitely specified or absolutely unavoidable.

THRESHOLDS

Acceptable Manufacturers and Product:

National Guard	Reese	Zero
425E	S425A	8655A

Where thresholds are specified in hardware groups, provide 8655A thresholds on out swinging doors unless detailed otherwise.

Refer to drawings for special details. Provide accessories, shims and fasteners.

Where thresholds occur at openings with one or more mullions, they shall be cut for the mullions and extended continuously for the entire opening.

WEATHERSTRIPPING

Acceptable Manufacturers and Product:

	National Guard	Reese	Zero
Sweeps	201NA	323C	39A
Jambs	700SA	755C	429A
Rain Drips	16A	R201C	142A

Where weatherstripping is specified in hardware groups, provide 429A unless detailed otherwise.

Provide self-tapping fasteners for weatherstripping being applied to hollow metal frames.

Where sweeps are specified in hardware groups, provide 39A unless detailed otherwise.

Where rain drips are specified in hardware groups, provide 142A x full frame width, unless detailed otherwise.

POWER SUPPLIES

Acceptable Manufacturers and Types:

Schlage Electronics	Precision	Securitron
PS900 Series	ELR Series	BPS Series

Requirements:

Provide power supplies, recommended and approved by the manufacturer of the electrified locking component, for the operation of electrified locks, electrified exit devices, magnetic locks, electric strikes, and other components requiring a power supply.

Provide the appropriate quantity of power supplies necessary for the proper operation of the electrified locking component and/or components as recommended by the manufacturer of the electrified locking components with consideration for each electrified component utilizing the power supply, the location of the power supply, and the approved wiring diagrams. Locate the power supplies as directed by the Architect.

Provide a power supply that is regulated and filtered 24 VDC, or as required, and UL class 2 listed.

Options: Provide the following options.

Provide a power supply, where specified, with the internal capability of charging optional sealed backup batteries 24 VDC, or as required, in addition to operating the DC load.

Provide sealed batteries for battery back-up at each power supply where specified.

Provide keyed power supply cabinet.

Provide a power supply complete requiring only 120VAC to the fused input and shall be supplied in an enclosure.

Provide a power supply with emergency release terminals, where required, that allow the release of all devices upon activation of the fire alarm system complete with fire alarm input for initiating "no delay" exiting mode.

SILENCERS

Acceptable Manufacturers and types:

Ives	Steelcraft	Don-Jo
SR64	Q146	1608

Provide grey rubber silencers featuring pneumatic design that, once installed, forms an air pocket to absorb shock and reduce noise of door closing.

Provide three (3) silencers per hollow metal strike jamb; two (2) per hollow metal double door head. Omit at doors scheduled to receive perimeter weatherstripping or smoke gasket.

Silencers shall meet ANSI/BHMA A156.16, L03011

KEY CABINET

Provide key cabinets by Lund Equipment, Telkee Incorporated, or Key Control.

Lund Deluxe wall type cabinet, Series 1200.

Provide cabinet with one hook for each lock or cylinder plus at least 50 percent extra hooks.

Provide each hook with one non-removable security key tag and one snap-on link duplicate key tag.

Provide tools, instruction sheets and accessories required to complete installation.

Owner will place keys in key cabinet and complete index cards furnished with key system.

KEY MANAGEMENT SOFTWARE

Provide Sitemaster 200® key management software.

Software shall provide tracking, issuing, collecting and transferring information regarding keys, doors, and hardware.

Provide training for Owner's personnel on the proper operation and application of the key management software.

FASTENERS

Including, but not limited to, wood or machine screws, bolts, nuts, anchors, etc. of proper type, material, and finish required for installation of hardware.

Use Phillips head for exposed screws. Do not use aluminum screws to attach hardware.

Provide self-tapping (TEC) screws for attachment of sweeps and stop-applied weatherstripping only.

TYPICAL FINISHES AND MATERIALS

Finishes, unless otherwise specified:

Butts: Outswinging Exterior Doors - US32D (BHMA 630) on Stainless Steel

Butts: Interior Doors and Inswinging Exterior Doors - US26D (BHMA 652) on Steel

Continuous Hinges: US28 (BHMA 628) on Aluminum

Flush Bolts: US26D (BHMA 626) on Brass or Bronze

Exit Devices: US26D (BHMA 626) on Brass or Bronze

Locks and Latches: US26D (BHMA 626) on Brass or Bronze

Push Plates, Pulls and Push Bars: US32D (BHMA 630) on Stainless Steel

Kick Plates, Armor Plates, and Edge Guards: US32D (BHMA 630) on Stainless Steel

Overhead Stops and Holders: US32D (BHMA 630) on Stainless Steel

Closers: Surface mounted. Sprayed Aluminum Lacquer.

Miscellaneous Hardware: US26D (BHMA 626) on Brass or Bronze

PART 3 - EXECUTION

EXAMINATION

Examine doors, frames, and related items for conditions that would prevent the proper application of finish hardware. Do not proceed until defects are corrected.

INSTALLATION

Mount hardware units at heights indicated in the following applicable publications, except as specifically indicated or required to comply with governing regulations and, except as otherwise indicated, by the Architect.

“Recommended Locations for Builders Hardware for Standard Steel Doors and Frames” by the Door and Hardware Institute.

Install each hardware item in compliance with the manufacturer's instructions and recommendations. Where cutting and fitting is required to install hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation or application of surface protection with finishing work specified in the Division 09 Sections. Do not install surface-mounted items until finishes have been completed on the substrates involved.

Sets units level, plumb, and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

Where scheduled, door pulls shall be through-bolted with bolt heads concealed behind push plates.

Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

Set thresholds, for exterior and interior doors, in a full bed of butyl-rubber or polyisobutylene mastic sealant complying with requirements specified in Division 07 - Joint Sealers.

Weatherstripping and Seals: Comply with manufacturer's instructions and recommendations to the extent installation requirements are not otherwise indicated.

The hardware installer shall be responsible for installation of all mechanical and electromechanical hardware items contained within this specification, in accordance with the manufacturer's technical installation guidance, and in addition to all applicable code requirements.

The Electrical Sub-Contractor, under Division 26 - Electrical, shall be responsible for providing and installing all (120 VAC) power source wiring as required for the electrified locking and access control hardware, equipment, accessories, and power supplies. This includes quad outlets as required on a dedicated circuit in designated IT / Telecommunication Room(s) and the related conduit, stud-ins, junction boxes, and connectors required for the power source delivery and connections. Provide cabling, conduit, stub-ins, patch cords, fire stop systems, data connectors, junction boxes, and back boxes for both the electrified locking hardware and access control equipment at each of the access controlled or monitored openings per plan drawings and specifications. Provide and install conduit between each of the aforementioned devices and between junction boxes, power supplies, and access control equipment located on or above each door opening.

At wall mounted remote card readers, provide conduit on the secured side of each door opening, at 48" from above the finished floor and 6" from the edge of each door frame, to the related power supplies and access control equipment; unless otherwise instructed by Architect.

At all electrical hardware power transfer items provide conduit on the secured side of each door opening, from the power transfer items, through-wire hinges, or serviceable panel locations, inside of frame's jambs, to the related power supplies and access control equipment.

Installation of power supplies and interfacing of security system with fire alarm system as required, and coordination of complete security system shall be provided by the Electrical Sub-Contractor, under the Division 26 - Electrical. Electrical Sub-Contractor shall be responsible for providing and installing all 120 VAC cabling connections and terminations from the electrical junction boxes to these electrical devices.

FIELD QUALITY CONTROL

After installation has been completed, provide services of qualified hardware consultant to check Project to determine proper application of finish hardware according to schedule. Also check operation and adjustment of hardware items.

Adjust door control devices to compensate for final operation of heating and ventilating equipment.

ADJUSTING AND CLEANING

At final completion, hardware shall be left clean and free from disfigurement. Make final adjustment to door closers and other items of hardware. Where hardware is found defective repair or replace or otherwise correct as directed.

Adjust door closers to meet opening force requirements of Uniform Federal Accessibility Standards.

Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy of space or area, return to work during week prior to acceptance or occupancy, and make final check and adjustment of hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors.

Instruct Owner's personnel in proper adjustment and maintenance of door hardware and hardware finishes.

Clean adjacent surfaces soiled by hardware installation.

PROTECTION

Provide for proper protection of items of hardware until Owner accepts Project as complete.

HARDWARE GROUPS

The following schedule of hardware groups shall be considered a guide only, and the supplier is cautioned to refer to general conditions, special conditions, and the preamble to this section. It shall be the hardware supplier's responsibility to furnish all required hardware.

Refer to the door schedule for hardware group required at each door opening.

FINISH HARDWARE SCHEDULE

HARDWARE GROUP NO. E-01

FOR USE ON DOOR #(S):

100- MAIN
ENTRY

PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	224HD EPT	628	IVE
2	EA	POWER TRANSFER	EPT10	689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL+-9849-EO	626	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL+-9849-NL-OP-110MD	626	VON
1	EA	RIM CYLINDER	20-057	626	SCH
2	EA	90 DEG OFFSET PULL	8190HD 10" O	630	IVE
1	EA	SURF. AUTO OPERATOR	9563 REG2 MS	ANCLR	LCN
2	EA	ACTUATOR, WALL MOUNT	8310-853	630	LCN
2	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	8655A	A	ZER
1	EA	POWER SUPPLY	PS902 900-BBK 900-4RL	LGR	FAL
1	SET	WIRING DIAGRAMS	AS REQUIRED		
1			SEALS BY DOOR SUPPLIER		

DOORS NORMALLY UNLOCKED DURING NORMAL BUSINESS HOURS. DOORS WILL OPERATE AS PUSH/ PULL. UPON DEPRESSING OF WALL MOUNTED ACTUATOR, LATCH BOLTS ON EXIT DEVICES WILL ELECTRICALLY RETRACT AND AUTOMATICALLY OPEN AND ALLOW INGRESS. UPON PRESSING OF INTERIOR WALL MOUNTED ACTUATOR, LATCH BOLTS ON EXIT DEVICES WILL RETRACT AND AUTOMATICALLY OPEN AND ALLOW EGRESS. FREE EGRESS AT ALL TIMES.

COORDINATE WITH ELECTRICAL SYSTEMS.

COORDINATE ALL ALUMINUM STOREFRONT HARDWARE WITH ALUMINUM STOREFRONT SUPPLIER.

HARDWARE GROUP NO. E-02

FOR USE ON DOOR #(S):

109 LOADING
DOCK

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	224HD	628	IVE
1	EA	CLASSROOM LOCK	ND70PD ATH	626	SCH
1	EA	SURFACE CLOSER	4111 SCUSH	689	LCN
1	EA	GASKETING	429A	A	ZER
		- USE AT HEAD AND JAMBS			
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	8655A	A	ZER
1	EA	RAIN DRIP	142A	A	ZER
		SEALS BY DOOR SUPPLIER			

HARDWARE GROUP NO. E-03

FOR USE ON DOOR #(S):

102 RETAIL EXIT
AND
108 WAREHOUSE EXIT

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	224HD	628	IVE
1	EA	PANIC HARDWARE	98L X 996L-R&V 07	626	VON
		RIM CYLINDER	20-057		
1	EA	SURFACE CLOSER	4111 SCUSH	689	LCN
1	EA	GASKETING	429A	A	ZER
		- USE AT HEAD AND JAMBS			
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	8655A	A	ZER
1	EA	RAIN DRIP	142A	A	ZER
		SEALS BY DOOR SUPPLIER			

HARDWARE GROUP NO. I-01

FOR USE ON DOOR #(S):

110- MAINT RM 104- BREAKRM

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	ND70PD ATH	626	SCH
1	EA	OH STOP & HOLDER	90H	630	GLY
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. I-02

FOR USE ON DOOR #(S):

105 AND 106-
TOILETS

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PRIVACY LOCK	ND40S ATH	626	SCH
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. I-03

FOR USE ON DOOR #(S):

107-
MANAGER'S
OFFICE

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50PD ATH	626	SCH
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. I-04

FOR USE ON DOOR #(S):

103 RETAIL TO
WAREHOUSE

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50PD ATH	626	SCH
1	EA	SURFACE CLOSER	1461 SCUSH	689	LCN
2	EA	KICK PLATE	8400 16"H X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

**Doors Not Listed In This Schedule but listed in the Door Schedule and on Floor Plans
Shall Be Provided With HARDWARE GROUP I-01.**

EXTRA STOCK ITEMS

2	CLASSROOM LOCKS	
2	ENTRANCE/OFFICE LOCKS	
4	CYLINDERS	
20	KEY BLANKS – MATCH SYSTEM	
2	SURFACE CLOSERS	1461 SCUSH
1	KEY CABINET	TELKEE AWC-150-S GRAY

END OF SECTION 08710

SECTION 08800 - GLASS AND GLAZING

PART 1 - GENERAL

RELATED DOCUMENTS:

Drawings, General Conditions and Supplementary General Conditions and other Division-1 Specification Sections, apply to this Section.

DESCRIPTION OF WORK:

Definitions: "Glass" includes both primary and fabricated glass products as described in FMGA "Glazing Manual". "Glazing" includes glass installation and materials used to install glass.

Extent of glass and glazing work is indicated on drawings and schedule attached at end of this section.

Types of work in this section include glass, insulating glass, security impact insulating glass, transparent mirror glass and glazing for:

- Window units, not indicated as "preglazed".
- Glazed interior hollow metal frames.
- Clear door glass panels.
- Entrances and other doors, not indicated as "preglazed".

PLEASE NOTE- All glazing shall be Category II, Safety Glazing.

SYSTEM PERFORMANCES:

Provide glass and glazing that has been produced, fabricated and installed to withstand normal temperature changes, wind loading, impact loading (where applicable), without failure including loss or breakage of glass, failure of sealants or gaskets to remain watertight and airtight, deterioration of glass and glazing materials, and other defects in the work.

Provide insulating glass and glazing that has been produced, fabricated and installed to withstand normal temperature changes, wind loading, impact loading (where applicable), without failure including loss or breakage of glass, failure of sealants or gaskets to remain watertight and airtight, deterioration of insulating glass and glazing materials, and other defects in the work. Deterioration of insulating glass is defined as failure of hermetic seal due to other causes than breakage which results in intrusion of dirt or moisture, internal condensation or fogging at temperatures above -20 degrees F (-28 degrees C), deterioration of protected internal glass coating, if any, resulting from seal failure, and other visual evidence of seal failure or performance.

SUBMITTALS:

Product Data: For each glass product and glazing material indicated.

Samples: For the following products, in the form of 12-inch-square samples for glass and of 12-inch-long samples for sealants. Install sealant samples between two strips of material representative in color of the adjoining framing system.

Samples: For the following products, in the form of 12-inch-square samples for glass.

- Each color of tinted glass.
- Insulating glass for each designation indicated.

QUALITY ASSURANCE:

Glazing Standards: Comply with recommendations of Flat Glass Marketing Association (FMGA) "Glazing Manual" and "Sealant Manual" except where more stringent requirements are indicated. Refer to those publications for definitions of glass and glazing terms not otherwise defined in this section or other referenced standards.

Safety Glazing Standard: Where safety glass is indicated or required by authorities having jurisdiction, provide type of products indicated which comply with ANSI Z97.1 and testing requirements of 16 CFR Part 1201 for category II materials.

Insulating Glass Certification Program: Subject to compliance with requirements, provide insulating glass units permanently marked either on spacers or on at least one component pane of units with appropriate certification label of inspecting and testing organization indicated below.

Insulating Glass Certification Council (IGCC).
Associated Laboratories, Inc. (ALI).

Single Source Responsibility: Provide materials obtained from one source for each type of glass and glazing product indicated.

DELIVERY, STORAGE, AND HANDLING:

Protect glass and glazing materials during delivery, storage and handling to comply with manufacturer's directions and as required to prevent edge damage to glass, and damage to glass and glazing materials from effects of moisture including condensation, of temperature changes, of direct exposure to sun, and from other causes.

PROJECT CONDITIONS:

Comply with manufacturer's instructions for shipping, storing and handling insulating glass units, including protection of edges.

Where substantial altitude changes will be made, comply with venting-and-sealing recommendations to avoid hermetic seal ruptures.

SPECIFIED PRODUCT WARRANTY:

Manufacturer's Warranty on Insulating Glass: Provide written warranty signed by manufacturer of laminated glass agreeing to furnish f.o.b. point of manufacture, freight allowed project site, within specified warranty period indicated below, insulating glass units which develop manufacturing defects. Manufacturing defects are defined as failure of hermetic seal of air space (beyond that due to glass breakage) as evidenced by intrusion of dirt or moisture, internal condensation or fogging at temperature above -20 degrees F (-29 degrees C), deterioration of protected internal glass coatings, if any, and other visual indications of seal failure or performance; provided the manufacturer's instructions for handling, installing, protecting and maintaining units have been complied with during the warranty period.

Warranty Period: Manufacturer's standard but not less than 10 years after date of substantial completion.

PART 2 - PRODUCTS

ACCEPTABLE MANUFACTURERS:

Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include; but are not limited to, the following:

Manufacturers of Clear Float and Tempered Glass:

AFG Industries, Inc.
Ford Motor Co., Glass Div.
Guardian Industries Corp.
Libby-Owens-Ford Co.
PPG Industries Inc.

Manufacturers of Insulating Glass Products (including Insulating Laminated Glass):

Advanced Coating Technology.
AFG Industries, Inc.
Ford Motor Co. Glass Div.
Hordis Brothers, Inc.

Libbey-Owens-Ford Co.
Oldcastle BuildingEnvelope
PPG Industries, Inc.
Guardian
Viracon

GLASS PRODUCTS, GENERAL:

Primary Glass Standard: Provide primary glass which complies with FS DD-G-451 requirements, including those indicated by reference to type, class, quality, and form.

Heat-Treated Glass Standard: Provide heat-treated glass which complies with FS DD-G-1403 requirements, including those indicated by reference to grade, style, type, quality, and class.

Sizes: Fabricate glass to sizes required for glazing openings indicated, with edge clearances and tolerances complying with recommendations of glass manufacturer. Provide thicknesses indicated or, if not otherwise indicated, as recommended by glass manufacturer for application indicated.

Insulating Glass Standard: Provide preassembled sealed insulating glass units which comply with ASTM E 774 requirements for classification designated below:
Class A.

PRIMARY GLASS PRODUCTS:

Clear Float Glass: Type I, class 1 (transparent), quality q3 (glazing select).
See Schedule for "coated" / "tinted" glazing requirements.

Fire Rated Glazing: If any. See Section 08817.

HEAT-TREATED GLASS PRODUCTS:

Manufacturing Process: Manufacture heat-treated glass as follows:

Clear Tempered Float Glass: Grade B (fully tempered), style I (uncoated surfaces), type I (float), quality q3 (glazing quality), class 1 (transparent).

Clear Heat-Strengthened Float Glass: Grade A (heat strengthened), style I (uncoated surfaces), type I (float), quality q3 (glazing select), class 1 (transparent).

SEALED INSULATING GLASS UNITS:

General: Provide preassembled units consisting of organically sealed panes of glass enclosing a hermetically sealed dehydrated air space; comply with requirements indicated for glass characteristics, air space, sealing system, sealant, spacer material, corner design, and dessicant.

"Low-E" coating: Clear transparent float glass sputter coated on the #2 surface meeting the following requirements:

Provide & Coordinate Coatings with "tinting" as listed on Glazing Schedule.

Provide heat-treated panes of grade and at locations indicated or, if not indicated, provide heat-strengthened panes where recommended by manufacturer for application indicated and tempered where indicated or where safety glass is designated or required.

SECURITY IMPACT GLASS:

General: Heat and pressure treated glass with a plastic interlayer between two panes of annealed, tempered or heat-strengthened glass.

9/16" Insulated Glazing ¼" Heat Strengthened Outboard Lite
 .015 Aliphatic Urethane Lamina
 .070 Polycarbonate
 .050 Aliphatic Urethane Lamina
 ¼" Heat Strengthened Inboard Lite

Product Similar to: SAF-GLAS by Security Impact Glass

TRANSPARENT MIRROR GLASS:

General: Surveillance and security glazing creating a One-Way Mirror.

Category II, Safety Glazing with reflective coating meeting ASTM C 1376.

Silver colored, partially reflective, partially transparent coating – applied to 1/4" thick, grey tinted glass.

Durable, pyrolytic coating – tempered cut, heat-strengthened.

Product Similar to: Pilkington Mirrorpane by NSG Group.

GLAZING SEALANTS:

General: Comply with recommendations of sealant and glass manufacturers for selection of glazing sealants which have performance characteristics suitable for applications indicated and conditions at time of installation.

Compatibility: Select sealants with proven compatibility with surfaces contacted in the installation and under service conditions indicated, as demonstrated by testing and field experience.

Colors: Provide color of exposed sealants indicated or, if not otherwise indicated, as selected by Architect from manufacturer's standard colors.

2-Part Polysulfide Glazing Sealant: Polysulfide elastomeric sealant complying with FS TT-S-00227, Class A, Type 2; and with ASTM C 920, Type M, Grade NS, Class 25, Use G and, as applicable to use indicated, Uses A and O.

Uses: Typical glazing unless noted otherwise.

Acrylic Glazing Sealant: Acrylic terpolymer or polypropenate solvent-based thermo-plastic 1-part sealant complying with FS TT-S-00230, Class B, Type II; and with ASTM C 920, Type S, Grade NS, Class 12-1/2, Use G and, as applicable to use indicated, Uses A and O.

Use: Interior glazing conditions only.

Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:

2-Part Polysulfide Glazing Sealants:

Sonolastic Two-Part; Sonneborn Building Products Div., Rexnord Chemical Products, Inc.
Chem-Calk 100; Woodmont Products, Inc.

Acrylic Glazing Sealants:

60+; Pecora Corp.
Mono; Tremco.
Chem-Calk 800; Woodmont Products, Inc.

GLAZING GASKETS:

Lock-Strip Gaskets: Neoprene extrusions of size and shape indicated, fabricated into frames with molded corner units and zipper lock strips, complying with ASTM C 542; black.

Dense Elastomeric Compression Seal Gaskets: Molded or extruded neoprene or EPDM gaskets of profile and hardness required to maintain watertight seal; complying with ASTM C 864, Option 1.

MISCELLANEOUS GLAZING MATERIALS:

Compatibility: Provide materials with proven record of compatibility with surfaces contacted in installation.

Cleaners, Primers, and Sealers: Type recommended by sealant or gasket manufacturer.

Setting Blocks: Neoprene, EPDM or silicone blocks as required for compatibility with glazing sealants, 80 to 90 Shore A durometer hardness.

Spacers: Neoprene, EPDM or silicone blocks, or continuous extrusions, as required for compatibility with glazing sealant, of size, shape and hardness recommended by glass and sealant manufacturers for application indicated.

Edge Blocks: Neoprene, EPDM or silicone blocks as required for compatibility with glazing sealant, of size and hardness required to limit lateral movement (side-walking) of glass.

Compressible Filler Rods: Closed-cell or waterproof-jacketed rod stock of synthetic rubber or plastic foam, flexible and resilient, with 5-10 psi compression strength for 25% deflection.

PART 3 - EXECUTION

INSPECTION:

Require Glazier to inspect work of glass framing erector for compliance with manufacturing and installation tolerances, including those for size, squareness, offsets at corners; for presence and functioning of weep system; for existence of minimum required face or edge clearances; and for effective sealing of joinery. Obtain Glazier's written report listing conditions detrimental to performance of glazing work. Do not allow glazing work to proceed until unsatisfactory conditions have been corrected.

PREPARATION:

Clean glazing framing members to receive glass, immediately before glazing. Remove coatings which are not firmly bonded to substrates.

GLAZING, GENERAL:

Comply with combined printed recommendations of glass manufacturers, of manufacturers of sealants, gaskets and other glazing materials, except where more stringent requirements are indicated, including those of referenced glazing standards.

Glazing channel dimensions as indicated in details are intended to provide for necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by job conditions at time of installation.

Protect glass from edge damage during handling and installation; use a rolling block in rotating glass units to prevent damage to glass corners. Do not impact glass with framing. Use suction cups to shift glass units within openings; do not raise or drift glass with a pry bar. Rotate glass with flares or bevels along one horizontal edge which would occur in vicinity of setting blocks so that these are located at top of opening. Remove from project and dispose of glass units with edge damage or other imperfections of kind that, when installed, weakens glass and impairs performance and appearance.

Apply primers to joint surfaces where required for adhesion of sealants, as determined by proconstruction sealant-substrate testing.

GLAZING:

Install setting blocks of proper size in sill rabbet, located one quarter of glass width from each corner, but no closer than 6", unless otherwise required. Set blocks in thin course of sealant which is acceptable for heel bead use.

Provide spacers inside and out, of correct size and spacing to preserve required face clearances, for glass sizes larger than 50 united inches, except where gaskets or glazing tapes with continuous spacer rods are used for glazing. Provide 1/8" minimum bite of spacers on glass and use thickness equal to sealant width, except with sealant tape use thickness slightly less than final compressed thickness of tape.

Provide edge blocking to comply with requirements of referenced glazing standard, except where otherwise required by glass unit manufacturer.

Set units of glass in each series with uniformity of pattern, draw, bow and similar characteristics.

Provide compressible filler rods or equivalent back-up material, as recommended by sealant and glass manufacturers, to prevent sealant from extruding into glass channel weep systems and from adhering to

joints back surface as well as to control depth of sealant for optimum performance, unless otherwise indicated.

Force sealants into glazing channels to eliminate voids and to ensure complete "wetting" or bond of sealant to glass and channel surfaces.

Tool exposed surfaces of sealants to provide a substantial "wash" away from glass. Install pressurized tapes and gaskets to protrude slightly out of channel, so as to eliminate dirt and moisture pockets.

Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage to ensure that gasket will not "walk" out when installation is subjected to movement.

Miter cut wedge-shaped gaskets at corners and install gaskets in manner recommended by gasket manufacturer to prevent pull away at corners; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

Lock-Strip Gasket Glazing: Comply with ASTM C 716 and gasket manufacturer's printed recommendations. Provide supplementary wet seal and weep system unless otherwise indicated.

PROTECTION AND CLEANING:

Protect exterior glass from breakage immediately upon installation by use of crossed streamers attached to framing and held away from glass. Do not apply markers to surfaces of glass. Remove nonpermanent labels and clean surfaces.

Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove immediately by method recommended by glass manufacturer.

Remove and replace glass which is broken, chipped, cracked, abraded or damaged in other ways during construction period, including natural causes, accidents and vandalism.

Wash glass on both faces not more than 4 days prior to date scheduled for inspections intended to establish date of substantial completion in each area of project. Wash glass by method recommended by glass manufacturer.

GLAZING SCHEDULE

EXTERIOR:

Typical Windows/Curtain Wall:

1" thick *SOLARGRAY Insulated Units:
Exterior light 1/4" "TINT" Coated on 2nd surface
(category II, safety glazing, typical)
Air space 1/2" (Argon Gas-filled)
Interior light 1/4" "Clear Float"

Coating of *SOLARGRAY - composed of Solarban 70XL (2) + Solargray + Clear
per **ppg tinted glazing** - (or equal) to produce
Transmittances of UV 3%, Visible 34% and Total Solar Energy 13%.

Exterior Door Lites -

5/8" thick *SOLARGRAY Insulated Units:
exterior light -3/16", "TINT" coated on 2nd surface
(category II, safety glazing, typical)
air space -1/4 (Argon gas filled)
interior light -3/16" "Clear Float"

Warehouse Windows:

Security Impact Glazing
approx 9/16" thick
Insulating Units

INTERIOR:

One-Way Transparent Mirror Glazing (Alum-1 and 2) Retail to Office and Retail to Breakroom:-

1/4" min. single glazed, clear Category II, safety glazing.
with mirror coating applied.

Non Rated Interior Door, Side Light, and Interior Windows: -

1/4" min. single glazed, clear Category II, safety glazing.
(typical unless noted otherwise on drawings).

End of SECTION 08800

SECTION 09250 - GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

RELATED DOCUMENTS:

Drawings, General Conditions and Supplementary General Conditions and other Division-1 Specification Sections, apply to this Section.

DESCRIPTION OF WORK:

Types of work include:

- Gypsum drywall including screw-type metal support system.
- Gypsum drywall applied to metal framing and furring.
- ~~Tile Backer Board applied to screw type metal support system.~~
- Drywall finishing (joint tape-and-compound treatment).
- Sound attenuation blankets.

Steel framing and furring are specified in Division 5.

Other insulation products specified in Division 7.

QUALITY ASSURANCE:

Fire-Resistance Ratings: Where gypsum drywall systems with fire-resistance ratings are indicated, provide materials and installations which are identical with those of applicable assemblies tested per ASTM E 119 by fire testing laboratories acceptable to authorities having jurisdiction.

Acoustical Ratings: Where sound ratings are indicated, provide materials and application procedures identical to those tested by manufacturer to achieve Sound Transmission (STC) scheduled or indicated in accordance with ASTM E90.

Gypsum Board Terminology Standard: GA-505 by Gypsum Association.

Single-Source Responsibility: Obtain gypsum board products from a single manufacturer, or from manufacturers recommended by the prime manufacturer of gypsum boards.

DELIVERY, STORAGE AND HANDLING:

Deliver materials in original packages, containers or bundles bearing brand name and identification of manufacturer or supplier.

Store materials inside under cover and in manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes. Neatly stack gypsum boards flat to prevent sagging.

Handle gypsum boards to prevent damage to edges, ends or surfaces. Protect metal corner beads and trim from being bent or damaged.

PROJECT CONDITIONS:

Environmental Requirements, General: Comply with requirements of referenced gypsum board application standards and recommendations of gypsum board manufacturer, for environmental conditions before, during and after application of gypsum board.

Cold Weather Protection: When ambient outdoor temperatures are below 55 deg. F (13 deg. C) maintain continuous, uniform, comfortable building working temperatures of not less than 55 deg. F (13 deg. C) for a minimum period of 48 hours prior to, during and following application of gypsum board and joint treatment materials or bonding of adhesives.

Ventilation: Ventilate building spaces as required to remove water in excess of that required for drying of joint treatment material immediately after its application. Avoid drafts during dry, hot weather to prevent too rapid drying.

PART 2 - PRODUCTS

ACCEPTABLE MANUFACTURERS:

Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:

Metal Support Materials:

ClarkDietrich Building Systems
Marino
United States Gypsum Co.

Direct Suspension Systems:

Chicago Metallic Corp.
United States Gypsum Co.

Gypsum Board and Related Products:

American Gypsum Co.
Certaineed Gypsum Co.
Georgia-Pacific Corp.
Gold Bond Building Products Div.,
National Gypsum Co.
United States Gypsum Co.

METAL SUPPORT MATERIALS:

Ceiling Support Materials and Systems:

General: Size ceiling support components to comply with ASTM C 754 unless otherwise indicated.

Main Runners: Steel channels cold-rolled.

Hanger Wire: ASTM A 641, soft, Class 1 galvanized.

Hanger Rods and Flats: Mild steel with zinc or equally rust inhibitive coating for rods and zinc or rust-inhibitive paint finish for flats.

Angle-Type Hangers: Not less than 7/8" x 7/8" x 16-gage galvanized steel formed angles, with bolted connections and 5/16" diameter bolts.

Hanger Anchorage Devices: Screws, clips, bolts, cast-in-place concrete inserts or other devices applicable to the indicated method of structural anchorage for ceiling hangers and whose suitability for use intended has been proven through standard construction practices or by certified test data. Size devices for 3 x calculated load supported except size direct pull-out concrete inserts for 5 x calculated loads.

Furring Members: ASTM C 645; 0.0179" min. thickness of base metal, hat-shaped.

Where shown as "Resilient", provide manufacturer's special type designed to reduce sound transmission.

Furring Members: ASTM C 645; 0.0179" min. thickness of base metal, "C"-shaped studs.

Furring Anchorages: 16 gage galvanized wire ties, manufacturer's standard wire-type clips, bolts, nails or screws as recommended by furring manufacturer and complying with C 754.

Direct Suspension Systems: Manufacturer's standard zinc-coated or painted steel system of furring runners, furring tees, and accessories designed for concealed support of gypsum drywall ceilings; of proper type for use intended.

Wall/Bulkhead/Partition Support Materials:

Studs: (Wall height - 12 foot tall and under): ASTM C 645; **24 gage** 0.0239" min. thickness of base metal unless otherwise indicated.

Studs: (Wall height - 13 foot tall and over): ASTM C 645; **20 gage** 0.0312" min. thickness of base metal unless otherwise indicated.

Depth of Section: 3-5/8" and 6", except as otherwise indicated.

Runners: **18 gage**; type recommended by stud manufacturer for floor base and ceiling support of studs, and for vertical abutment of drywall work at other work.

Furring Members: ASTM C 645; **25 gage**, 0.0179" min. thickness of base metal, hat shaped.

Slotted Deflection Track: ASTM C 645; 20 gauge 0.0296 inch minimum base-steel thickness.

Backing Plate: Fire-retardant-treated wood blocking and bracing in width indicated.

Fasteners for Furring Members: Type and size recommended by furring manufacturer for substrate and application indicated.

Rated Shaft Wall Systems:

Studs: 2 1/2" C-H Studs, 25 gauge at 24" on center, minimum. 1 Hour Fire-Rated Construction as Tested by USG – UL Design U415.

GYPSUM BOARD:

Gypsum Wallboard: ASTM C 1396, of types, edge configuration and thickness indicated below; in maximum lengths available to minimize end-to-end butt joints.

Type: Type X (**Typical all wall, ceiling and bulkhead surfaces**)

Edges: Tapered.

Thickness: 5/8", unless otherwise indicated.

Finish: Level 4, Typical.

CEMENTITIOUS BACKER UNITS

Provide cementitious backer units complying with ANSI 118.9, of thickness and width indicated below, and in maximum vertical lengths available to minimize end-to-end butt joints.

Thickness: 5/8", unless otherwise indicated.

Width: 32 inches (813 mm)

Available products: Subject to compliance with requirements, cementitious backer units that may be incorporated in the Work include, but are not limited to, the following:

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

Wonderboard Multi+Board; Custom Building Products.

DomCrete Cementitious Tile-Backer Board; Domtar Gypsum.

Util-A-Crete Concrete Backer Board; FinPan, Inc.

DUROCK Cement Board; United States Gypsum Co.

TRIM ACCESSORIES:

General: Provide manufacturer's standard trim accessories of types indicated for drywall work, formed of galvanized steel unless otherwise indicated, with either knurled and perforated or expanded flanges for nailing or stapling, and beaded for concealment of flanges in joint compound. Provide corner beads, L-type edge trim-beads, U-type edge trim-beads, special L-kerf-type edge trim-beads, and one-piece control joint beads.

JOINT TREATMENT MATERIALS:

General: ASTM C 475; type recommended by the manufacturer for the application indicated, except as otherwise indicated.

Joint Tape: Reinforced tape. (Provide joint tape recommended by the drywall manufacturer for Paperless/Moisture Resistant drywall installation.)

Joint Compound: Ready-mixed vinyl-type for interior use.

Grade: A single multi-purpose grade, for entire application. (Provide compound recommended by the drywall manufacturer for Paperless/Moisture Resistant drywall installation.)

Exterior Joint Compound: Special chemical - hardening - type for exterior application.

Water-Resistant Joint Compound: Special water-resistant type for treatment of joints, fastener heads and cut edges of water-resistant backing board.

Product: Subject to compliance with requirements, provide Sheetrock Brand W/R Compound; United States Gypsum Co.

MISCELLANEOUS MATERIALS:

General: Provide auxiliary materials for gypsum drywall work of the type and grade recommended by the manufacturer of the gypsum board.

Laminating Adhesive: Special adhesive or joint compound specifically recommended for laminating gypsum boards.

Spot Grout: ASTM C 475, setting-type joint compound of type recommended for spot grouting hollow metal door frames.

Gypsum Board Screws: Comply with ASTM C 1002.

Gypsum Board Nails: Comply with ASTM C 514.

Sound Attenuation Blankets: See “fiberglass” Sound Insulation specified in Section 07200.

PART 3 - EXECUTION

PREPARATION FOR METAL SUPPORT SYSTEMS:

Ceiling Anchorages: Coordinate work with structural ceiling work to ensure that inserts and other structural anchorage provisions have been installed to receive ceiling hangers.

Furnish concrete inserts, steel deck hanger clips and similar devices to other trades for installation well in advance of time needed for coordination with other work.

INSTALLATION OF METAL SUPPORT SYSTEMS:

General:

Metal Support Installation Standard: Comply with ASTM C 754.

Do not bridge building expansion joints with support system, frame both sides of joints with furring and other support as indicated.

Screw furring members to metal framing as indicated.

Ceiling Support Suspension Systems:

Secure hangers to structural support by connecting directly to structure where possible, otherwise connect to inserts, clips or other anchorage devices or fasteners as indicated.

Space main runners 4'-0" o.c. and space hangers 4'-0" o.c. along runners, except as otherwise shown.

Level main runners to a tolerance of 1/4" in 12'-0", measured both lengthwise on each runner and transversely between parallel runners.

Wire-tie or clip furring members to main runners and to other structural supports as indicated.

Direct-hung Metal Support System: Attach perimeter wall track or angle wherever support system meets vertical surfaces. Mechanically join support members to each other and butt-cut to fit into wall track.

Space furring member 16" o.c., except as otherwise indicated.

Install auxiliary framing at termination of drywall work, and at openings for light fixtures and similar work, as required for support of both the drywall construction and other work indicated for support thereon.

Wall/Bulkhead/Partition Support Systems:

Install supplementary framing, blocking and bracing at terminations in the work and for support of fixtures, equipment services, heavy trim, and similar work to comply with details indicated or if not otherwise indicated, to comply with applicable published recommendations of gypsum board manufacturer, or if not available, of "Gypsum Construction Handbook" published by United States Gypsum Co.

Isolate stud system from transfer of structural loading to system, both horizontally and vertically. Provide slip or cushioned type joints to attain lateral support and avoid axial loading.

Install runner tracks at ceilings and structural walls and columns where gypsum drywall stud system abuts other work, except as otherwise indicated.

Extend partition stud system through acoustical ceilings and elsewhere as indicated to the structural support or substrate above the ceiling.

Terminate partition stud system at ceilings, except where indicated to be extended to structural support or substrate above.

Space studs 16" o.c., unless otherwise indicated.

Resilient Channels manufactured from 20 gage corrosion resistant galvanized steel. Single leg resilient channels with extra-wide 1 1/2" screw flange for added rigidity and a wider surface for easier installation of sheathing materials.

Frame door openings to comply with details indicated or if not otherwise indicated, to comply with applicable published recommendations of gypsum board manufacturer, or if not available, of "Gypsum Construction Handbook" published by United States Gypsum Co. Attach vertical studs at jambs with screws either directly to frames or to jamb anchor clips on door frames; install runner track section (for jack studs) at head and secure to jamb studs.

Extend vertical jamb studs through suspended ceilings and attach to underside of floor or roof structure above, unless otherwise indicated.

Frame openings other than door openings to comply with details indicated or if not indicated, in same manner as required for door openings; and install framing below sills of openings to match framing required above door heads.

TILE BACKER BOARD INSTALLATION:

Install Tile Backer board behind all tile wall finishes. ~~See Room Finish Schedule.~~

GENERAL GYPSUM BOARD INSTALLATION REQUIREMENTS:

Gypsum Board Application and Finishing Standards: ASTM C 840 and GA 216.

Install sound attenuation blankets as indicated, prior to gypsum board unless readily installed after board has been installed.

Locate exposed end-butt joints as far from center of walls and ceilings as possible, and stagger not less than 1'-0" in alternate courses of board.

Install ceiling boards in the direction and manner which will minimize the number of end-butt joints, and which will avoid end joints in the central area of each ceiling. Stagger end joints at least 1'-0".

Install wall/bulkhead partition boards vertically to avoid end-butt joints wherever possible.

Install exposed gypsum board with face side out. Do not install imperfect, damaged or damp boards. Butt boards together for a light contact at edges and ends with not more than 1/16" open space between boards. Do not force into place.

Located either edge or end joints over supports, except in horizontal applications or where intermediate supports or gypsum board back-blocking is provided behind end joints. Position boards so that like edges abut, tapered edges against tapered edges and mill-cut or field-cut ends against mill-cut or field cut ends. Do not place tapered edges against cut edges or ends. Stagger vertical joints over different studs on opposite sides of partitions.

Attach gypsum board to supplementary framing and blocking provided for additional support at openings and cutouts.

Spot grout hollow metal door frames for solid core wood doors, hollow metal doors and doors over 32 inches wide. Apply spot grout at each jamb anchor clip just before inserting board into frame.

Form control joints and expansion joints with space between edges of boards, prepared to receive trim accessories.

Cover both faces of steel stud bulkhead framing with gypsum board in concealed spaces (above ceilings, etc.).

Except where concealed application is required for sound, fire, air or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. area, and may be limited to not less than 75% of full coverage.

Isolate perimeter of non-load-bearing drywall installations at structural abutments. Provide 1/4" to 1/2" space and trim edge with J-type semi-finishing edge trim. Seal joints with acoustical sealant.

Where sound-rated drywall work is indicated (STC rating), including double-layer work and work on resilient furring, seal the work at perimeters, control and expansion joints, openings and penetrations with a continuous bead of acoustical sealant including a bead at both faces of partitions. Comply with ASTM C 919 and manufacturer's recommendations for location of beads, and close off sound-flanking paths around or through the work, including sealing of partitions above acoustical ceilings.

For double-layer partition systems, work above acoustical ceilings may be installed with base layer only.

Space fasteners in gypsum boards in accordance with referenced standards and manufacturer's recommendations, except as otherwise indicated.

METHODS OF GYPSUM DRYWALL APPLICATION:

Single-layer Application: Install gypsum wallboard.

On ceilings apply gypsum board prior to wall/bulkhead/partition board application to the greatest extent possible.

On partitions/bulkheads/walls apply gypsum board vertically (parallel), unless otherwise indicated, and provide sheet lengths which will minimize end joints.

On partitions/walls 8'-1" or less in height apply gypsum board horizontally (perpendicular); use maximum length sheets possible to minimize end joints.

On Z-furring members apply gypsum board vertically (parallel to framing) with on end joints. Locate edge joints over furring members.

Wall Tile Base: Where drywall is base for thin-set ceramic tile and similar rigid applied wall finishes, install gypsum backing board.

In "dry" areas install gypsum backing board or wallboard with tapered edges taped and finished to produce a flat surface.

At Janitor's mop sinks, and similar "wet" areas, install water-resistant gypsum backing board to comply with ASTM C 840 and recommendations of gypsum board manufacturer.

Double-Layer Application: Install gypsum backing board for base layer and exposed gypsum board for face layer.

On ceilings apply base layer prior to application of base layer on walls/partitions; apply face layers in same sequence. Offset joints between layers at least 10 inches. Apply base layers at right angles to supports unless otherwise indicated.

On partition/walls apply base layer and face layers vertically (parallel) with joints of base layer over supports and face layer joints offset at least 10" with base layer joints.

Single-Layer Fastening Methods: Apply gypsum boards to supports as follows:

Fasten with screws.

Fasten with cadmium-plated screws, or with galvanized or aluminum nails where supports are nailable.

INSTALLATION OF DRYWALL TRIM ACCESSORIES:

General: Where feasible, use the same fasteners to anchor trim accessory flanges as required to fasten gypsum board to the supports. Otherwise, fasten flanges by nailing or stapling in accordance with manufacturer's instructions and recommendations.

Install metal corner beads at external corners of drywall work.

Install metal edge trim whenever edge of gypsum board would otherwise be exposed or semi-exposed, and except where plastic trim is indicated. Provide type with face flange to receive joint compound except where semi-finishing type is indicated. Install L-type trim where work is tightly abutted to other work, and install special kerf-type where other work is kerfed to receive long leg of L-type trim. Install U-type trim where edge is exposed, revealed, gasketed, or sealant-filled (including expansion joints).

Install semi-finishing trim where indicated, and where exterior gypsum board edges are not covered by applied moldings or indicated to receive trim with face flanges covered with joint compound.

FINISHING OF DRYWALL:

General: Apply treatment at gypsum board joints (both directions), flanges of trim accessories, penetrations, fastener heads, surface defects and elsewhere as required to prepare work for decoration. Prefill open joints and rounded or beveled edges, if any, using type of compound recommended by manufacturer.

Apply joint tape at joints between gypsum boards, except where a trim accessory is indicated.

Apply joint compound in 3 coats (not including prefill of openings in base), and sand between last 2 coats and after last coat.

Typical finish shall be Level 4.

Partial Finishing: Omit third coat (if specified) and sanding on concealed drywall work which is indicated for drywall finishing or which requires finishing to achieve fire-resistance rating, sound rating or to act as air or smoke barrier.

Refer to sections on painting, coatings and wall-coverings in Division-9 for decorative finishes to be applied to drywall work.

PROTECTION OF WORK:

Provide final protection and maintain conditions in a manner suitable to Installer, which ensures gypsum drywall work being without damage or deterioration at time of substantial completion.

END OF SECTION 09250

SECTION 09300 - TILE

PART 1 - GENERAL

RELATED DOCUMENTS:

Drawings, General Conditions and Supplementary General Conditions and other Division-1 Specification Sections, apply to this Section.

Division 3 Section "Concrete" for monolithic slab finishes specified for tile substrates.

Division 7 Section "Joint Sealers" for sealing of expansion, contraction, control and isolation joints in tile surfaces.

DESCRIPTION OF WORK:

Definitions: Tile includes ceramic surfacing units made from clay or other ceramic materials.

Extent of tile work is indicated on drawings and schedules

Types of tile work in this section include the following:

Slate Window sills

Sealing expansion and other joints in tile work with elastomeric joint sealers is work of this section.

REFERENCES AND PERFORMANCE REQUIREMENTS:

TCA (HB) - Handbook for Ceramic Tile Installation; Tile Council of America, Inc. – Current Edition

ASTM C1028 - Test method for Determining the Static Coefficient of Friction on Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull meter Method.

ANSI A108 1999 - Specifications for Installation of Ceramic Tile

Static Coefficient of Friction: Tile on walkway surfaces shall be provided with the following values as determined by testing in conformance with ASTM C 1028.

Level Surfaces: Minimum of 0.6 (Wet).
Step Treads: Minimum of 0.6 (Wet).
Ramp Surfaces: Minimum of 0.8 (Wet).

QUALITY ASSURANCE:

Maintain one copy each of all Referenced standards and specifications on site. Include the TCA Handbook, ANSI A108 Series, ANSI A118 Series ANSI A136.1 and ANSI A137.1 and others as specified under paragraph References.

Source of Materials: Provide materials obtained from one source for each type and color of tile, grout, and setting materials.

Installer Qualifications: Engage an experienced Installer who has successfully completed tile installations similar in material, design and extent to that indicated for Project.

SUBMITTALS:

Samples for Initial Selection Purposes: Submit manufacturer's color charts consisting of actual tiles or sections of tile showing full range of colors, textures and patterns available for each type of tile indicated. Include samples of grout and accessories involving color selection.

Samples for Verification Purposes: Submit the following:

Samples for each type of tile and for each color and texture required, not less than 12" square, on plywood or hardboard backing and grouted.

Full size samples for each type of trim, accessory and for each color.

PRODUCT HANDLING:

Deliver and store packaged materials and store in original containers with seals unbroken and labels intact until time of use. Prevent damage or contamination to materials by water, freezing, foreign matter or other causes.

PROJECT CONDITIONS:

Maintain environmental conditions and protect work during and after installation to comply with referenced standards and manufacturer's printed recommendations.

PART 2 - PRODUCTS

ACCEPTABLE MANUFACTURERS:

Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:

Tile:

Dal-Tile Corp.
American Olean Tile Co., Inc.
Mannington Tile Co.
United States Ceramic Tile Co.

Latex-Portland Cement Mortar:

American Olean Tile Co., Inc.
Summitville Tiles, Inc.
Dal-Tile Corp.
Laticrete.

Commercial Portland Cement Grout:

Summitville Tiles, Inc.
Dal-Tile Corp.
Laticrete

Tile Cleaners:

Hillyard Chemical Co.
Laticrete
L & M Surco Mfg. Co., Inc.

PRODUCTS, GENERAL:

ANSI Standard for Ceramic Tile: Comply with ANSI A137.1 "American National Standard Specifications for Ceramic Tile" for types and grades of tile indicated.

Furnish tile complying with "Standard Grade" requirements unless otherwise indicated.

ANSI Standard for Tile Installation Materials: Comply with ANSI standard referenced with installation products and materials indicated.

Colors, Textures and Patterns: For tile and other products requiring selection of colors, surface textures or other appearance characteristics, provide products to match characteristics indicated or, if not otherwise indicated, as selected by Architect from manufacturer's standards.

Note: Minimum two tile colors per Room.

Or as indicated on drawings.

Provide tile trim and accessories which match color and finish of adjoining flat tile.

Mounting: Where factory-mounted tile is required provide back- or edge-mounted tile assemblies as standard with manufacturer unless another mounting method is indicated.

TILE PRODUCTS:

SLATE WINDOW SILLS:

Slate Window Sills: Provide natural slate sills at all interior windows, vents anywhere described on the drawings. Sills shall be 1" thick natural finish slate. All applications shall use single pieces (to a maximum of 6'-0"). If wider sill is required, provide joint at a logical place with respect to the adjacent window division points. Slate color shall be Gray, Black or Charcoal. Clean and seal slate surface after installation.

THRESHOLDS:

Marble Thresholds: Provide marble thresholds complying with ASTM C 503 requirements for exterior use and abrasion resistance for uses subject to heavy foot traffic, a minimum hardness of 10 per ASTM C 241.

Color/Finish: As selected from the manufacturers standard range.

Size: Fabricate 2 inches (50 mm) wide by full width of wall or frame opening; 1/2 inch (12 mm) thick; beveled one long edge with radiused corners on top side; without holes, cracks, or open seams.

Provide to provide transition between tile surface and adjoining finishes and at doorways where tile terminates.

WATERPROOFING:

Polyethylene Membrane: Latacrete 9235 with Laticrete Anti-fracture Protection Fabric OR, at contractor's option, an approved reinforced liquid waterproofing application designed to provide a complete waterproof barrier under tile applications.

SETTING MATERIALS:

Portland Cement Mortar Installation Materials: Provide materials complying with ANSI A108-1B and as specified below:

Latex Additive: (water emulsion) described below, serving as replacement for part or all of water, of type specifically recommended by latex additive manufacturer for use with job-mixed Portland cement and aggregate mortar bed.

Latex Additive: Manufacturer's standard.

Latex-Portland Cement Mortar: ANSI A118.4, composed as follows:

Prepackaged Dry-Mortar Mix: Factory-prepared mixture of portland cement; dry, redispersible, ethylene vinyl acetate additive; and other ingredients to which only water needs to be added at Project site.

Mixture of Dry-Mortar Mix and Latex Additive: Mixture of prepackaged dry-mortar mix and liquid-latex additive complying with the following requirements:

Latex Additive: Manufacturer's standard.

GROUTING MATERIALS:

Commercial Portland-Cement Grout: Proprietary preblended compound composed of portland cement and additives formulated for the type of tile installed.

ELASTOMERIC SEALANTS:

Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing, elastomeric sealant of base polymer indicated which complies with ASTM C 920 requirements, including those for Type, Grade, Class and Uses.

Compatibility: Provide 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 testing and field experience.

Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints, unless otherwise indicated.

Locations: Provide expansion joints, filled with elastomeric sealant, above expansion joint locations in concrete slab subfloor and as recommended for quality tile installations.

One-Part Mildew Resistant Silicone Sealant: Type S; Grade NS; Class 25; Uses NT, G, A; formulated with fungicide for sealing interior joints in and around ceramic tile, showers, sinks and plumbing fixtures. USDA approved products required for kitchen area sealants.

MISCELLANEOUS MATERIALS:

Tile Cleaner: Product specifically acceptable to manufacturer of tile and grout manufacturer for application indicated and as recommended by National Tile Promotion Federation, 112 North Alfred St., Alexandria, VA 22134 or Ceramic Tile Institute, 700 N. Virgil Ave., Los Angeles, CA 90029.

PART 3 - EXECUTION

INSPECTION:

Examine surfaces to receive tile work and conditions under which tile will be installed. Do not proceed with tile work until surfaces and conditions comply with requirements indicated in referenced tile installation standards.

INSTALLATION:

ANSI Tile Installation Standard: Comply with applicable parts of ANSI 108 series of tile installation standards included under "American National Standard Specifications for the Installation of Ceramic Tile".

TCA Installation Guidelines: TCA "Handbook for Ceramic Tile Installation"; comply with TCA installation methods indicated or, if not otherwise indicated, as applicable to installation conditions shown.

Extend tile work into recesses and under or behind equipment and fixtures, to form a complete covering without interruptions, except as otherwise shown. Terminate work neatly at obstructions, edges and corners without disrupting pattern or joint alignments.

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 that plates, collars, or covers overlap tile.

Jointing Pattern: Unless otherwise shown, lay tile in grid pattern. Align joints when adjoining tiles on floor, base, walls and trim are 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 shown.

For tile mounted in sheets make joints between sheets same width as joints within tile sheets so that extent of each sheet is not apparent in finish work.

Expansion Joints: Locate expansion joints and other sealant filled, including control, contraction and isolation joints at all inside corners.

Prepare joints and apply sealants to comply with requirements of referenced installation standards and sealant manufacturer.

Grout tile to comply with referenced installation standards, using grout materials indicated.

Mix and install proprietary components to comply with grout manufacturer's directions.

TILE INSTALLATION METHODS:

Marble Thresholds: Install marble thresholds at locations specified; set in same type of setting bed as abutting field tile unless otherwise indicated.

Set thresholds in thinset mortar for locations, where mortar bed would otherwise be exposed above adjacent non-tile floor finish.

SLATE SILL INSTALLATION:

Install sills carefully scribed to fit within ¼” of walls and under window rail as detailed..All exposed ends, edges, and corners shall be eased to 1/16” radius. Sills shall be set in a full bed of Latex-Portland cement mortar and all joints cleanly finished flush with the face of stone. Clean and seal exposed surfaces.

CLEANING AND PROTECTION

Cleaning: Upon completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer's printed instructions, but not sooner than 14 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.

Finished Tile Work: Leave finished installation clean and free of cracked, chipped, broken, unbonded, or otherwise defective tile work.

Protection: 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.

Prohibit foot and wheel traffic from using tiled floors for at least 7 days after grouting is completed.

Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

End of SECTION 09300

SECTION 09510 - ACOUSTICAL CEILINGS

PART 1 - GENERAL

RELATED DOCUMENTS:

Drawings, General Conditions and Supplementary General Conditions and other Division-1 Specification Sections, apply to this Section.

SUMMARY:

Extent of each type of acoustical ceiling is shown and scheduled on drawings.

Types of acoustical ceilings specified in this section include the following: See Floor Plan and Room Finish Schedule for locations of each type.

“Typical Type A” Interior Areas - Acoustical ceiling tiles, - exposed suspension.
Applications using 2'x2' grid.

“Specialty Drop Ceiling - Type B” Interior Areas - Acoustical ceilings tiles, - exposed suspension.
Applications using 2'x2' grid.

Specialty Drop Ceiling Installed with 12” H curved extruded aluminum perimeter trim.

QUALITY ASSURANCE:

Installer Qualifications: Firm with not less than three years of successful experience in installation of acoustical ceilings similar to requirements for this project and which is acceptable to manufacturer of acoustical units, as shown by current written statement from manufacturer.

Fire Performance Characteristics: Provide acoustical ceiling components that are identical to those tested for the following fire performance characteristics, according to ASTM test method indicated, by UL or other testing and inspecting agency acceptable to authorities having jurisdiction. Identify acoustical ceiling components with appropriate marking of applicable testing and inspecting agency.

Surface Burning Characteristics: As follows, tested per ASTM E 84.

Flame Spread: 25 or less.

Smoke Developed: 50 or less.

Fire Resistance Ratings: As indicated by reference to design designation in UL "Fire Resistance Directory" or "FM Approval Guide", for assemblies in which acoustical ceilings function as a fire protective membrane; tested per ASTM E 119.

Coordination of Work: Coordinate layout and installation of acoustical ceiling units and suspension system components with other work supported by, or penetrating through, ceilings, including light fixtures, HVAC equipment, fire-suppression system components (if any), and partition system (if any).

SUBMITTALS:

Product Data: Manufacturer's product specifications and installation instructions for each acoustical ceiling material required, and for each suspension system, including certified laboratory test reports and other data as required to show compliance with these specifications.

Include manufacturer's recommendations for cleaning and refinishing acoustical units, including precautions against materials and methods which may be detrimental to finishes and acoustical performances.

Samples: Set of 6" x 4" square samples for each acoustical unit required, showing full range of exposed color and texture to be expected in completed work.

DELIVERY, STORAGE, AND HANDLING:

Deliver acoustical ceiling units 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 or other causes.

Before installing acoustical ceiling units, permit them to reach room temperature and a stabilized moisture content.

Handle acoustical ceiling units carefully to avoid chipping edges or damaging units in any way.

PROJECT CONDITIONS:

Space Enclosure: Do not install interior acoustical ceilings until space is enclosed and weatherproof, wet-work in space is completed and nominally dry, work above ceilings is complete, and ambient conditions of temperature and humidity will be continuously maintained at values near those indicated for final occupancy.

PART 2 - PRODUCTS

ACOUSTICAL CEILING UNITS, GENERAL:

Standard for Acoustical Ceiling Units: Provide manufacturer's standard units of configuration indicated which are prepared for mounting method designated and which comply with ASTM E1264 requirements, including those indicated by reference to type, form, pattern, grade (NRC or NIC' as applicable), light reflectance coefficient (LR), edge detail, and joint detail (if any).

Colors, Textures, and Patterns: Provide products to match appearance characteristics indicated or, if not otherwise indicated, as selected by Architect from manufacturer's standard colors, surface textures, and patterns available for acoustical ceiling units and exposed metal suspension system members of quality designated.

ACOUSTICAL PANELS:

“Typical Type A Ceiling Tile” – typical

Type III, Form 2:

Pattern CDE Medium-Textured Panel, NRC .70, CAC 35, Panel Size 24" x 24" x 3/4"

Use: **Typical** acoustical suspended ceiling where shown on Room Finish Schedule (**TYPE A**).

Color: White.

Fire-Resistance Rated Panels:

Radar *ClimaPlus* High NRC, High CAC, Square Edge (SQ) with Grid Option “A”
United States Gypsum Co., or equal.

“Specialty Drop Ceiling -Type B Ceiling Tile” – Over Sales Platform

Metal Finish, Smooth Texture, Mircoperforated Panels, NRC .80, CAC 35/45, Panel Size 24" x 24" x 5/8"

Use: Acoustical suspended ceiling over Sales Platform.

Color: Silver Gray

Surface Burn (ASTM E84): Class A

Metalworks, Tegular, smooth texture. 5/8" Square (with acoustical fleece)
M2 – Micro Perforated.

Item #6463-2820 M2 SG with 15/16" Square Tegular suspension system
by Armstrong Commercial Ceilings, or equal.

or equal by United States Gypsum Co. or others.

Extruded Aluminum Perimeter Trim: Used with the Specialty Drop Ceiling – Type B

Exposed custom decorative trim used with suspended lay-in panels. Commercial quality extruded aluminum allow 6063. Factory applied baked polyester paint finish. (See A2 for Ceiling Shape)

12" Tall Curved Trim Channel with Pre-mitered Corners
& all necessary installation hardware & accessories.

Custom Color – to be determined.

AXIOM Classic Trim Item #AX12CUR

By Armstrong Commercial Ceilings, or equal.

or equal by United States Gypsum Co. or others.

METAL SUSPENSION SYSTEMS, GENERAL:

Standard for Metal Suspension Systems: Provide metal suspension systems of type, structural classification and finish indicated which comply with applicable ASTM C 635 requirements.

Finishes and Colors: Provide manufacturer's standard finish for type of system indicated, unless otherwise required. For exposed suspension members and accessories with painted finish, provide color indicated or white if not otherwise indicated.

Attachment Devices: Size for 5 times design load indicated in ASTM C 635, Table 1, Direct Hung.

Concrete Inserts: Inserts formed from hot-dipped galvanized sheet steel and designed for attachment to concrete forms and for embedment in concrete, with holes or loops for attachment at hanger wires.

Hanger Wire: Galvanized carbon steel wire, ASTM A 641, soft temper, prestretched, Class 1 coating, sized so that stress at 3-times hanger design load (ASTM C 635, Table 1, Direct Hung), will be less than yield stress of wire, but provide not less than 12 gage.

Edge Moldings and Trim: Metal or extruded plastic of types and profiles indicated or, if not indicated, provide manufacturer's standard molding for edges and penetrations of ceiling which fits with type of edge detail and suspension system indicated.

Available Manufacturers: Subject to compliance with requirements, manufacturers offering suspension systems which may be incorporated in the work include, but are not limited to, the following:

Manufacturer: Subject to compliance with requirements, provide suspension systems of one of the following:

Manufacturers of Steel Exposed Suspension Systems:

Same as acoustical unit manufacturer.

Chicago Metallic Corp.

Donn Corp.

National Rolling Mills, Inc.

Roper Eastern.

EXPOSED METAL DIRECT-HUNG SUSPENSION SYSTEMS:

Fire-Rated Single Web Steel Suspension System: (Typical")

Structural Classification: As required per for rated systems.

Finish: Painted, white.

Uses: Typical suspension system unless noted otherwise.

Fire-Rated Single Web Aluminum Suspension System: (All Toilets")

Structural Classification: As required per for rated systems.

Finish: Painted, white.

Uses: Toilet area suspension system unless noted otherwise.

MISCELLANEOUS MATERIALS:

Tile Adhesive: Comply with ASTM D 1779 or FS MMM-A-00150, type recommended by tile manufacturer, bearing UL label for Class 0 - 25 flame spread.

Tile Fasteners: Cadmium plated, type recommended by tile manufacturer, but for not less than 1/2" penetration of substrate.

PART 3 - EXECUTION

PREPARATION:

Coordination: Furnish layouts for inserts, clips, or other supports required to be installed by other trades for support of acoustical ceilings.

Furnish concrete inserts and similar devices to other trades for installation well in advance of time needed for coordination of other work.

Provide and install fasteners in wood joists, rafters, and/or trusses to support hanging loads in shear and not in tension (i.e. attach to sides of supporting structure, not bottoms of supporting structure).

Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less-than-half width units at borders, and comply with reflected ceiling plans wherever possible.

INSTALLATION:

General: Install materials in accordance with manufacturer's printed instructions, and to comply with governing regulations, fire resistance rating requirements as indicated, and Cisca standards applicable to work.

Arrange acoustical units and orient directionally-patterned units (if any) in manner shown by reflected ceiling plans.

Install tile with pattern running in alternating directions to form "checkerboard" layout.

Install suspension systems to comply with ASTM C 636, with hangers supported only from building structural members. Locate hangers not less than 6" from each end and spaced 4'-0" along each carrying channel or direct-hung runner, unless otherwise indicated, leveling to tolerance of 1/8" in 12'-0".

Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eye-screws, or other devices which are secure and appropriate for substrate, and which will not deteriorate or fail with age or elevated temperatures.

Install hangers plumb and free from contact with insulation or other objects within ceiling plenum which are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal force by bracing, countersplaying or other equally effective means.

Install edge moldings of type indicated at perimeter of acoustical ceiling area and at locations where necessary to conceal edges of acoustical units.

Install hold-down clips in areas indicated, and in areas where required by governing regulations or for fire-resistance ratings; space as recommended by panel manufacturer, unless otherwise indicated or required.

ADJUST AND CLEAN:

Clean exposed surfaces of acoustical ceilings, including trim, edge moldings, and suspension members; comply with manufacturer's instructions for cleaning and touch-up of minor finish damage. Remove and replace work which cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

EXTRA STOCK:

Deliver stock to maintenance material to Owner. Furnish maintenance material matching products installed, packaged with protective covering for storage and identified with appropriate labels.

Acoustical Ceiling Units: Furnish quantity of full size units equal to **2.0%** of amount installed.

Exposed Suspension-Components: Furnish quantity of each exposed component required for actual installation equal to **1.0%** of amount installed.

End of SECTION 09510

SECTION 09650 - RESILIENT FLOORING

PART 1 - GENERAL

RELATED DOCUMENTS:

Drawings, General Conditions and Supplementary General Conditions and other Division-1 Specification Sections, apply to this Section.

DESCRIPTION OF WORK:

Extent of resilient flooring and accessories is shown on drawings and in schedules.

Luxury Vinyl (LV) Tile – Provide and Installed By Owner
Rubber Wall Base – Provide and Installed By Owner

PLEASE NOTE:

THIS SECTION IS PROVIDED FOR CONTRACTOR TO APPROPRIATELY PREPARE ALL SURFACES FOR OWNER TO PROVIDE & INSTALL PRODUCTS INDICATED.

QUALITY ASSURANCE:

Manufacturer: Provide each type of resilient flooring and accessories as produced by a single manufacturer, including recommended primers, adhesives, sealants, and leveling compounds.

Fire Test Performance: Provide resilient flooring which complies with the following fire test performance criteria as determined by an independent testing laboratory acceptable to authorities having jurisdiction.

Flame Spread: Not more than 75 per ASTM E 84.

Smoke Developed: Not more than 450 per ASTM E 84.

Critical Radiant Flux: 0.45 watts per sq. cm. or more per ASTM E 648.

Smoke Density: Less than 450 per ASTM E 662.

SUBMITTALS:

Product Data: Submit manufacturer's technical data for each type of resilient flooring and accessory.

Samples required for approval if not those specified in Color Schedule: Submit manufacturer's standard color charts in form of actual sections of resilient flooring, including accessories, showing full range of colors and patterns available, for each type of resilient flooring required.

PROJECT CONDITIONS:

Maintain minimum temperature of 70 degrees F (21 degrees C) in spaces to receive resilient flooring for at least 48 hours prior to installation, during installation, and for not less than 48 hours after installation. Store resilient flooring materials in spaces where they will be installed for at least 48 hours before beginning installation. Subsequently, maintain minimum temperature of 55 degrees F (13 degrees C) in areas where work is completed.

Install resilient flooring and accessories after other finishing operations, including painting, have been completed. Do not install resilient flooring over concrete slabs until the latter have been cured and are sufficiently dry to achieve bond with adhesive as determined by manufacturer's recommended bond and moisture test.

PART 2 - PRODUCTS

ACCEPTABLE MANUFACTURERS: BY OWNER

Manufacturer: Subject to compliance with requirements, provide products of one of the following:

Manufacturers of Solid Vinyl Tile (LVT)

Armstrong World Industries, Inc.
Mannington Tile Co.
Shaw Industries.

Manufacturers of Rubber Wall Base:

Roppe Rubber Corp.
Johnson Rubber Co., Inc.
Armstrong World Industries, Inc.

RESILIENT FLOORING COLORS AND PATTERNS:

Color and Patterns: Manufacturer's standard colors as selected and approved by Architect.

FLOOR TILE: PROVIDED BY OWNER

Solid Vinyl Tile: A layered construction consisting of a tough, clear, vinyl wear layer protecting a high-fidelity print layer on a solid vinyl backing. Protected by a UV-cured polyurethane finish, the wear surface is embossed with different textures to enhance each of the printed visuals. Colors are insoluble in water and resistant to cleaning agents and light.

Luxury Solid Vinyl Tile shall conform to the requirements of ASTM F 1700, 'Standard Specification for Solid Vinyl Tile', Class III, Type B - Embossed Surface.

<u>Thickness:</u>	0.125 inches
<u>Wear Layer Thickness:</u>	0.020 inches
<u>Finish:</u>	UV-cured Polyurethane
<u>Size:</u>	size of tile to be determined.

Product/Manufacturer: **BY OWNER**

ACCESSORIES: BY OWNER

Wall Base: Provide base complying with FS SS-W-40; Type I rubber, with matching end stops and preformed or molded outside corner units, and as follows:

Manufacturer: Roppe
Height: 4".
Thickness: 1/8" inch.
Style: Standard top-set cove.
Finish: Matte.

Color: as selected and approved by Architect from manufacturer's standard, premium and custom colors.

Rubber Transition: VC Tile to Carpet.

Manufacturer: Roppe
Height: ADA compliant.
Thickness: ADA compliant.
Finish: Matte.

Color: as selected and approved by Architect from manufacturer's standard, premium and custom colors.

Adhesives (Cement): Waterproof, stabilized type as recommended by flooring manufacturer to suit material and substrate conditions.

Concrete Slab Primer: Non-staining type as recommended by flooring manufacturer.

Leveling Compound: Latex type as recommended by flooring manufacturer.

PART 3 - EXECUTION

EXAMINATION:

General: Require Installer to inspect subfloor surfaces to determine that they are satisfactory. A satisfactory subfloor surface is defined as one that is smooth and free from cracks, holes, ridges, coatings preventing adhesive bond, and other defects impairing performance or appearance.

Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:

Slab substrates are dry and free of curing compounds, sealers, hardeners and other materials whose presence would interfere with bonding of adhesive. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by tile manufacturer.

Finishes of subfloors comply with tolerances and other requirements specified in Division 3 Section "Cast-In-Place Concrete" for slabs receiving resilient flooring.

Subfloors are free of cracks, ridges, depressions, scales and foreign deposits of any kind.

Do not allow resilient flooring work to proceed until subfloor surfaces are clean, dry, and free of all particles which could translate through tile.

PREPARATION:

Prepare subfloor surfaces as follows:

Use leveling and patching compounds as recommended by resilient flooring manufacturer for filling small cracks, holes and depressions in subfloors.

Remove coatings from subfloor surfaces that would prevent adhesive bond, including curing compounds incompatible with resilient flooring adhesives, paint, oils, waxes and sealers.

Broom clean, vacuum, wet mop, and dry surfaces to be covered. Inspect subfloor for small particles which would translate through tile. Repeat preparation of subfloor until all particles are removed.

Apply concrete slab primer, if recommended by flooring manufacturer, prior to application of adhesive. Apply in compliance with manufacturer's directions.

INSTALLATION:

GENERAL:

Install resilient flooring using method indicated in strict compliance with manufacturer's printed instructions. Extend flooring into toe spaces, door reveals, and into closets and similar openings.

Scribe, cut, and fit resilient flooring to permanent fixtures, built-in furniture and cabinets, pipes, outlets and permanent columns, walls and partitions.

Maintain reference markers, holes, or openings that are in place or plainly marked for future cutting by repeating on finish flooring as marked on subfloor. Use chalk or other non-permanent marking device.

Tightly cement resilient flooring to subbase without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, or other surface imperfections. Hand roll resilient flooring at perimeter of each covered area to assure adhesion.

INSTALLATION OF TILE FLOORS:

Lay tile from center marks established with principal walls, discounting minor offsets, so that tile at opposite edges of room are of equal width. Adjust as necessary to avoid use of cut widths less than 1/2 tile at room perimeters. Lay tile square to room axis, unless otherwise shown.

Match tiles for color and pattern by using tile from cartons in same sequence as manufactured and packaged if so numbered. Cut tile neatly around all fixtures. Broken, cracked, chipped, or deformed tiles are not acceptable.

Lay tile in pattern with respect to location of colors, patterns and sizes as indicated on Drawings.

Adhere tile flooring to substrates using full spread of adhesive applied in compliance with flooring manufacturer's directions.

INSTALLATION OF ACCESSORIES:

Apply wall base to walls, columns, pilasters, casework and other permanent fixtures in rooms or areas where base is required. Install base in lengths as long as practicable, with preformed corner units, or fabricated from base materials with mitered or coped inside corners. Tightly bond base to substrate throughout length of each piece, with continuous contact at horizontal and vertical surfaces.

On masonry surfaces, or other similar irregular substrates, fill voids along top edge of resilient wall base with manufacturer's recommended adhesive filler material.

Apply resilient accessories to stairs as indicated and in strict accordance with manufacturer's installation instructions.

Place resilient edge strips tightly butted to flooring and secure with adhesive. Install edging strips at edges of flooring which would otherwise be exposed.

CLEANING AND PROTECTION:

Perform following operations immediately upon completion of resilient flooring:

Sweep or vacuum floor thoroughly.

Do not wash floor until time period recommended by resilient flooring manufacturer has elapsed to allow resilient flooring to become well-sealed in adhesive.

Damp mop floor being careful to remove black marks and excessive soil.

Remove any excess adhesive or other surface blemishes, using appropriate cleaner recommended by resilient flooring manufacturers.

Protect flooring against damage during construction period to comply with resilient flooring manufacturer's directions.

Apply protective floor polish to resilient flooring surfaces free from soil, excess adhesive or surface blemishes. Use commercially available metal cross-linked acrylic product acceptable to resilient flooring manufacturer.

Cover resilient flooring with undyed, untreated building paper until inspection for substantial completion.

Clean resilient flooring not more than 4 days prior to date scheduled for inspections intended to establish date of substantial completion in each area of project. Clean resilient flooring by method recommended by resilient flooring manufacturer.

Strip protective floor polish, which was applied after completion of installation, prior to cleaning.

Reapply floor polish after cleaning.

EXTRA STOCK:

Deliver stock of maintenance materials to Owner. Furnish maintenance materials from same manufactured lot as materials installed and enclosed in protective packaging with appropriate identifying labels.

Tile Flooring: Furnish not less than one box for each 50 boxes or fraction thereof, for each type, color, pattern and size installed.

END OF SECTION 09650

SECTION 09680: CARPETING

PART 1 - GENERAL

RELATED DOCUMENTS:

Drawings, General Conditions and Supplementary General Conditions and other Division-1 Specification Sections, apply to this Section.

DESCRIPTION OF WORK:

Extent of carpeting is indicated on the drawings, finish schedule and by specifications, and is defined to include carpet and accessories; see Room Finish Schedule on Drawings.

Broadloom Carpet and or Carpet Tiles – Provided and Installed by Owner.

PLEASE NOTE:

THIS SECTION IS PROVIDED FOR CONTRACTOR TO APPROPRIATELY PREPARE ALL SURFACES FOR OWNER TO PROVIDE & INSTALL PRODUCTS INDICATED.

Each type of required carpet is specified by data sheets, included as last page(s) of this section.

QUALITY ASSURANCE:

Installer Qualifications: Firm with not less than 5 years of experience in installation of commercial carpeting of type, quantity and installation methods similar to work of this section.

Manufacturer Qualifications: Firm (carpet mill) with not less than 5 years of production experience with carpet similar to types specified in this section; and whose published product literature clearly indicates compliance of products with requirements of this section.

General Terminology/Information Standard: Refer to current edition of "Carpet Specifier's Handbook" by The Carpet and Rug Institute; for definitions of terminology not otherwise defined herein, and for general recommendations and information.

Flame/Smoke Resistance Standards: Where ratings are indicated for carpet or for carpet-plus-pad installations, provide materials complying with ratings as indicated for the following test standards:

Floor Radiant Panel Test: Test for burning under varying radiant energy levels; ASTM E 648, with minimum average radiant flux ratings not less than the following:

FRPT Rating: 0.45 watts/sq. cm.

Smoke Density Test: Test in radiant heat chamber, with and without flame, for density of smoke generated; ASTM E 662, or NFPA No. 258, also known as NBS Smoke Density Chamber Test.

Sound Absorption Standard: Where a noise reduction coefficient (NRC) rating is indicated for installed carpet and cushion (if any), provide materials complying with ratings as indicated, which have been tested in accordance with ASTM C 423.

Static Resistance: Provide yarn or yarn blend as indicated in carpet construction, and include provisions to comply with static resistance ratings as indicated, either by selection of yarns known to be effective or by inclusion of small percentages of special anti-static yarn known to be effective in achieving indicated static resistance. Where rating is not otherwise indicated, provide 3.5 KV resistance for 20% R.H. at 70 degrees F (21 degrees C), AATCC 134.

SUBMITTALS:

Product Data: Submit manufacturer's complete technical product data for each type of carpet, cushion and accessory item required.

Colors, Textures and Patterens: For Carpet and other products requiring colors, surface textures or other appearance characteristics, **provide product characteristics indicated by color/pattern selections listed on Carpet Data Sheet.**

For approval of Alternate Product: Submit three (3) sets of manufacturer's color selections samples for distribution to the Architect and the Owner. Submittals considered will be only those of very similar color, texture and pattern to those used as the Basis for Design as well as equivalence of carpet materials, tile size and construction.

Shop Drawings: Submit carpet tile layout drawings, clearly indicating carpet directions, locations and methods of adhering tiles, and locations and types of edge strips. Indicate columns, doorways, enclosing walls/partitions, built-in cabinets and locations where cut-outs are required in carpet.

Samples: Submit 24" x 24" samples of each carpet required, 6" long samples of each type exposed edge stripping, and 6" square samples of separate cushions.

Maintenance Data: Submit manufacturer's printed maintenance recommendations, including methods and frequency recommended for maintaining carpet in optimum conditions under anticipated traffic and use conditions for inclusion in Master Maintenance Manual.

EXTRA STOCK: BY OWNER

PRODUCT DELIVERY AND STORAGE:

Deliver carpeting materials in original mill protective wrapping with mill register numbers and tags attached. Store inside, in well ventilated area, protected from weather, moisture and soiling.

PART 2 - PRODUCTS

CARPET: BY OWNER

CARPET ACCESSORIES: BY OWNER

PART 3 - EXECUTION

PRE-INSTALLATION REQUIREMENTS:

Examine substrates for moisture content and other conditions under which carpeting is to be installed. Repair minor holes, cracks, depressions or rough areas using material recommended by carpet or adhesive manufacturer. Notify Contractor in writing of major conditions detrimental to proper completion of the work. Do not proceed until unsatisfactory conditions have been corrected.

Calcium Chloride and PH and Moisture Tests are to be performed per manufacturers recommendations. Test results shall be provided to architect prior to installation.

Clear away debris and scrape up cementitious deposits from surfaces to receive carpeting; vacuum clean immediately before installation. Check concrete surfaces to ensure no "dusting" through installed carpet; apply sealer where required to prevent dusting.

Sequence carpeting with other work so as to minimize possibility of damage and soiling of carpet during remainder of construction period.

Special installation procedures must be taken in the installation of carpet tiles. Obtain installation guidelines from carpet tile manufacturer and install exactly as instructed. Diaviations from manufacturer instructions will result in poorly installed carpet that will require replacing.

INSTALLATION: BY OWNER

Carpet Tiles: Comply with manufacturer's instructions and recomendations for installing carpet tile flooring.

Tile squares shall be layed in directions as instructed by the Architect in the field. Installation shall be performed when the following jobsite conditions exist:

HVAC system is operational and provides the minimum temperature of 65 degrees F and maximum temperature of 95 degrees F for 24 hours proceeding the installation; relative humidity shall not exceed 65% and anhydrous calcium chloride results do not exceed 10lbs/1000 sf per 24 hours and ph readings are between 5.0 and 12.0.

Lay out carpet tiles from the center marks established with principal walls, discounting minor offsets, so that tile at the opposite edges of the room are of equal width. Adjust as necessary to avoid use of cut widths less than ½ tile at room perimeters. Lay tile square to room axis, unless otherwise shown.

Tiles will be installed using Shaw carpets "Lok*Dots carpeting installation. Lok*Dots adhesive system must be installed in accordance with Shaw carpeting recommendations for a warranted installation.

Broadloom Carpet: Comply with manufacturer's instructions and recommendations for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doors, center seams under doors; do not place seams in traffic direction at doorways.

Glue-Down Installation: Broadloom

Fit sections of carpet into each space prior to application of adhesive. Trim edges and butter cuts with seaming cement.

Apply adhesive uniformly to substrate in accordance with manufacturer's instructions. Butt carpet edges tightly together to form seams without gaps. Roll entire carpet area lightly to eliminate air pockets and ensure uniform bond. Remove adhesive promptly from face of carpet.

End (head) seams (defined to be "edge to edge" seams perpendicular to the longest edge defining manufacturer's carpet width) will not be permitted in rooms where the longest dimension is 45' or less.

Side seams (defined to be "edge to edge" seams defining manufacturer's carpet width) will not be permitted in rooms where narrowest dimension is 12 feet or less.

Carpet direction for intersecting areas or corridors shall be determined by that area or corridor having the greater width.

Extend carpet under open-bottomed obstructions and under removable flanges and furnishings, and into alcoves and closets of each space.

Provide cut-outs where required, and bind cut edges properly where not concealed by protective edge guards or overlapping flanges.

Install carpet edge guard where edge of carpet is exposed; anchor guards to substrate.

Expansion Joints: Do not bridge building expansion joints with continuous carpeting, provide for movement.

Avoid location of seams in areas of high, concentrated traffic such as step treads, landings, ramps, aisles, at areas immediately at entrances and doorways, and immediately in front and parallel to cabinets.

CLEANING AND PROTECTION:

Remove and dispose of debris and unusable scraps.

Remove debris, sorting pieces to be saved from scraps to be disposed of.

Vacuum carpet using commercial machine with face-beater element. Remove spots and replace carpet where spots cannot be removed. Remove any protruding face yarn using sharp scissors.

Advise Contractor of protection methods and materials needed to ensure that carpeting will be without deterioration or damage at time of substantial completion.

Maintenance Materials: Deliver specified overrun and usable scraps of carpet to Owner's designated storage space, properly packaged (paper wrapped) and identified. Usable scraps are defined to include

roll ends of less than 9'-0" length, and pieces of more than 3 sq. ft. area and more than 8" wide. Dispose of smaller pieces as "construction waste".

End of SECTION 09680

SECTION 09911 - EXTERIOR PAINTING

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings, General Conditions and Supplementary General Conditions and other Division-1 Specification Sections, apply to this Section.

SUMMARY

This Section includes surface preparation and the application of paint systems on the following exterior substrates:

- Steel.
- Wood.

Related Sections include the following:

- Division 5 Sections for shop priming of metal substrates with primers specified in this Section.
- Division 6 Sections for shop priming carpentry with primers specified in this Section.
- Division 9 Section "Interior Painting" for surface preparation and the application of paint systems on interior substrates.

SUBMITTALS

Product Data: For each type of product indicated.

Samples for Initial Selection: For each type of topcoat product indicated.

Samples for Verification: For each type of paint system and each color and gloss of topcoat indicated.

- Submit Samples on rigid backing, 8 inches (200 mm) square.
- Step coats on Samples to show each coat required for system.
- Label each coat of each Sample.
- Label each Sample for location and application area.

Product List: For each product indicated, include the following:

- Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
- Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

QUALITY ASSURANCE

MPI Standards:

- Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
- Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.

DELIVERY, STORAGE, AND HANDLING

Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).

- Maintain containers in clean condition, free of foreign materials and residue.

- Remove rags and waste from storage areas daily.

PROJECT CONDITIONS

Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

EXTRA MATERIALS

Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.

- Quantity: Furnish an additional 1 unopened gallon of each material and color applied.

PART 2 - PRODUCTS

MANUFACTURERS

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

- Benjamin Moore & Co.
- Duron, Inc.
- ICI Paints.
- PPG Architectural Finishes, Inc.
- Sherwin-Williams Company (The).

PAINT, GENERAL

Material Compatibility:

- Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
- For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

Colors: As selected by Architect from manufacturer's full range

METAL PRIMERS

Alkyd Anticorrosive Metal Primer: MPI #79.

- VOC Content: E Range of E2

WOOD PRIMERS

Exterior Alkyd Wood Primer: MPI #5.

VOC Content: E Range of [E2] [E3].

EXTERIOR LATEX PAINTS

Exterior Latex (Gloss) for Wood substrates: MPI #119 (Gloss Level 6, except minimum gloss of 65 units at 60 deg).

- VOC Content: E Range of [E1] [E2 or] [E3].

EXTERIOR ALKYD PAINTS

Exterior Alkyd Enamel (Gloss) For metal substrates: MPI #9 (Gloss Level 6).

VOC Content: E Range of [E1] [E2].

PART 3 - EXECUTION

EXAMINATION

Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.

Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

- Concrete: 12 percent.
- Masonry (Clay and CMU): 12 percent.
- Wood: 15 percent.
- Plaster: 12 percent.
- Gypsum Board: 12 percent.

Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

PREPARATION

Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

Remove plates, machined surfaces, and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

- After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.

See MPI Maintenance Repainting Manual for renovation or restoration work.

- Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.

Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

Clay Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content of surfaces or alkalinity of mortar joints to be painted exceed that permitted in manufacturer's written instructions.

Concrete Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer.

Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

Aluminum Substrates: Remove surface oxidation.

Wood Substrates:

- Scrape and clean knots, and apply coat of knot sealer before applying primer.
- Sand surfaces that will be exposed to view, and dust off.
- Prime edges, ends, faces, undersides, and backsides of wood.
- After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

Plastic Trim Fabrication Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

Plaster Substrates: Do not begin paint application until plaster is fully cured and dry.

Exterior Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth.

APPLICATION

Apply paints according to manufacturer's written instructions.

- Use applicators and techniques suited for paint and substrate indicated.
- Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.

Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

FIELD QUALITY CONTROL

Testing of Paint Materials: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when paints are being applied:

CLEANING AND PROTECTION

At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

EXTERIOR PAINTING SCHEDULE

Steel Substrates: (any & all exposed steel substrates - including but not limited to Steel Bollards, Steel Gates, HM Doors and Frames, and Lintels)

Alkyd System: MPI EXT 5.1D.

Prime Coat: Alkyd anticorrosive metal primer.

Intermediate Coat: Exterior alkyd enamel matching topcoat.

Topcoat: Exterior alkyd enamel (**gloss**).

Wood Panel Substrates:

Latex Over Alkyd Primer System: MPI EXT 6.4G.

Prime Coat: Exterior alkyd wood primer.

Intermediate Coat: Exterior latex matching topcoat.

Topcoat: Exterior latex [(gloss.)].

END OF SECTION 09911

SECTION 09912 - INTERIOR PAINTING

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings, General Conditions and Supplementary General Conditions and other Division-1 Specification Sections, apply to this Section.

SUMMARY

This Section includes surface preparation and the application of paint systems on the following interior substrates:

- Concrete masonry units (CMU).
- Steel.
- Wood.
- Gypsum board.
- Wood Stains

Related Sections include the following:

- Division 5 Sections for shop priming of metal substrates with primers specified in this Section.
- Division 8 Sections for factory priming windows and doors with primers specified in this Section.
- Division 9 Section "Exterior Painting" for surface preparation and the application of paint systems on exterior substrates.

SUBMITTALS

Product Data: For each type of product indicated.

Samples for Initial Selection: For each type of topcoat product indicated.

Samples for Verification: For each type of paint system and in each color and gloss of topcoat indicated.

- Submit Samples on rigid backing, 8 inches (200 mm) square.
- Step coats on Samples to show each coat required for system.
- Label each coat of each Sample.
- Label each Sample for location and application area.

Product List: For each product indicated, include the following:

- Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
- Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

QUALITY ASSURANCE

MPI Standards:

Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."

Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.

Mockups: Apply benchmark samples of each paint and stain system indicated and each color and finish selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.

Wall and Ceiling Surfaces: Provide samples of at least 16 sq. ft. (9 sq. m).

Other Items: Architect will designate items or areas required.

Apply benchmark samples after permanent lighting and other environmental services have been activated.

Final approval of color selections will be based on benchmark samples.

If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Architect at no added cost to Owner.

DELIVERY, STORAGE, AND HANDLING

Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).

Maintain containers in clean condition, free of foreign materials and residue.

Remove rags and waste from storage areas daily.

PROJECT CONDITIONS

Apply paints/stains only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

Do not apply paints/stains when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

EXTRA MATERIALS

Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.

Quantity: Furnish an additional 2 unopened gallons of each material and color applied.

PART 2 - PRODUCTS

MANUFACTURERS

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

- Benjamin Moore & Co.
- Duron, Inc.
- ICI Paints.
- PPG Architectural Finishes, Inc.
- Sherwin-Williams Company (The).

PAINT, GENERAL

Material Compatibility:

Systems could fail if paints used for individual coats are incompatible. MPI's paint systems match primers and topcoats and take compatibility into consideration.

- Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
- For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

Chemical Components of Field-Applied Interior Paints and Coatings: Provide products that comply with the following limits for VOC content, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24) and the following chemical restrictions; these requirements do not apply to primers or finishes that are applied in a fabrication or finishing shop:

- Flat Paints and Coatings: VOC content of not more than 50 g/L.
- Nonflat Paints and Coatings: VOC content of not more than 150 g/L.
- Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
- Restricted Components: Paints and coatings shall not contain any of the following:
 - Acrolein.
 - Acrylonitrile.
 - Antimony.
 - Benzene.
 - Butyl benzyl phthalate.
 - Cadmium.
 - Di (2-ethylhexyl) phthalate.
 - Di-n-butyl phthalate.
 - Di-n-octyl phthalate.
 - 1,2-dichlorobenzene.
 - Diethyl phthalate.
 - Dimethyl phthalate.
 - Ethylbenzene.
 - Formaldehyde.
 - Hexavalent chromium.
 - Isophorone.
 - Lead.
 - Mercury.
 - Methyl ethyl ketone.
 - Methyl isobutyl ketone.
 - Methylene chloride.
 - Naphthalene.
 - Toluene (methylbenzene).
 - 1,1,1-trichloroethane.
 - Vinyl chloride.

Colors: As selected by Architect from manufacturer's full range

BLOCK FILLERS

Interior/Exterior Latex Block Filler: MPI #4.

VOC Content: E Range of **E2 or E3**.

PRIMERS/SEALERS

Interior Latex Primer/Sealer: MPI #50.

VOC Content: E Range of **E2 or E3**.

Environmental Performance Rating: **EPR 2 minimum.**

METAL PRIMERS

Rust-Inhibitive Primer (Water Based): MPI #107.

VOC Content: E Range of **E2 or E3**.

Environmental Performance Rating: **EPR 2 minimum.**

WOOD PRIMERS

Interior Latex-Based Wood Primer: MPI #39.

VOC Content: E Range of **E2**

Environmental Performance Rating: **EPR 2**

LATEX PAINTS

Interior Latex (Flat): (Offices)

VOC Content: E Range of E2

Interior Latex (Eggshell): MPI #52 (Gloss Level 3). (Typical)

VOC Content: E Range of E2

Institutional Low-Odor/VOC Latex (Eggshell): MPI #145 (Gloss Level 3). (Stairwells, Lobby, Hallways, Exit Passageways, toilets, restrooms, Kitchens)

VOC Content: E Range of E3.

Environmental Performance Rating: EPR 4.5.

WOOD STAINS:

Interior Wood Stain (Satin):

VOC Content: E Range of [E2] [E3].

Wood Filler Paste: MPI#91.

VOC Content: E Range of **E3**.

Interior Stain (Semi-transparent): MPI#90

VOC Content: E Range of **E2**.

Interior Varnish (Satin): MPI#75 Gloss Level 4, alkyd type.

VOC Content: E Range of **E2 or E3**.

PART 3 - EXECUTION

EXAMINATION

Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.

Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

- Concrete: 12 percent.
- Masonry (Clay and CMU): 12 percent.
- Wood: 15 percent.

- Gypsum Board: 12 percent.
- Plaster: 12 percent.

Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

- Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

PREPARATION

Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

Remove plates, machined surfaces, and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

- After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.

Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.

Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

Clay Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content of surfaces or alkalinity of mortar joints to be painted exceed that permitted in manufacturer's written instructions.

Concrete Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer. **(or shop-primed).**

Wood Substrates:

Scrape and clean knots, and apply coat of knot sealer before applying primer.

Sand surfaces that will be exposed to view, and dust off.

Prime edges, ends, faces, undersides, and backsides of wood.

After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth. Repair all surface blemishes, dust dirt, or other foreign material is removed.

APPLICATION

Apply paints according to manufacturer's written instructions.

Use applicators and techniques suited for paint and substrate indicated.

Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.

Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

Painting Mechanical and Electrical Work: Paint items exposed in equipment rooms and occupied spaces including, but not limited to, the following:

Mechanical Work:

- Spiral Ductwork
- Uninsulated metal piping.
- Uninsulated plastic piping.
- Pipe hangers and supports.
- Tanks that do not have factory-applied final finishes.
- Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
- Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
- Mechanical equipment that is indicated to have a factory-primed finish for field painting.

Electrical Work:

- Electrical equipment that is indicated to have a factory-primed finish for field painting.

FIELD QUALITY CONTROL

Testing of Paint Materials: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when paints are being applied:

CLEANING AND PROTECTION

At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

INTERIOR PAINTING SCHEDULE

Concrete Substrates: (by UCoat-It or equal)

Applied to all Warehouse Concrete Floor Areas-

Provide and install Water Based Hybrid **Epoxy** Floor Coating, applied at the rate of 200 sq. ft. per gallon per coat with traction additive in the base coat.

Color: Typical – **to be selected from Standard Range of Colors**

Approved product: *DuraKote Water Based Pigmented Epoxy* by SureCrete Design Products.

-Or UCoat-It with first/bond coats & second/finish coats.

-Or equal.

CMU Substrates:

Latex System: MPI INT 4.2A.

Institutional Low Odor/VOC Latex System: MPI INT 4.2E.

Prime Coat: Interior/exterior latex block filler.

Intermediate Coat: Institutional low odor/VOC interior pre-catalyzed water based epoxy matching topecoat.

Topcoat: Institutional low odor/VOC interior pre-catalyzed water based epoxy (eggshell)

Steel Substrates:

Institutional Low-Odor/VOC Latex System: MPI INT 5.1S.

Prime Coat: Rust-inhibitive primer (water based).

Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.

Topcoat: Institutional low-odor/VOC interior latex (**semigloss**).

Galvanized-Metal Substrates:

Institutional Low-Odor/VOC Latex System: MPI INT 5.3N

Prime Coat: Primer, galvanized, water based.

Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.

Topcoat: Institutional low-odor/VOC interior latex (**semigloss**).

Aluminum (Not anodized or Otherwise Coated) Substrates:

Institutional Low-Odor/VOC Latex System: MPI INT 5.4G

Prime Coat: Primer, galvanized, water based.

Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.

Topcoat: Institutional low-odor/VOC interior latex (**semigloss**).

Dressed Lumber Substrates: Including architectural woodwork, doors where indicated to be painted.

Latex System: MPI INT 6.3T.

Prime Coat: Interior latex-based wood primer.

Intermediate Coat: Interior latex matching topcoat.

Topcoat: Interior latex (**semigloss**).

Gypsum Board Substrates:

Latex System: MPI INT 9.2A.

Prime Coat: Interior latex **primer/sealer** matching topcoat. **Use this paint system on Interior offices and Rooms.**

Intermediate Coat: Interior latex matching topcoat.

Topcoat: Interior latex (**flat @ painted ceilings & Offices; eggshell typical on walls**).

Institutional Low-Odor/VOC Latex System: MPI INT 9.2M. **Use this paint system at all interior Corridors, Foyer, Lobby, Toilets, Restrooms, and Kitchens.**

Prime Coat: One Coat - Interior Latex primer/sealer.

Basis of Design: S-W Pro Mar 200 Zero VOC Interior Latex Primer #B28W2600

Finish Coat: Two Coats – Interior pre-catalyzed water based epoxy

Basis of Design: S-W Pre-Catalyzed Waterbased Epoxy #K45-150 Series

INTERIOR WOOD STAINING SCHEDULE:

~~Stained Woodwork: Provide low VOC, Class A stain finish products by single manufacturer.~~

~~Stained Varnished Rubbed Finish: 3 Finish coats over stain plus filler in open grain wood.~~

~~Stain Coat: Interior Oil Stain: Note stains shall be applied in different staining strengths/coats on wood substrates to conceal differing grains or wood specie type. The objective is to finish the wood panels, trim moldings and doors with one uniform consistent stain coloration.~~

~~First Coat: Bleached Shellac.~~

~~Filler Coat on Open Grain Wood: Paste Wood Filler.~~

~~Second and Third Coats: Oil Rubbing Varnish, Satin finish.~~

END OF SECTION 09912

SECTION 10000 - MISCELLANEOUS ACCESSORIES

PART 1 - GENERAL

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

DESCRIPTION OF WORK:

Provide and install the specified products as indicated on the plans and described in the specifications.

NOTE: ALL ITEMS LISTED ARE SPECIFIC MODEL NUMBERS BY SPECIFIC MANUFACTURERS; HOWEVER, EQUAL PRODUCTS BY OTHER MANUFACTURER'S OF SIMILAR PRODUCTS WILL BE ACCEPTED UPON APPROVAL (either before or after bidding) BY ARCHITECT. FINAL DECISION OF EQUALITY WILL BE BASED ON ALL QUALITIES AND QUANTITIES OF THE NAMED PRODUCT.

SUBMITTALS:

Product Data: Submit manufacturer's specifications and installation instructions for each of the listed products. Include any operation and maintenance instructions as applicable.

DELIVERY, STORAGE AND HANDLING:

Deliver materials and products in original packages either assembled or "knocked-down" for field assembly.

Store materials inside, under cover and in a manner acceptable to the manufacturer of each product.

PART 2 - PRODUCTS

EXTERIOR SIGNAGE – YARD SIGN

Furnish and install **Yard Sign** as follows:

Series 1200 by GGP-CI www.cisigns.com
similar series by Best Sign Systems, Kaltech Architectural Signage, or approved equal.

12” deep, 5 feet high (with standard skirt) and 6 feet wide.

Internally Illuminated sign with integral hinging system for easy access to internal components.

Base shall be recessed and skirted, standard ground mount.

Finishes standard colors in acrylic polyurethane.

Aluminum Face with routed graphics and backed in white acrylic.

Letter Style: to be selected by Architect.

Letter Height: 18” high.

Lettering: “A B C”

-on both sides of sign.

(verify lettering with Architect prior to ordering)

WALL SIGNAGE: (See Div 1 - Allowances for ABC Signage)

911 EXTERIOR SIGNAGE: (Over Front Elevation entrance doors)

Provide and install exterior three (4) 8" tall x 3/4" thick letters/Numerals precision cast aluminum letters with baked enamel color finish. Provide letters/numerals with provision to be mounted on exterior finish as indicated on exterior elevations. Text font type to be "FUTURA BOLD".

INTERIOR SIGNAGE:

Furnish and install the following plastic or acrylic signs with 1/32" raised lettering and braille copy meeting ADA and ANSI A117.1 requirements.

Type MP Plastic: Best Signs HC-300 Series, Mohawk 200 series,
Baynuk Graphic Systems, Blasted Melamine Product Line
or approved equal.
Sign Sizes: 8" x 8" x 1/8" with 1/2" radiused corners and thin line border around
perimeter.
Corners: Radius, 1/2".
Color: To be selected by Architect.

Installation of Door Signage per manufacturer's standard adhesive method. Locate signs as directed by Architect.

Provide the following types and quantities of signage:

2 toilet signs (Men, Women symbol, or both for Unisex)
8" wide x 8" tall, for interior door application

1" high "Men" and "Women" "Unisex"
Braille copy
Raised International Men or Women's and HC symbol

4 signs for individual doors. 8" wide x 8" tall, for interior door application.

1" high room NAME text up to 20 characters.
braille copy.

METAL AWNINGS:

Mitchell Metals, LLC
Smyrna, GA 30080 tele (770-431-7300) www.mitchellmetals.net

DAC Architectural Canopies
Raleigh, NC tele (919-384-0678) www.raleighawning.com

Or equal by, Mapes Industries www.mapes.com

Type: Structural Grade "Standing Seam" Aluminum Awning & brackets
Awning supplied with all frames, brackets and assembly hardware necessary to install.

Main Frame: sizes as indicated on drawings, aluminum tubular extruded members with minimum thickness of 0.125".

Decking Support Frame: Support frame to be made using 2" x 2" aluminum tubular extruded members, unless larger required due to canopy spans. Support Frame to be welded to solid frame prior to installation. Roof framing/furring to be made using 1" x 2" aluminum tubing.

Canopy Flashing: shall be aluminum sheet painted to match color of the canopy. Minimum flashing thickness shall be 0.040" thick.

Awning Material: Standing seam roof panels, **22 gauge**, aluminum-zinc alloy coated carbon steel (*Galvalume*) meeting ASTM A 792.

Roof Panel Design: 2" Leg Height
16" Panel Width, Striated Pan Finish

Aluminum Framing, Brackets and Roofing Panels : Color Selected for Standard Color Guide

Size: **Reference Drawings** (coordinate install with out swinging doors)

Provide the following quantities: **Reference Drawings**

METAL COLUMN COVERS:

Provide and install pre-engineered 300 Series Stainless Steel Alloy (brushed finish) column covers.

Provide Shop Drawings and Samples: Provide 12x12 sample of each type of metal and finish specified.

System: No exposed fasteners for Column Covers will be accepted.

Materials: Stainless Steel sheet shall be Type 304 with a thickness of 16 gauge.

Finish: Stainless Steel sheets shall receive a factory applied mechanical finish.

Fabrication: Column Covers shall have a butt (soft "V") vertical joint with Recessed Horizontal reveals at both top and bottom - as indicated on drawings.

Basis of Design: SAF Metal Fabrications, Series M-1000

DRAIN CHAIN:

Provide and install drain chain on Main Entry Canopy Gutter.

Stainless Steel Link Rain Chain: Marine Grade 316L stainless

Link Width: 1-1/16"

Link Length: 1- 3/4"

Thickness: 1/4"

Provide with Rain Chain Install Kit: Aluminum Outlet Tube with 3" outlet length and hanging bar.

DOCK LEVELER:

Provide and install heavy duty manual edge of dock leveler. Constructed with a 2-1/2" districution bar, three gussets, grease fittings and an adjustable torsion spring. Manual Edge of Dock is welded to minimum 8 inch imbedded channel or the optional formed angle and approach plate.

Capacities: 25,000 lbs.

Standard: 15 inch hinged lip and dock bumpers

Warranty: 2 year limited

Basis of Design: Beacon BBL Series, Model #BBL-6625H

ASH BUTT RECEPTACLE: BY OWNER

FIRE EXTINGUISHER CABINETS:

Typical FEC: **Models 1027-P50** as manufactured by J. L. Industries or approved equal. Plans indicate required locations (denoted by "FEC"). Extinguisher by owner.

Finish and type: Natural color anodized aluminum, semi-recessed.

Provide the following quantities: **2 typical FECs total** or as indicated on drawings (whichever number is greater).

KNOX BOX – RAPID ENTRY SYSTEM:

Furnish and install the following rapid entry system by Knox Company

Knox Box 3200 Series, Hinged Door Model with Recessed Mounting Kit, or approved equal.

Order form and installation requirements to be provided by and coordinated with **local Fire Department**.

TEMPLATE FOR IDENTIFYING RATED WALLS:

Contractor shall provide labeling of all rated walls in new or renovated construction in concealed spaces in accordance with N.C. Building Code requirements for protection of fire rated openings. Labeling must be permanent but can be sprayed using a template stenciling format or adhered sign. Minimum letter height 4”.

PART 3: EXECUTION:

INSTALLATION:

Install units in accordance with manufacturer's instructions. Securely anchor to adjacent walls and/or floors with concealed devices as applicable for product specified.

Coordinate with other trades as necessary for proper and timely installation.

ADJUST AND CLEAN:

Ensure that operating parts work freely and fit neatly. Adjust hardware and moving parts as necessary.

Repair or replace damaged parts, dents, buckles, abrasions, or other defect affecting appearance or serviceability.

Clean all products prior to time of final inspection.

END OF SECTION 10000

SECTION 10800 - TOILET ACCESSORIES

PART 1 - GENERAL

RELATED DOCUMENTS:

Drawings, General Conditions and Supplementary General Conditions and other Division-1 Specification Sections, apply to this Section.

SUMMARY

This section includes toilet and bath accessory items as scheduled.

SUBMITTALS:

Product data for each toilet accessory item specified, including construction details relative to materials, dimensions, gages, profiles, mounting method, specified options, and finishes.

QUALITY ASSURANCE:

Inserts and Anchorages: Furnish inserts and anchoring devices which must be set in concrete or built into masonry; coordinate delivery with other work to avoid delay.

Accessory Locations: Coordinate accessory locations with other work to avoid interference and to assure proper operation and servicing of accessory units.

PART 2 - PRODUCTS

ACCEPTABLE MANUFACTURERS:

Available Manufacturers: Subject to compliance with requirements, manufacturers offering toilet accessories which may be incorporated in the work include, but are not limited to, the following:

Accessory Specialties, Inc.
American Dispenser Co.
Bobrick Washroom Equip., Inc.
Bradley Corp.

MATERIALS, GENERAL:

Stainless Steel: AISI Type 302/304, with polished No. 4 finish, 22 gage minimum, unless otherwise indicated.

Sheet Steel: Cold rolled, commercial quality ASTM A 366, 20 gage minimum, unless otherwise indicated. Surface preparation and metal pretreatment as required for applied finish.

Galvanized Steel Sheet: ASTM A 527, G60.

Chromium Plating: Nickel and chromium electro-deposited on base metal, ASTM B 456, Type SC 2.

Mirror Glass: Nominal 6.0-mm (0.23 inch) thick, conforming to ASTM C 1036, Type I, Class 1, Quality q2 and with silvering, electro-plated copper coating, and protective organic coating.

Galvanized Steel Mounting Devices: ASTM A 386, hot-dip galvanized after fabrication.

Fasteners: Screws, bolts, and other devices of same material as accessory unit or of galvanized steel where concealed.

TOILET TISSUE DISPENSERS

Double-Roll Dispenser: Size to accommodate two separate rolls of core type tissue to 5-inch diameter roll.

Fabrication: Spindless, chrome-plated, steel construction with tension-spring delivery control; designed for surface mounting, self-locking device extends through core and prevents core removal until roll is empty.

ELECTRIC HAND DRYERS:

~~One piece heavy duty, surface mounted, rustproof, 1500 watt, automatic electric wall mounted hand dryer with infrared optical sensor and 970 watt heating element in a UL rated, internally grounded unit. Automatic shut-off after 35 seconds for hand dryers. G.C. to coordinate unit voltage with available building power. Provide 22 gage recess kit for ADA compliant installation. Hand dryer and recess kit to be brushed stainless steel finish. Provide unit equal to XLERATOR by Excel Dryer Inc. or MACHFLOW M09ACS Electric Hand Dryers w/ADA Recess Kit by SANIFLOW Corp.~~

GRAB BARS:

Stainless Steel Type: Provide grab bars with thickness not less than 18 gage and as follows:

Mounting: Concealed, manufacturer's standard flanges and anchorages.

Clearance: 1-1/2 inch clearance between wall surface and inside face of bar.

Gripping Surfaces: Manufacturer's standard non-slip texture.

Heavy-Duty Size: Outside diameter of 1-1/2 inch.

SANITARY NAPKIN DISPOSAL UNITS:

Surface Mounted Type: ~~Fabricate of stainless steel with seamless exposed walls, tightly self closing top cover and locking bottom panel with continuous, stainless steel piano hinge.~~

MISCELLANEOUS ACCESSORIES

Double Robe/Towel Hook: Heavy-duty satin finished stainless steel double prong robe hook; rectangular wall bracket with backplate for concealed mounting.

Shower Rods: Heavy Duty satin-finished stainless steel rods with rectangular wall bracket with backplate for concealed mounting.

MIRROR UNITS:

Standard Stainless Steel Framed Mirror Units: Fabricate frame with channel shapes not less than 0.04 inch (20 gage), with square corners carefully mitered to hairline joints and mechanically interlocked. Provide in Type 430 bright polished finish.

FABRICATION:

General: Stamped names or labels on exposed faces of toilet accessory units are not permitted, except where otherwise indicated; inobtrusive labels on surfaces not exposed to view are acceptable. Where locks are required for a particular type of toilet accessory, provide same keying throughout project. Furnish two keys for each lock.

Surface-Mounted Toilet Accessories, General: Except where otherwise indicated, fabricate units with tight seams and joints, exposed edges rolled. Hang doors or access panels with continuous stainless steel piano hinge. Provide concealed anchorage wherever possible.

Recessed Toilet Accessories, General: Except where otherwise indicated, fabricate units of all-welded construction, without mitered corners. Hang doors or access panels with full-length, stainless steel piano hinge. Provide anchorage that is fully concealed when unit is closed.

Framed Mirror Units, General: Fabricate frames for glass mirror units to accommodate wood, felt, plastic, or other glass protection material. Provide mirror backing and support system that will permit rigid, tamperproof glass installation and prevent moisture accumulation, as follows:

Provide galvanized-steel backing sheet, not less than 0.034 inch (22 gage) and full mirror size, with nonabsorptive filler material. Corrugated cardboard is not an acceptable filler material.

Mirror Unit Hangers: Provide system for mounting mirror units that will permit rigid, tamperproof, and theftproof installation, as follows:

One-piece, galvanized-steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.

Keys: Provide universal keys for access to toilet accessory units requiring internal access for servicing, resupply, etc. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

INSTALLATION:

Install toilet accessory units in accordance with manufacturers' instructions, using fasteners which are appropriate to substrate and recommended by manufacturer of unit. Install units plumb and level, firmly anchored in locations as directed by Architect.

Secure mirrors to walls in concealed, tamperproof manner with special hangers, toggle bolts, or screws. Set units plumb, level, and square at locations indicated, according to manufacturer's instructions for type of substrate involved.

Install grab bars to withstand a downward load of at least 250 lbf, complying with ASTM F 446.

ADJUST AND CLEAN:

Adjust toilet accessories for proper operation and verify that mechanisms function smoothly.

Clean and polish all exposed surfaces after removing protective coatings.

SCHEDULE OF TOILET ACCESSORIES

Manufacturer: Model numbers of toilet accessories listed below are those of Bobrick Washroom Equipment, Inc., unless otherwise indicated. See drawings for quantity and locations.

symbol	description		model number
1	HC Toilet Grab Bars - horizontal	42"	B-6806.99 x 42"
1A	HC Toilet Grab Bars - vertical	18"	B-6806.99 x 18"
2	HC Toilet Grab Bars - horizontal	36"	B-6806.99 x 36"
3	Double Toilet Tissue Dispenser		B-274
4			
5	Paper Towel Dispenser		B-262
6			
7	Soap Dispenser		By owner
8			
9	Wall-Mounted Lavatory Mirror	24" x 36"	B165-2436
10			
11			
12			

Verify mounting height requirements for all mirror units with Architect.

Contractor shall install all toilet accessories described as being "by Owner" indicated in the Accessory Schedule.

Accessory numbers coordinate with those used on the Toilet Fixture and Accessories Schedule on Sheet A2.

See Plumbing Fixture Schedule on Plumbing Drawings for required Fixtures and Accessories.

END OF SECTION 10800

TABLE OF CONTENTS

SPECIFICATIONS:

	<u>DESCRIPTION</u>	<u>PAGES</u>
DIVISION 15 – MECHANICAL		
15050	BASIC MECHANICAL MATERIALS AND METHODS	1 - 15
15060	HANGERS AND SUPPORTS	1 - 8
15071	MECHANICAL VIBRATION AND SEISMIC CONTROLS	1 - 7
15075	MECHANICAL IDENTIFICATION	1 - 5
15081	DUCT INSULATION	1 - 11
15082	EQUIPMENT INSULATION	1 - 9
15083	PIPE INSULATION	1 - 9
15100	VALVES	1 - 7
15121	PIPE EXPANSION FITTINGS AND LOOPS	1 - 5
15122	METERS AND GAGES	1 - 7
15170	MOTORS	1 - 3
15194	FUEL GAS PIPING	1 - 9
15410	PLUMBING FIXTURES	1 - 11
15411	WATER DISTRIBUTION PIPING	1 - 8
15420	DRAINAGE AND VENT PIPING	1 - 9
15430	PLUMBING SPECIALTIES	1 - 16
15485	ELECTRIC, DOMESTIC WATER HEATERS	1 - 7
15510	HYDRONIC PIPING	1 - 10
15738	SPLIT-SYSTEM AIR-CONDITIONING UNITS	1 - 5
15815	METAL DUCTS	1 - 9
15820	DUCT ACCESSORIES	1 - 6
15838	POWER VENTILATORS	1 - 7
15855	DIFFUSERS, REGISTERS, AND GRILLES	1 - 3
15900	HVAC INSTRUMENTATION AND CONTROLS	1 - 12
15990	TESTING, ADJUSTING, AND BALANCING	1 - 13



SECTION 15050 - BASIC MECHANICAL MATERIALS AND METHODS

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 basic mechanical materials and methods to complement other Division 15 Sections.
 - 1. Piping materials and installation instructions common to most piping systems.
 - 2. Concrete base construction requirements.
 - 3. Escutcheons.
 - 4. Dielectric fittings.
 - 5. Flexible connectors.
 - 6. Mechanical sleeve seals.
 - 7. Equipment nameplate data requirements.
 - 8. Labeling and identifying mechanical systems and equipment is specified in Division 15 Section "Mechanical Identification."
 - 9. Nonshrink grout for equipment installations.
 - 10. Field-fabricated metal and wood equipment supports.
 - 11. Installation requirements common to equipment specification sections.
 - 12. Cutting and patching.
 - 13. Touchup painting and finishing.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. CPVC: Chlorinated polyvinyl chloride plastic.
3. NP: Nylon plastic.
4. PE: Polyethylene plastic.
5. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. CR: Chlorosulfonated polyethylene synthetic rubber.
2. EPDM: Ethylene propylene diene terpolymer rubber.

1.4 SUBMITTALS

- A. Product Data: For dielectric fittings, flexible connectors, mechanical sleeve seals, and identification materials and devices.
- B. Shop Drawings: Detail fabrication and installation for metal and anchorage for mechanical materials and equipment.
- C. Coordination Drawings: For access panel and door locations.
- D. Coordination Drawings: **Detail major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Show space requirements for installation and access. Indicate if sequence and coordination of installations are important to efficient flow of the Work. Include the following:**
1. Planned piping layout, including valve and specialty locations and valve-stem movement.
 2. Clearances for installing and maintaining insulation.
 3. Clearances for servicing and maintaining equipment, accessories, and specialties, including space for disassembly required for periodic maintenance.
 4. Equipment and accessory service connections and support details.
 5. Exterior wall and foundation penetrations.
 6. Fire-rated wall and floor penetrations.
 7. Sizes and location of required concrete pads and bases.
 8. Scheduling, sequencing, movement, and positioning of large equipment into building during construction.
 9. Floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
 10. Reflected ceiling plans to coordinate and integrate installation of air outlets and inlets, light fixtures, communication system components, sprinklers, and other ceiling-mounted items.

1.5 QUALITY ASSURANCE

- A. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.
- B. Equipment Selection: Equipment of higher electrical characteristics, physical dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. Additional costs shall be approved in advance by appropriate Contract Modification for these increases. If minimum energy ratings or efficiencies of equipment are specified, equipment must meet design and commissioning requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and prevent entrance of dirt, debris, and moisture.
- B. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, if stored inside.
- C. Protect flanges, fittings, and piping specialties from moisture and dirt.
- D. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 SEQUENCING AND SCHEDULING

- A. Coordinate mechanical equipment installation with other building components.
- B. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.
- C. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components, as they are constructed.
- D. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning before closing in building.
- E. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.
- F. Coordinate requirements for access panels and doors if mechanical items requiring access are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "Access Doors."
- G. Coordinate installation of identifying devices after completing covering and painting, if devices are applied to surfaces. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Dielectric Unions:
 - a. Capitol Manufacturing Co.
 - b. Central Plastics Co.
 - c. Eclipse, Inc.; Rockford-Eclipse Div.
 - d. Epco Sales Inc.
 - e. Hart Industries International, Inc.
 - f. Watts Industries, Inc.; Water Products Div.
 - g. Zurn Industries, Inc.; Wilkins Div.
 2. Dielectric Flanges:
 - a. Capitol Manufacturing Co.
 - b. Central Plastics Co.
 - c. Epco Sales Inc.
 - d. Watts Industries, Inc.; Water Products Div.
 3. Dielectric Couplings:
 - a. Calpico, Inc.
 - b. Lochinvar Corp.
 4. Dielectric Nipples:
 - a. Grinnell Corp.; Grinnell Supply Sales Co.
 - b. Perfection Corp.
 - c. Victaulic Co. of America.
 5. Metal, Flexible Connectors:
 - a. Central Sprink, Inc.
 - b. Flexicraft Industries.
 - c. Flex-Weld, Inc.
 - d. Hyspan Precision Products, Inc.
 - e. McWane, Inc.; Tyler Pipe; Gustin-Bacon Div.
 - f. Metraflex Co.
 - g. Uniflex, Inc.
 6. Mechanical Sleeve Seals:
 - a. Calpico, Inc.
 - b. Metraflex Co.
 - c. Thunderline/Link-Seal.

2.2 PIPE AND PIPE FITTINGS

- A. Refer to individual Division 15 piping Sections for pipe and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

- A. Refer to individual Division 15 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness, unless thickness or specific material is indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
 - 2. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- E. Solder Filler Metals: ASTM B 32.
 - 1. Alloy Sn95 or Alloy Sn94: Approximately 95 percent tin and 5 percent silver, with 0.10 percent lead content.
- F. Brazing Filler Metals: AWS A5.8.
 - 1. BCuP Series: Copper-phosphorus alloys.
 - 2. BAg1: Silver alloy.
- G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- H. Solvent Cements: Manufacturer's standard solvent cements for the following:
 - 1. ABS Piping: ASTM D 2235.
 - 2. CPVC Piping: ASTM F 493.
 - 3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
 - 4. PVC to ABS Piping Transition: ASTM D 3138.
- I. Plastic Pipe Seals: ASTM F 477, elastomeric gasket.

- J. Flanged, Ductile-Iron Pipe Gasket, Bolts, and Nuts: AWWA C110, rubber gasket, carbon-steel bolts and nuts.
- K. Couplings: Iron-body sleeve assembly, fabricated to match OD of plain-end, pressure pipes.
 - 1. Sleeve: ASTM A 126, Class B, gray iron.
 - 2. Followers: ASTM A 47 (ASTM A 47M) malleable iron or ASTM A 536 ductile iron.
 - 3. Gaskets: Rubber.
 - 4. Bolts and Nuts: AWWA C111.
 - 5. Finish: Enamel paint.

2.4 DIELECTRIC FITTINGS

- A. General: Assembly or fitting with insulating material isolating joined dissimilar metals, to prevent galvanic action and stop corrosion.
- B. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld-neck end types and matching piping system materials.
- C. Insulating Material: Suitable for system fluid, pressure, and temperature.
- D. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).
- E. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.
- F. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

2.5 FLEXIBLE CONNECTORS

- A. General: Fabricated from materials suitable for system fluid and that will provide flexible pipe connections. Include 125-psig (860-kPa) minimum working-pressure rating, unless higher working pressure is indicated, and ends according to the following:
 - 1. 2-Inch NPS (DN50) and Smaller: Threaded.
 - 2. 2-1/2-Inch NPS (DN65) and Larger: Flanged.
- B. Stainless-Steel-Hose/Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include steel nipples or flanges, welded to hose.

2.6 MECHANICAL SLEEVE SEALS

- A. Description: Modular design, with interlocking rubber links shaped to continuously fill annular space between pipe and sleeve. Include connecting bolts and pressure plates.

2.7 PIPING SPECIALTIES

- A. Sleeves: The following materials are for wall, floor, slab, and roof penetrations:
 - 1. Steel Pipe: ASTM A 53, Type E, Grade A, Schedule 40, galvanized, plain ends.
 - 2. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
 - 3. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - a. Underdeck Clamp: Clamping ring with set screws.
- B. Escutcheons: Manufactured wall, ceiling, and floor plates; deep-pattern type if required to conceal protruding fittings and sleeves.
 - 1. ID: Closely fit around pipe, tube, and insulation of insulated piping.
 - 2. OD: Completely cover opening.
 - 3. Cast Brass: Split casting, with concealed hinge and set screw.
 - a. Finish: Polished chrome-plate.
 - 4. Cast-Iron Floor Plate: One-piece casting.

2.8 IDENTIFYING DEVICES AND LABELS

- A. General: Manufacturer's standard products of categories and types required for each application as referenced in other Division 15 Sections. If more than one type is specified for application, selection is Installer's option, but provide one selection for each product category.
- B. Equipment Nameplates: Metal nameplate with operational data engraved or stamped; permanently fastened to equipment.
 - 1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data.
 - 2. Location: Accessible and visible location.
- C. Snap-on Plastic Pipe Markers: Manufacturer's standard preprinted, semirigid, snap on, color-coded, complying with ASME A13.1.
- D. Plastic Duct Markers: Manufacturer's standard color-coded, laminated plastic. Comply with the following color code:
 - 1. Green: Cold air.
 - 2. Yellow: Hot air.
 - 3. Yellow/Green or Green: Supply air.
 - 4. Blue: Exhaust, outside, return, and mixed air.
 - 5. For hazardous exhausts, use colors and designs recommended by ASME A13.1.
 - 6. Nomenclature: Include the following:

- a. Direction of airflow.
 - b. Duct service.
 - c. Duct origin.
 - d. Duct destination.
 - e. Design cubic feet per meter (liters per second).
- E. Engraved Plastic-Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated.
 1. Fabricate in sizes required for message.
 2. Engraved with engraver's standard letter style, of sizes and with wording to match equipment identification.
 3. Punch for mechanical fastening.
 4. Thickness: 1/8 inch (3.2 mm), unless otherwise indicated.
 5. Fasteners: Self-tapping stainless-steel screws.
- F. Plastic Equipment Markers: Color-coded, laminated plastic. Comply with the following color code:
 1. Green: Cooling equipment and components.
 2. Yellow: Heating equipment and components.
 3. Yellow/Green: Combination cooling and heating equipment and components.
 4. Brown: Energy reclamation equipment and components.
 5. Blue: Equipment and components that do not meet any criteria above.
 6. For hazardous equipment, use colors and designs recommended by ASME A13.1.
 7. Nomenclature: Include the following, matching terminology on schedules as closely as possible:
 - a. Name and plan number.
 - b. Equipment service.
 - c. Design capacity.
 - d. Other design parameters such as pressure drop, entering and leaving conditions, and rpm.
 8. Size: Approximate 2-1/2 by 4 inches (65 by 100 mm) for control devices, dampers, and valves; and 4-1/2 by 6 inches (115 by 150 mm) for equipment.
- G. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in mechanical identification, with corresponding designations indicated. Use numbers, lettering, and wording indicated for proper identification and operation/maintenance of mechanical systems and equipment.
 1. Multiple Systems: If multiple systems of same generic name are indicated, provide identification that indicates individual system number and service such as "Boiler No. 3," "Air Supply No. 1H," or "Standpipe F12."

2.9 GROUT

- A. Nonshrink, Nonmetallic Grout: ASTM C 1107, Grade B.

1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psig (34.5-MPa), 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. General: Install piping as described below, unless piping Sections specify otherwise. Individual Division 15 piping Sections specify unique piping installation requirements.
- B. General Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated, unless deviations to layout are approved on Coordination Drawings.
- C. Install piping at indicated slope.
- D. Install components with pressure rating equal to or greater than system operating pressure.
- E. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.
- F. Install piping free of sags and bends.
- G. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.
- H. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.
- I. Install piping to allow application of insulation plus 1-inch (25-mm) clearance around insulation.
- J. Locate groups of pipes parallel to each other, spaced to permit valve servicing.
- K. Install fittings for changes in direction and branch connections.
- L. Install couplings according to manufacturer's written instructions.
- M. Install pipe escutcheons for pipe penetrations of concrete and masonry walls, wall board partitions, and suspended ceilings according to the following:
 1. Chrome-Plated Piping: Cast brass, one piece, with set screw, and polished chrome-plated finish. Use split-casting escutcheons if required, for existing piping.
 2. Uninsulated Piping Wall Escutcheons: Cast brass with set screw.
 3. Uninsulated Piping Floor Plates in Utility Areas: Cast-iron floor plates.

4. Insulated Piping: Cast brass; with concealed hinge, spring clips, and chrome-plated finish.
 5. Piping in Utility Areas: Cast brass, with set-screw or spring clips.
- N. Install sleeves for pipes passing through concrete and masonry walls, and concrete floor and roof slabs.
- O. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 2. Build sleeves into new walls and slabs as work progresses.
 3. Install sleeves large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - a. Steel Pipe Sleeves: For pipes smaller than 6-inch NPS (DN150).
 - b. Steel Sleeves: For pipes 6-inch NPS (DN150) and larger, penetrating gypsum-board partitions.
 - c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level.
 - 1) Seal space outside of sleeve fittings with nonshrink, nonmetallic grout.
 4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants. Refer to Division 7 Section "Joint Sealants" for materials.
 5. Use Type S, Grade NS, Class 25, Use O, neutral-curing silicone sealant, unless otherwise indicated.
- P. Aboveground, Exterior-Wall, Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeve for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
 2. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) in diameter and larger.
 3. Assemble and install mechanical sleeve seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.
- Q. Underground, Exterior-Wall, Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Size sleeve for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Assemble and install mechanical sleeve seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.
- R. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestopping materials. Refer to Division 7 Section "Firestopping" for materials.
- S. Verify final equipment locations for roughing-in.
- T. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.
- U. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping specification Sections:
1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
 2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
 3. Soldered Joints: Construct joints according to AWS's "Soldering Manual," Chapter "The Soldering of Pipe and Tube"; or CDA's "Copper Tube Handbook."
 4. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
 5. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - a. Note internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
 - b. Apply appropriate tape or thread compound to external pipe threads, unless dry seal threading is specified.
 - c. Align threads at point of assembly.
 - d. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
 - e. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
 6. Welded Joints: Construct joints according to AWS D10.12, "Recommended Practices and Procedures for Welding Low Carbon Steel Pipe," using qualified processes and welding operators according to "Quality Assurance" Article.
 7. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.
 8. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join pipe and fittings according to the following:
 - a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - b. ABS Piping: ASTM D 2235 and ASTM D 2661.

- c. CPVC Piping: ASTM D 2846 and ASTM F 493.
 - d. PVC Pressure Piping: ASTM D 2672.
 - e. PVC Nonpressure Piping: ASTM D 2855.
 - f. PVC to ABS Nonpressure Transition Fittings: Procedure and solvent cement according to ASTM D 3138.
9. Plastic Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657 procedures and manufacturer's written instructions. (Apply to all Lab waste piping)
- a. Plain-End Pipe and Fittings: Use butt fusion.
 - b. Plain-End Pipe and Socket Fittings: Use socket fusion.

V. Piping Connections: Make connections according to the following, unless otherwise indicated:

- 1. Install unions, in piping 2-inch NPS (DN50) and smaller, adjacent to each valve and at final connection to each piece of equipment with 2-inch NPS (DN50) or smaller threaded pipe connection.
- 2. Install flanges, in piping 2-1/2-inch NPS (DN65) and larger, adjacent to flanged valves and at final connection to each piece of equipment with flanged pipe connection.
- 3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
- 4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.2 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to provide maximum possible headroom, if mounting heights are not indicated.
- B. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to Architect.
- C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- D. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- E. Install equipment giving right of way to piping installed at required slope.
- F. Install flexible connectors on equipment side of shutoff valves, horizontally and parallel to equipment shafts if possible.

3.3 LABELING AND IDENTIFYING

- A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.
 - 1. Stenciled Markers: According to ASME A13.1.
 - 2. Plastic markers, with application systems. Install on insulation segment if required for hot, uninsulated piping.
 - 3. Locate pipe markers as follows if piping is exposed in finished spaces, machine rooms, and accessible maintenance spaces, such as shafts, tunnels, plenums, and exterior nonconcealed locations:
 - a. Near each valve and control device.
 - b. Near each branch, excluding short takeoffs for fixtures and terminal units. Mark each pipe at branch, if flow pattern is not obvious.
 - c. Near locations if pipes pass through walls, floors, ceilings, or enter nonaccessible enclosures.
 - d. At access doors, manholes, and similar access points that permit view of concealed piping.
 - e. Near major equipment items and other points of origination and termination.
 - f. Spaced at maximum of 50-foot (15-m) intervals along each run. Reduce intervals to 25 feet (7.5 m) in congested areas of piping and equipment.
 - g. On piping above removable acoustical ceilings, except omit intermediately spaced markers.
- B. Equipment: Install engraved plastic-laminate sign on or near each major item of mechanical equipment.
 - 1. Lettering Size: Minimum 1/4-inch- (6.4-mm-) high lettering for name of unit if viewing distance is less than 24 inches (610 mm), 1/2-inch- (12.7-mm-) high lettering for distances up to 72 inches (1800 mm), and proportionately larger lettering for greater distances. Provide secondary lettering two-thirds to three-fourths of size of principal lettering.
 - 2. Text of Signs: Provide name of identified unit. Include text to distinguish between multiple units, inform user of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.
- C. Duct Systems: Identify air supply, return, exhaust, intake, and relief ducts with duct markers; or provide stenciled signs and arrows, showing duct system service and direction of flow.
 - 1. Location: In each space, if ducts are exposed or concealed by removable ceiling system, locate signs near points where ducts enter into space and at maximum intervals of 50 feet (15 m).
- D. Adjusting: Relocate identifying devices as necessary for unobstructed view in finished construction.

3.4 PAINTING AND FINISHING

- A. Refer to Division 9 Section "Painting" for paint materials, surface preparation, and application of paint.

- B. Apply paint to exposed piping according to the following, unless otherwise indicated:
1. Interior, Ferrous Piping: Use semigloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
 2. Interior, Galvanized-Steel Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over galvanized metal primer.
 3. Interior, Ferrous Supports: Use semigloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
 4. Exterior, Ferrous Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over rust-inhibitive metal primer.
 5. Exterior, Galvanized-Steel Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over galvanized metal primer.
 6. Exterior, Ferrous Supports: Use semigloss, acrylic-enamel finish. Include two finish coats over rust-inhibitive metal primer.
- C. Do not paint piping specialties with factory-applied finish.
- D. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.5 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit. Follow supported equipment manufacturer's setting templates for anchor bolt and tie locations. Use 3000-psig (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."

3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGE

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
- B. Field Welding: Comply with AWS D1.1, "Structural Welding Code--Steel."

3.7 CUTTING AND PATCHING

- A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of trades involved.
- B. Repair cut surfaces to match adjacent surfaces.

3.8 GROUTING

- A. Install nonmetallic, nonshrink, grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's written instructions.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placing of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases to provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout according to manufacturer's written instructions.

END OF SECTION 15050

SECTION 15060 - HANGERS AND SUPPORTS

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 hangers and supports for mechanical system piping and equipment.
- B. Related Sections include the following:
 - 1. Division 13 Sections on fire-suppression piping for fire-suppression pipe hangers.
 - 2. Division 15 Section "Mechanical Vibration Controls and Seismic Restraints" for vibration isolation and seismic restraint devices.

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society for the Valve and Fittings Industry.
- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

- A. Design channel support systems for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
- B. Design heavy-duty steel trapezes for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
- C. Design seismic restraint hangers and supports for piping and equipment.
- D. Design and obtain approval from authorities having jurisdiction for seismic restraint hangers and supports for piping and equipment.

1.5 SUBMITTALS

- A. Product Data: For each type of pipe hanger, channel support system component, and thermal-hanger shield insert indicated.

- B. Shop Drawings: Signed and sealed by a qualified professional engineer for multiple piping supports and trapeze hangers. Include design calculations and indicate size and characteristics of components and fabrication details.
- C. Welding Certificates: Copies of certificates for welding procedures and operators.

1.6 QUALITY ASSURANCE

- A. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
- B. Engineering Responsibility: Design and preparation of Shop Drawings and calculations for each multiple pipe support and trapeze by a qualified professional engineer.
- C. Engineering Responsibility: Design and preparation of Shop Drawings and calculations for each multiple pipe support, trapeze, and seismic restraint by a qualified professional engineer.
 - 1. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of hangers and supports that are similar to those indicated for this Project in material, design, and extent.

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. Pipe Hangers:
 - a. B-Line Systems, Inc.
 - b. Grinnell Corp.
 - c. Michigan Hanger Co., Inc.
 - d. Piping Technology & Products, Inc.
 - 2. Channel Support Systems:
 - a. B-Line Systems, Inc.
 - b. Grinnell Corp.; Power-Strut Unit.
 - c. Michigan Hanger Co., Inc.; O-Strut Div.
 - d. Thomas & Betts Corp.
 - e. Unistrut Corp.
 - 3. Thermal-Hanger Shield Inserts:

- a. Carpenter & Patterson, Inc.
- b. Michigan Hanger Co., Inc.
- c. PHS Industries, Inc.
- d. Pipe Shields, Inc.
- e. Rilco Manufacturing Co., Inc.

2.2 MANUFACTURED UNITS

- A. Pipe Hangers, Supports, and Components: MSS SP-58, factory-fabricated components. Refer to "Hanger and Support Applications" Article in Part 3 for where to use specific hanger and support types.
 1. Galvanized, Metallic Coatings: For piping and equipment that will not have field-applied finish.
 2. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- B. Channel Support Systems: MFMA-2, factory-fabricated components for field assembly.
 1. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.
 2. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- C. Thermal-Hanger Shield Inserts: 100-psi (690-kPa) minimum compressive-strength insulation, encased in sheet metal shield.
 1. Material for Cold Piping: ASTM C 552, Type I cellular glass or water-repellent-treated, ASTM C 533, Type I calcium silicate with vapor barrier.
 2. Material for Hot Piping: ASTM C 552, Type I cellular glass or water-repellent-treated, ASTM C 533, Type I calcium silicate.
 3. For Trapeze or Clamped System: Insert and shield cover entire circumference of pipe.
 4. For Clevis or Band Hanger: Insert and shield cover lower 180 degrees of pipe.
 5. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.3 MISCELLANEOUS MATERIALS

- A. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.
- B. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars, black and galvanized.
- C. Grout: ASTM C 1107, Grade B, factory-mixed and -packaged, nonshrink and nonmetallic, dry, hydraulic-cement grout.
 1. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
 2. Properties: Nonstaining, noncorrosive, and nongaseous.
 3. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger requirements are specified in Sections specifying equipment and systems.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Specification Sections.
- C. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
 - 1. Adjustable Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30 (DN15 to DN750).
 - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F (49 to 232 deg C) pipes, NPS 4 to NPS 16 (DN100 to DN400), requiring up to 4 inches (100 mm) of insulation.
 - 3. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24 (DN15 to DN600), if little or no insulation is required.
 - 4. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4 (DN15 to DN100), to allow off-center closure for hanger installation before pipe erection.
 - 5. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN15 to DN200).
 - 6. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8 (DN10 to DN200).
 - 7. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36 (DN100 to DN900), with steel pipe base stanchion support and cast-iron floor flange.
 - 8. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36 (DN65 to DN900), if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
 - 9. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30 (DN25 to DN750), from two rods if longitudinal movement caused by expansion and contraction might occur.
 - 10. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20 (DN65 to DN500), from single rod if horizontal movement caused by expansion and contraction might occur.
 - 11. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42 (DN50 to DN1050), if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
 - 12. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24 (DN50 to DN600), if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
 - 13. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30 (DN50 to DN750), if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- D. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20 (DN20 to DN500), if longer ends are required for riser clamps.
- E. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Specification 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.
- F. Building Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
1. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction to attach to top flange of structural shape.
 2. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 3. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 4. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 5. C-Clamps (MSS Type 23): For structural shapes.
 6. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 7. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 8. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 9. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 10. 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 (675 kg).
 - c. Heavy (MSS Type 33): 3000 lb (1350 kg).
 11. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
 12. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where head room is limited.
- G. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Specification 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 by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe, 360-degree insert of high-density, 100-psi (690-kPa) minimum compressive-strength, water-repellent-treated calcium silicate or cellular-glass pipe insulation, same thickness as adjoining insulation with vapor barrier and encased in 360-degree sheet metal shield.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Pipe Hanger and Support Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Channel Support System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems.
 1. Field assemble and install according to manufacturer's written instructions.
- C. Heavy-Duty Steel Trapeze Installation: Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated, heavy-duty trapezes.
 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
 2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D-1.1.
- D. Install building attachments within concrete slabs or attach to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, and expansion joints, 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.
- E. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- F. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- G. 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.
- H. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- I. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping," is not exceeded.
- J. Insulated Piping: Comply with the following:

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 according to ASME B31.9.
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 (DN100) 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 arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN100) 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 (DN8 to DN90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
 - b. NPS 4 (DN100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
 - c. NPS 5 and NPS 6 (DN125 and DN150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
 - d. NPS 8 to NPS 14 (DN200 to DN350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
5. Pipes NPS 8 (DN200) and Larger: Include wood inserts.
6. Insert Material: Length at least as long as protective shield.
7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure above or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

3.4 METAL FABRICATION

- A. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes 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 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 contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

- A. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

3.6 PAINTING

- A. Touching Up: 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. Touching Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 9 Section "Painting."
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 15060

SECTION-15071 MECHANICAL VIBRATION AND SEISMIC CONTROLS

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. Elastomeric isolation pads and mounts.
 - 2. Restrained elastomeric isolation mounts.
 - 3. Housed spring mounts.
 - 4. Elastomeric hangers.
 - 5. Thrust limits.
 - 6. Pipe riser resilient supports.
 - 7. Seismic snubbers.
 - 8. Restraining cables.

1.3 DEFINITIONS

- A. A_v : Effective peak velocity related acceleration coefficient.
- B. OSHPD: Office of Statewide Health Planning & Development for the State of California. OSHPD assigns a unique anchorage preapproval "R" number to each seismic restraint it tests. The number describes a specific device applied as tested.

1.4 PERFORMANCE REQUIREMENTS

- A. Refer to North Carolina Building Code.
- B. Component Seismic Coefficient: Refer to North Carolina Building Code.
- C. Performance Criteria Factor: Refer to North Carolina Building Code.
- D. Attachment Amplification Factor: Refer to North Carolina Building Code.

1.5 SUBMITTALS

- A. Product Data: Include load deflection curves for each vibration isolation device.

- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Include the following:
1. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
 2. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system has been examined for excessive stress and that none will exist.
 3. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.
 4. Seismic-Restraint Details: Detail fabrication and attachment of seismic restraints and snubbers. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.
 5. Submittals for Interlocking Snubbers: Include load deflection curves up to **1/2-inch (13-mm)** deflection in x, y, and z planes.
- C. Welding certificates.
- D. Air-Mounting System Performance Certification: Include natural frequency, load, and damping tests performed by an independent laboratory or acoustician.
- E. Manufacturer Seismic Qualification Certification: Submit certification that all specified equipment will withstand seismic forces identified in "Performance Requirements" Article above. Include the following:
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.
 - 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.

1.6 QUALITY ASSURANCE

- A. Seismic-restraint devices shall have horizontal and vertical load testing and analysis performed according to OSHPD and shall bear anchorage pre-approval "R" number, from OSHPD or another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If pre-approved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer. Testing and

calculations must include both shear and tensile loads and 1 test or analysis at 45 degrees to the weakest mode.

- B. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."

1.7 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into base. Concrete, reinforcement, and formwork requirements are specified in Division 3.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 7 Section "Roof Accessories."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 VIBRATION ISOLATORS

- A. Available Manufacturers:
- B. Manufacturers:
 - 1. B-Line Systems, Inc.
 - 2. Kinetics Noise Control, Inc.
 - 3. Mason Industries, Inc.
 - 4. Vibration Isolation Co., Inc.
 - 5. Vibration Mountings & Controls/Korfund.
- C. Elastomeric Isolator Pads: Oil- and water-resistant elastomer or natural rubber, arranged in single or multiple layers, molded with a nonslip pattern and galvanized steel baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment.
 - 1. Material: Standard neoprene.
 - 2. Durometer Rating: 50.
 - 3. Number of Layers: 4.
- D. Elastomeric Mounts: Double-deflection type, with molded, oil-resistant rubber or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.

1. Durometer Rating: 50.
 - E. Restrained Elastomeric Mounts: All-directional elastomeric mountings with seismic restraint.
 1. Materials: Cast-ductile-iron housing containing two separate and opposing, molded, bridge-bearing neoprene elements that prevent central threaded sleeve and attachment bolt from contacting the casting during normal operation.
 2. Neoprene: Shock-absorbing materials compounded.
 - F. Housed Spring Mounts: Housed spring isolator with integral seismic snubbers.
 1. Housing: Ductile-iron or steel housing to provide all-directional seismic restraint.
 2. Base: Factory drilled for bolting to structure.
 3. Snubbers: Vertically adjustable to allow a maximum of **1/4-inch (6-mm)** travel before contacting a resilient collar.
 - G. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression and with a load stop. Include rod and angle-iron brackets for attaching to equipment.
 1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
 2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 4. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
 7. Coil Spring: Factory set and field adjustable for a maximum of **1/4-inch (6-mm)** movement at start and stop.
 - H. Pipe Riser Resilient Support: All-directional, acoustical pipe anchor consisting of 2 steel tubes separated by a minimum of **1/2-inch- (13-mm-)** thick, 60-durometer neoprene. Include steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions. Design support for a maximum load on the isolation material of **500 psig (3.45 MPa)** and for equal resistance in all directions.
 - I. Resilient Pipe Guides: Telescopic arrangement of 2 steel tubes separated by a minimum of **1/2-inch- (13-mm-)** thick, 60-durometer neoprene. Factory set guide height with a shear pin to allow vertical motion due to pipe expansion and contraction. Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.
- 2.3 SEISMIC-RESTRAINT DEVICES
- A. Available Manufacturers:
 - B. Manufacturers:

1. B-Line Systems, Inc.
 2. Kinetics Noise Control, Inc.
 3. Mason Industries, Inc.
 4. Unistrut Diversified Products Co.; Wayne Manufacturing Division.
 5. Vibration Eliminator Co., Inc.
 6. Vibration Mountings & Controls/Korfund.
- C. Resilient Isolation Washers and Bushings: 1-piece, molded, bridge-bearing neoprene complying with AASHTO M 251 and having a durometer of 50, plus or minus 5, with a flat washer face.
- D. Seismic Snubbers: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.
1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
 2. Resilient Isolation Washers and Bushings: 1-piece, molded, bridge-bearing neoprene complying with AASHTO M 251 and having a durometer of 50, plus or minus 5.
- E. Restraining Cables: Galvanized steel aircraft cables with end connections made of steel assemblies that swivel to final installation angle and utilize two clamping bolts for cable engagement.
- F. Anchor Bolts: Seismic-rated, drill-in, and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488/E 488M.

2.4 FACTORY FINISHES

- A. Manufacturer's standard prime-coat finish ready for field painting.
- B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.
1. Powder coating on springs and housings.
 2. All hardware shall be electrogalvanized. Hot-dip galvanize metal components for exterior use.
 3. Baked enamel for metal components on isolators for interior use.
 4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements, installation tolerances, and other conditions affecting performance.

- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install roof curbs, equipment supports, and roof penetrations as specified in Division 7 Section "Roof Accessories."
- B. Install thrust limits at centerline of thrust, symmetrical on either side of equipment.
- C. Install seismic snubbers on isolated equipment. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
- D. Install restraining cables at each trapeze and individual pipe hanger. At trapeze anchor locations, shackle piping to trapeze. Install cables so they do not bend across sharp edges of adjacent equipment or building structure.
- E. Install steel angles or channel, sized to prevent buckling, clamped with ductile-iron clamps to hanger rods for trapeze and individual pipe hangers. At trapeze anchor locations, shackle piping to trapeze. Requirements apply equally to hanging equipment. Do not weld angles to rods.
- F. Install resilient bolt isolation washers on equipment anchor bolts.

3.3 EQUIPMENT BASES

- A. Fill concrete inertia bases, after installing base frame, with 3000-psi (20.7-Mpa) concrete; trowel to a smooth finish.
 - 1. Cast-in-place concrete materials and placement requirements are specified in Division 3.
- B. Concrete Bases: Anchor equipment to concrete base according to supported equipment manufacturer's written instructions for seismic codes at Project site.
 - 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of 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 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. Cast-in-place concrete materials and placement requirements are specified in Division 3.

3.4 FIELD QUALITY CONTROL

- A. Testing: Engage a qualified testing agency to perform the following field quality-control testing:

B. Testing: Perform the following field quality-control testing:

1. Isolator seismic-restraint clearance.
2. Isolator deflection.
3. Snubber minimum clearances.

3.5 ADJUSTING

- A. Adjust isolators after piping systems have been filled and equipment is at operating weight.
- B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
- C. Attach thrust limits at centerline of thrust and adjust to a maximum of **1/4-inch (6-mm)** movement during start and stop.
- D. Adjust active height of spring isolators.
- E. Adjust snubbers according to manufacturer's written recommendations.
- F. Adjust seismic restraints to permit free movement of equipment within normal mode of operation.
- G. Torque anchor bolts according to equipment manufacturer's written recommendations to resist seismic forces.

3.6 CLEANING

- A. After completing equipment installation, inspect vibration isolation and seismic-control devices. Remove paint splatters and other spots, dirt, and debris.

END OF SECTION 15071

SECTION 15075 - MECHANICAL IDENTIFICATION

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 mechanical identification materials and devices.

1.3 SUBMITTALS

- A. Product Data: For identification materials and devices.
- B. Valve Schedules: For each piping system. Reproduce on standard-size bond paper. Tabulate valve number, piping system, system abbreviation as shown on tag, room or space location of valve, and variations for identification. Mark valves intended for emergency shutoff and similar special uses. Besides mounted copies, furnish copies for maintenance manuals specified in Division 1.

1.4 QUALITY ASSURANCE

- A. Comply with ASME A13.1, "Scheme for the Identification of Piping Systems" for lettering size, length of color field, colors, and viewing angles of identification devices.

1.5 SEQUENCING AND SCHEDULING

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 IDENTIFYING DEVICES AND LABELS

- A. General: Products specified are for applications referenced in other Division 15 Sections. If more than single type is specified for listed applications, selection is Installer's option.

- B. Equipment Nameplates: Metal permanently fastened to equipment with data engraved or stamped.
 - 1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and essential data.
 - 2. Location: Accessible and visible.
- C. Stencils: Standard stencils, prepared with letter sizes conforming to recommendations of ASME A13.1. Minimum letter height is 1-1/4 inches (30 mm) for ducts, and 3/4 inch (20 mm) for access door signs and similar operational instructions.
 - 1. Material: Brass.
 - 2. Stencil Paint: Exterior, oil-based, alkyd gloss black enamel, unless otherwise indicated. Paint may be in pressurized spray-can form.
 - 3. Identification Paint: Exterior, oil-based, alkyd enamel in colors according to ASME A13.1, unless otherwise indicated.
- D. Snap-On Plastic Pipe Markers: Manufacturer's standard preprinted, semirigid, snap-on type. Include color-coding according to ASME A13.1, unless otherwise indicated.
- E. Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): Full-band pipe markers, extending 360 degrees around pipe at each location.
- F. Pipes with OD, Including Insulation, 6 Inches (150 mm) and Larger: Either full-band or strip-type pipe markers, at least 3 times letter height and of length required for label.
- G. Lettering: Manufacturer's standard preprinted captions as selected by Architect.
- H. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.
 - 1. Arrows: Either integrally with piping system service lettering, to accommodate both directions, or as separate unit, on each pipe marker to indicate direction of flow.
- I. Plastic Duct Markers: Manufacturer's standard laminated plastic, in the following color codes:
 - 1. Green: Cold-air supply.
 - 2. Yellow: Hot-air supply.
 - 3. Blue: Exhaust, outside, return, and mixed air.
 - 4. Hazardous Material Exhausts: Use colors and designs recommended by ASME A13.1.
 - 5. Terminology: Include direction of airflow; duct service such as supply, return, and exhaust; duct origin, duct destination, and design flow.
- J. Valve Tags: Stamped or engraved with 1/4-inch (6-mm) letters for piping system abbreviation and 1/2-inch (13-mm) sequenced numbers. Include 5/32-inch (4-mm) hole for fastener.
 - 1. Material: 0.032-inch- (0.8-mm-) thick, polished brass.
 - 2. Size: 1-1/2-inches (40-mm) diameter, unless otherwise indicated.
 - 3. Shape: As indicated for each piping system.
- K. Valve Tag Fasteners: Brass S-hooks.

- L. Access Panel Markers: 1/16-inch- (2-mm-) thick, engraved plastic-laminate markers, with abbreviated terms and numbers corresponding to concealed valve. Provide 1/8-inch (3-mm) center hole for attachment.
- M. Valve Schedule Frames: Glazed display frame for removable mounting on masonry walls for each page of valve schedule. Include screws.
 - 1. Frame: Extruded aluminum.
 - 2. Glazing: ASTM C 1036, Type I, Class 1, Glazing quality B, 2.5-mm, single-thickness glass.
- N. Engraved Plastic-Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.
 - 1. Engraving: Engraver's standard letter style, of sizes and with terms to match equipment identification.
 - 2. Thickness: 1/8 inch (3 mm), unless otherwise indicated.
 - 3. Fasteners: Self-tapping, stainless-steel screws.
- O. Plasticized Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with mat finish suitable for writing.
 - 1. Size: 3-1/4 by 5-5/8 inches (85 by 145 mm).
 - 2. Fasteners: Brass grommets and wire.
 - 3. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.
- P. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in mechanical identification with corresponding designations indicated. Use numbers, letters, and terms indicated for proper identification, operation, and maintenance of mechanical systems and equipment.
 - 1. Multiple Systems: Identify individual system number and service if multiple systems of same name are indicated.

PART 3 - EXECUTION

3.1 LABELING AND IDENTIFYING PIPING SYSTEMS

- A. Install pipe markers on each system. Include arrows showing normal direction of flow.
- B. Marker Type: Plastic markers, with application systems. Install on pipe insulation segment where required for hot, noninsulated pipes.
- C. Fasten markers on pipes and insulated pipes smaller than 6 inches (150 mm) OD by one of following methods:

1. Snap-on application of pretensioned, semirigid plastic pipe marker.
 2. Laminated or bonded application of pipe marker to pipe or insulation.
- D. Fasten markers on pipes and insulated pipes 6 inches (150 mm) in diameter and larger by one of following methods:
1. Strapped to pipe or insulation with manufacturer's standard stainless-steel bands.
- E. Locate pipe markers and color bands where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior non-concealed locations according to the following:
1. Near each valve and control device.
 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Mark each pipe at branch, where flow pattern is not obvious.
 3. Near penetrations through walls, floors, ceilings, or nonaccessible 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 a maximum of 50-foot (15-m) intervals along each run. Reduce intervals to 25 feet (7.5 m) in areas of congested piping and equipment.
 7. On piping above removable acoustical ceilings, except omit intermediately spaced markers.

3.2 VALVE TAGS

- A. Install on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, plumbing fixture supply stops, 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 valve schedule.
- B. Valve Tag Application Schedule: Tag valves according to size, shape, color scheme, and with captions similar to those indicated in the following:
- C. Tag Material: Brass.
- D. Tag Size and Shape: According to the following:
1. Cold Water: 1-1/2 inches (40 mm), round.
 2. Hot Water: 1-1/2 inches (40 mm), square.
 3. Fire Protection: 2 inches (50 mm), round.
 4. Gas: 1-1/2 inches (40 mm), round.
 5. Steam: 1-1/2 inches (40 mm), round.
- E. Tag Color: According to the following:
1. Cold Water: Green.
 2. Hot Water: White.
 3. Fire Protection: Red.
 4. Gas: Yellow.

5. Steam: Black.

F. Letter Color: According to the following:

1. Cold Water: White.
2. Hot Water: White.
3. Fire Protection: White.
4. Gas: White.
5. Steam: White.

G. Install mounted valve schedule in each major equipment room.

3.3 EQUIPMENT SIGNS AND MARKERS

A. Install engraved plastic-laminate signs or equipment markers on or near each major item of mechanical equipment. Include signs for the following general categories of equipment:

1. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
2. Fire department hose valves and hose stations.
3. Meters, gages, thermometers, and similar units.
4. Fuel-burning units, including boilers and heaters.
5. Pumps, compressors, chillers, condensers, and similar motor-driven units.
6. Heat exchangers, coils, evaporators, cooling towers, and similar equipment.
7. Fans, blowers.
8. Packaged HVAC central-station and zone-type units.
9. Tanks and pressure vessels.
10. Strainers, filters, humidifiers, water-treatment systems, and similar equipment.

B. Duct Systems: Identify air supply, return, exhaust, intake, and relief ducts with duct markers; or provide stenciled signs and arrows showing service and direction of flow.

1. Location: Locate signs near points where ducts enter into concealed spaces and at maximum intervals of 50 feet (15 m) in each space where ducts are exposed or concealed by removable ceiling system.

3.4 ADJUSTING AND CLEANING

A. Relocate mechanical identification materials and devices that have become visually blocked by work of this or other Divisions.

B. Clean faces of identification devices and glass frames of valve charts.

END OF SECTION 15075

SECTION 15081 - DUCT INSULATION

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 semirigid and flexible duct, plenum, and breeching insulation; insulating cements; field-applied jackets; accessories and attachments; and sealing compounds.
- B. Related Sections include the following:
 - 1. Division 7 Section "Firestopping" for firestopping materials and requirements for penetrations through fire and smoke barriers.
 - 2. Division 15 Section "Equipment Insulation" for insulation materials and application for pumps, tanks, hydronic specialties, and other equipment.
 - 3. Division 15 Section "Pipe Insulation" for insulation for piping systems.

1.3 SUBMITTALS

- A. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details for the following:
 - 1. Removable insulation sections at access panels.
 - 2. Application of field-applied jackets.
 - 3. Applications at linkages for control devices.
- C. Installer Certificates: Signed by the Contractor certifying that installers comply with requirements.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program.
- B. Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.
2. Insulation Installed Outdoors: Flame-spread rating of 75 or less, and smoke-developed rating of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.

1.6 COORDINATION

- A. Coordinate clearance requirements with duct Installer for insulation application.

1.7 SCHEDULING

- A. Schedule insulation application after testing duct systems. Insulation application may begin on segments of ducts that have satisfactory test results.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Mineral-Fiber Insulation:
 - a. CertainTeed Manson.
 - b. Knauf FiberGlass GmbH.
 - c. Owens-Corning Fiberglas Corp.
 - d. Schuller International, Inc.
 2. Flexible Elastomeric Thermal Insulation:
 - a. Armstrong World Industries, Inc.
 - b. Rubatex Corp.
 3. Calcium Silicate Insulation:
 - a. Owens-Corning Fiberglas Corp.
 - b. Pabco.
 - c. Schuller International, Inc.

2.2 INSULATION MATERIALS

- A. Mineral-Fiber Board Thermal Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IB, without facing and with all-service jacket manufactured from kraft paper, reinforcing scrim, aluminum foil, and vinyl film.
- B. Mineral-Fiber Blanket Thermal Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II, without facing and with all-service jacket manufactured from kraft paper, reinforcing scrim, aluminum foil, and vinyl film.
- C. Flexible Elastomeric Thermal Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type II for sheet materials.
 - 1. Adhesive: As recommended by insulation material manufacturer.
 - 2. Ultraviolet-Protective Coating: As recommended by insulation manufacturer.
- D. Calcium Silicate Insulation: Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a nonasbestos fibrous reinforcement. Comply with ASTM C 533, Type I.

2.3 FIELD-APPLIED JACKETS

- A. General: ASTM C 921, Type 1, unless otherwise indicated.
- B. Foil and Paper Jacket: Laminated, glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil.
- C. Aluminum Jacket: Deep corrugated sheets manufactured from aluminum alloy complying with ASTM B 209 (ASTM B 209M), and having an integrally bonded moisture barrier over entire surface in contact with insulation. Metal thickness and corrugation dimensions are scheduled at the end of this Section.
 - 1. Finish: Stucco-embossed finish.
 - 2. Moisture Barrier: 1-mil- (0.025-mm-) thick, heat-bonded polyethylene and kraft paper.

2.4 ACCESSORIES AND ATTACHMENTS

- A. Glass Cloth and Tape: Comply with MIL-C-20079H, Type I for cloth and Type II for tape. Woven glass-fiber fabrics, plain weave, presized a minimum of 8 oz./sq. yd. (270 g/sq. m).
 - 1. Tape Width: 4 inches (100 mm).
- B. Bands: 3/4 inch (19 mm) wide, in one of the following materials compatible with jacket:
 - 1. Stainless Steel: ASTM A 666, Type 304; 0.020 inch (0.5 mm) thick.
- C. Wire: 0.062-inch (1.6-mm), soft-annealed, stainless steel.
- D. Adhesive-Attached Anchor Pins and Speed Washers: Galvanized steel plate, pin, and washer manufactured for attachment to duct and plenum with adhesive. Pin length sufficient for insulation thickness indicated.

1. Adhesive: Recommended by the anchor pin manufacturer as appropriate for surface temperatures of ducts, plenums, and breechings; and to achieve a holding capacity of 100 lb (45 kg) for direct pull perpendicular to the adhered surface.

2.5 VAPOR RETARDERS

- A. Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

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.
- B. 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.

3.3 GENERAL APPLICATION REQUIREMENTS

- A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; and free of voids throughout the length of ducts and fittings.
- B. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each duct system.
- C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Apply multiple layers of insulation with longitudinal and end seams staggered.
- E. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.
- F. Keep insulation materials dry during application and finishing.
- G. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.
- H. Apply insulation with the least number of joints practical.

- I. Apply insulation over fittings and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
- J. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic. Apply insulation continuously through hangers and around anchor attachments.
- K. Insulation Terminations: For insulation application where vapor retarders are indicated, seal ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
- L. Apply insulation with integral jackets as follows:
 - 1. Pull jacket tight and smooth.
 - 2. Joints and Seams: Cover with tape and vapor retarder as recommended by insulation material manufacturer to maintain vapor seal.
 - 3. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to duct flanges and fittings.
- M. Cut insulation according to manufacturer's written instructions to prevent compressing insulation to less than 75 percent of its nominal thickness.
- N. Install vapor-retarder mastic on ducts and plenums scheduled to receive vapor retarders.
 - 1. Ducts with Vapor Retarders: Overlap insulation facing at seams and seal with vapor-retarder mastic and pressure-sensitive tape having same facing as insulation. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-retarder seal.
 - 2. Ducts without Vapor Retarders: Overlap insulation facing at seams and secure with outward clinching staples and pressure-sensitive tape having same facing as insulation.
- O. Roof Penetrations: Apply insulation for interior applications to a point even with top of roof flashing.
 - 1. Seal penetrations with vapor-retarder mastic.
 - 2. Apply insulation for exterior applications tightly joined to interior insulation ends.
 - 3. Seal insulation to roof flashing with vapor-retarder mastic.
- P. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and partitions, except fire-rated walls and partitions.
- Q. Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire/smoke damper sleeves for fire-rated wall and partition penetrations.
- R. Floor Penetrations: Terminate insulation at underside of floor assembly and at floor support at top of floor.
 - 1. For insulation indicated to have vapor retarders, taper termination and seal insulation ends with vapor-retarder mastic.

3.4 MINERAL-FIBER INSULATION APPLICATION

- A. Blanket Applications for Ducts and Plenums: Secure blanket insulation with adhesive and anchor pins and speed washers.
1. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 2. Install anchor pins and speed washers on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches (450 mm) and smaller, along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.
 - b. On duct sides with dimensions larger than 18 inches (450 mm). Space 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Apply additional pins and clips to hold insulation tightly against surface at cross bracing.
 - c. Anchor pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 3. Impale insulation over anchors and attach speed washers.
 4. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 5. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation segment with 1/2-inch (13-mm) staples, 1 inch (25 mm) o.c., and cover with pressure-sensitive tape having same facing as insulation.
 6. Overlap unfaced blankets a minimum of 2 inches (50 mm) on longitudinal seams and end joints. Secure with steel band at end joints and spaced a maximum of 18 inches (450 mm) o.c.
 7. Apply insulation on rectangular duct elbows and transitions with a full insulation segment for each surface. Apply insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
 8. Insulate duct stiffeners, hangers, and flanges that protrude beyond the insulation surface with 6-inch- (150-mm-) wide strips of the same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with anchor pins spaced 6 inches (150 mm) o.c.
 9. Apply vapor-retarder mastic to open joints, breaks, and punctures for insulation indicated to receive vapor retarder.
- B. Board Applications for Ducts and Plenums: Secure board insulation with adhesive and anchor pins and speed washers.
1. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 2. Space anchor pins as follows:
 - a. On duct sides with dimensions 18 inches (450 mm) and smaller, along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.

- b. On duct sides with dimensions larger than 18 inches (450 mm). Space 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Apply additional pins and clips to hold insulation tightly against surface at cross bracing.
 - c. Anchor pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
3. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation segment with 1/2-inch (13-mm) staples, 1 inch (25 mm) o.c., and cover with pressure-sensitive tape having same facing as insulation.
5. Apply insulation on rectangular duct elbows and transitions with a full insulation segment for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Apply insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond the insulation surface with 6-inch- (150-mm-) wide strips of the same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with anchor pins spaced 6 inches (150 mm) o.c.
7. Apply vapor-retarder mastic to open joints, breaks, and punctures for insulation indicated to receive vapor retarder.

3.5 FLEXIBLE ELASTOMERIC THERMAL INSULATION APPLICATION

A. Apply insulation to ducts and plenums as follows:

1. Follow the manufacturer's written instructions for applying insulation.
2. Seal longitudinal seams and end joints with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the duct and plenum surface.

3.6 CALCIUM SILICATE INSULATION APPLICATION

A. Apply insulation according to the manufacturer's written instructions and as follows:

1. Secure single layer of insulation to duct with stainless-steel bands. Tighten bands without deforming the insulation material.
2. Apply two-layer insulation with joints tightly butted and staggered at least 3 inches (75 mm). Secure inner layer with 0.062-inch (1.6-mm), soft-annealed, stainless-steel wire. Secure outer layer with stainless-steel bands.
3. On exposed applications, without metal jacket, finish insulation with a skim coat of mineral-fiber, hydraulic-setting cement to surface of installed insulation. When dry, apply flood coat of lagging adhesive and press on one layer of glass cloth or tape. Overlap edges at least 1 inch (25 mm). Apply finish coat of lagging adhesive over glass cloth or tape. Thin the finish coat to achieve smooth finish.

3.7 FIELD-APPLIED JACKET APPLICATION

- A. Apply glass-cloth jacket, where indicated, directly over bare insulation or insulation with factory-applied jackets.
 - 1. Apply jacket smooth and tight to surface with 2-inch (50-mm) overlap at seams and joints.
 - 2. Embed glass cloth between two 0.062-inch- (1.6-mm-) thick coats of jacket manufacturer's recommended adhesive.
 - 3. Completely encapsulate insulation with jacket, leaving no exposed raw insulation.

3.8 FINISHES

- A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

3.9 DUCT SYSTEM APPLICATIONS

- A. Insulation materials and thicknesses are specified in schedules at the end of this Section.
- B. Materials and thicknesses for systems listed below are specified in schedules at the end of this Section.
- C. Insulate the following plenums and duct systems:
 - 1. Indoor concealed supply-, return-, and outside-air ductwork.
 - 2. Indoor exposed supply-, return-, and outside-air ductwork.
 - 3. Outdoor exposed supply and return ductwork.
- D. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:
 - 1. Factory-insulated plenums, casings, terminal boxes, and filter boxes and sections.
 - 2. Flexible connectors.
 - 3. Vibration-control devices.
 - 4. Testing agency labels and stamps.
 - 5. Nameplates and data plates.
 - 6. Access panels and doors in air-distribution systems.

3.10 INDOOR DUCT AND PLENUM APPLICATION SCHEDULE

- A. Service: Round, supply-air ducts, concealed.
 - 1. Material: **Mineral-fiber blanket.**
 - 2. Thickness: **1-1/2 inches (38 mm).**
 - 3. Number of Layers: **One.**
 - 4. Field-Applied Jacket: **Foil and paper.**
 - 5. Vapor Retarder Required: **Yes.**

- B. Service: Round, return-air ducts, concealed.
1. Material: **Mineral-fiber blanket.**
 2. Thickness: **1-1/2 inches (38 mm).**
 3. Number of Layers: **One.**
 4. Field-Applied Jacket: **Foil and paper.**
 5. Vapor Retarder Required: **Yes.**
- C. Service: Round, outside-air ducts, concealed
1. Material: Mineral-fiber blanket.
 2. Thickness: **1-1/2 inches.**
 3. Number of Layers: **One.**
 4. Field-Applied Jacket: **Foil and paper.**
 5. Vapor Retarder Required: **Yes.**
- D. Service: Rectangular, supply-air ducts, concealed.
1. Material: **Mineral-fiber blanket.**
 2. Thickness: **1-1/2 inches (38 mm).**
 3. Number of Layers: **One.**
 4. Field-Applied Jacket: **Foil and paper.**
 5. Vapor Retarder Required: **Yes.**
- E. Service: Rectangular, return-air ducts, concealed.
1. Material: **Mineral-fiber blanket.**
 2. Thickness: **1-1/2 inches (38 mm).**
 3. Number of Layers: **One.**
 4. Field-Applied Jacket: **Foil and paper.**
 5. Vapor Retarder Required: **Yes.**
- F. Service: Rectangular, outside-air ducts, concealed.
1. Material: Mineral-fiber blanket.
 2. Thickness: **2 inches**
 3. Number of Layers: **One.**
 4. Field-Applied Jacket: **Foil and paper.**
 5. Vapor Retarder Required: **Yes.**
- G. Service: Round, supply-air ducts, exposed in attic and equipment room spaces.
1. Material: **Mineral-fiber board.**
 2. Thickness: **1-1/2 inches (38 mm).**
 3. Number of Layers: **One.**
 4. Field-Applied Jacket: **Foil and paper.**
 5. Vapor Retarder Required: **Yes.**
- H. Service: Round, return-air ducts, exposed in attic and equipment room spaces.
1. Material: **Mineral-fiber board.**
 2. Thickness: **1-1/2 inches (38 mm).**
 3. Number of Layers: **One.**

4. Field-Applied Jacket: **Foil and paper.**
 5. Vapor Retarder Required: **Yes.**
- I. Service: Round, outside-air ducts, exposed.
1. Material: **Mineral-fiber blanket.**
 2. Thickness: **2 inches.**
 3. Number of Layers: **One.**
 4. Field-Applied Jacket: **Foil and paper.**
 5. Vapor Retarder Required: **Yes.**
- J. Service: Rectangular, supply-air ducts, exposed in equipment room spaces.
1. Material: **Mineral-fiber board.**
 2. Thickness: **2 inches (50 mm).**
 3. Number of Layers: **two.**
 4. Field-Applied Jacket: **Foil and paper.**
 5. Vapor Retarder Required: **Yes.**
- K. Service: Rectangular, return-air ducts, exposed in equipment room spaces.
1. Material: **Mineral-fiber blanket.**
 2. Thickness: **2 inches (50 mm).**
 3. Number of Layers: **two.**
 4. Field-Applied Jacket: **Foil and paper.**
 5. Vapor Retarder Required: **Yes.**
- L. Service: Rectangular, outside-air, supply and return air ducts, exposed in equipment rooms.
1. Material: **Mineral-fiber board.**
 2. Thickness: **2 inches (50 mm).**
 3. Number of Layers: **Two.**
 4. Field-Applied Jacket: **Foil and paper.**
 5. Vapor Retarder Required: **Yes.**

3.11 OUTDOOR DUCT AND PLENUM APPLICATION SCHEDULE

- A. Service: Round, supply-air ducts.
1. Material: **Mineral-fiber board.**
 2. Thickness: **2 inches (50 mm).**
 3. Number of Layers: **Two.**
 4. Field-Applied Jacket: **Aluminum.**
 - a. Aluminum Thickness: **0.032 inch (0.8 mm).**
 - b. Corrugation Dimension: **1-1/4 by 1/4 inch (32 by 6 mm).**
 5. Vapor Retarder Required: **Yes.**
- B. Service: Round, return-air ducts.

1. Material: **Mineral-fiber board.**
2. Thickness: **2 inches (50 mm).**
3. Number of Layers: **Two.**
4. Field-Applied Jacket: Aluminum.
 - a. Aluminum Thickness: **0.032 inch (0.8 mm).**
 - b. Corrugation Dimension: **1-1/4 by 1/4 inch (32 by 6 mm).**
5. Vapor Retarder Required: **Yes.**

C. Service: Rectangular, supply-air ducts.

1. Material: **Mineral-fiber board.**
2. Thickness: **2 inches (50 mm).**
3. Number of Layers: **Two.**
4. Field-Applied Jacket: Aluminum.
 - a. Aluminum Thickness: **0.032 inch (0.8 mm).**
 - b. Corrugation Dimension: **1-1/4 by 1/4 inch (32 by 6 mm).**
5. Vapor Retarder Required: **Yes.**

D. Service: Rectangular, return-air ducts.

1. Material: **Mineral-fiber board.**
2. Thickness: **2 inches (50 mm).**
3. Number of Layers: **Two.**
4. Field-Applied Jacket: Aluminum.
 - a. Aluminum Thickness: **0.032 inch (0.8 mm).**
 - b. Corrugation Dimension: **1-1/4 by 1/4 inch (32 by 6 mm).**
5. Vapor Retarder Required: **Yes.**

END OF SECTION 15081

SECTION 15082 - EQUIPMENT INSULATION

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 blanket, board, and block insulation; insulating cements; field-applied jackets; accessories and attachments; and sealing compounds.
- B. Related Sections include the following:
 - 1. Division 15 Section "Duct Insulation" for insulation materials and application for ducts and plenums.
 - 2. Division 15 Section "Pipe Insulation" for insulation for piping systems.

1.3 SUBMITTALS

- A. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details for the following:
 - 1. Field application for each equipment type.
 - 2. Removable insulation sections at access panels.
 - 3. Application of field-applied jackets.
 - 4. Special shapes for cellular-glass insulation.
- C. Installer Certificates: Signed by the Contractor certifying that installers comply with requirements.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program.
- B. Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.
2. Insulation Installed Outdoors: Flame-spread rating of 75 or less, and smoke-developed rating of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.

1.6 COORDINATION

- A. Coordinate clearance requirements with equipment Installer for insulation application.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Mineral-Fiber Insulation:
 - a. CertainTeed Manson.
 - b. Knauf FiberGlass GmbH.
 - c. Owens-Corning Fiberglas Corp.
 - d. Schuller International, Inc.
 2. Cellular-Glass Insulation:
 - a. Pittsburgh-Corning Corp.
 3. Flexible Elastomeric Thermal Insulation:
 - a. Armstrong World Industries, Inc.
 - b. Rubatex Corp.
 4. Calcium Silicate Insulation:
 - a. Owens-Corning Fiberglas Corp.
 - b. Pabco.
 - c. Schuller International, Inc.

2.2 INSULATION MATERIALS

- A. Mineral-Fiber Board Thermal Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IB, without facing and with all-service jacket manufactured from kraft paper, reinforcing scrim, aluminum foil, and vinyl film.
- B. Mineral-Fiber Blanket Thermal Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II, without facing and with all-service jacket manufactured from kraft paper, reinforcing scrim, aluminum foil, and vinyl film.
- C. Cellular-Glass Insulation: Inorganic, foamed or cellulated glass, annealed, rigid, hermetically sealed cells, incombustible.
 - 1. Block Insulation: ASTM C 552, Type I.
 - 2. Special-Shaped Insulation: ASTM C 552, Type III.
 - 3. Board Insulation: ASTM C 552, Type IV.
- D. Flexible Elastomeric Thermal Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type II for sheet materials.
 - 1. Adhesive: As recommended by insulation material manufacturer.
 - 2. Ultraviolet-Protective Coating: As recommended by insulation manufacturer.
- E. Closed-Cell Phenolic-Foam Insulation: Block insulation of rigid, expanded, closed-cell structure. Comply with ASTM C 1126, Type II, Grade 1.
- F. Calcium Silicate Insulation: Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a nonasbestos fibrous reinforcement. Comply with ASTM C 533, Type I.

2.3 FIELD-APPLIED JACKETS

- A. General: ASTM C 921, Type 1, unless otherwise indicated.
- B. Foil and Paper Jacket: Laminated, glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil.
- C. PVC Jacket: High-impact, ultraviolet-resistant PVC; 20 mils (0.5 mm) thick; roll stock ready for shop or field cutting and forming.
 - 1. Adhesive: As recommended by insulation material manufacturer.
 - 2. PVC Jacket Color: White.
- D. Aluminum Jacket: Deep corrugated sheets manufactured from aluminum alloy complying with ASTM B 209 (ASTM B 209M), and having an integrally bonded moisture barrier over entire surface in contact with insulation. Metal thickness and corrugation dimensions are scheduled at the end of this Section.
 - 1. Finish: Stucco-embossed finish.
 - 2. Moisture Barrier: 1-mil- (0.025-mm-) thick, heat-bonded polyethylene and kraft paper.

2.4 ACCESSORIES AND ATTACHMENTS

- A. Glass Cloth and Tape: Comply with MIL-C-20079H, Type I for cloth and Type II for tape. Woven glass-fiber fabrics, plain weave, presized a minimum of 8 oz./sq. yd. (270 g/sq. m).
 - 1. Tape Width: 4 inches (100 mm).
- B. Bands: 3/4 inch (19 mm) wide, in one of the following materials compatible with jacket:
 - 1. Stainless Steel: ASTM A 666, Type 304; 0.020 inch (0.5 mm) thick.
- C. Wire: 0.062-inch (1.6-mm), soft-annealed, stainless steel.
- D. Adhesive-Attached Anchor Pins and Speed Washers: Galvanized steel plate, pin, and washer manufactured for attachment to duct and plenum with adhesive. Pin length sufficient for insulation thickness indicated.
 - 1. Adhesive: Recommended by the anchor pin manufacturer as appropriate for surface temperatures of ducts, plenums, and breechings; and to achieve a holding capacity of 100 lb (45 kg) for direct pull perpendicular to the adhered surface.

2.5 VAPOR RETARDERS

- A. Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

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.
- B. 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.

3.3 GENERAL APPLICATION REQUIREMENTS

- A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; and free of voids throughout the length of equipment.

- B. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each equipment system.
- C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either the wet or dry state.
- D. Apply multiple layers of insulation with longitudinal and end seams staggered.
- E. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.
- F. Keep insulation materials dry during application and finishing.
- G. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.
- H. Apply insulation with the least number of joints practical.
- I. Apply insulation over fittings and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
- J. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic. Apply insulation continuously through hangers and around anchor attachments.
- K. Insulation Terminations: For insulation application where vapor retarders are indicated, seal ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
- L. Apply insulation with integral jackets as follows:
 - 1. Pull jacket tight and smooth.
 - 2. Joints and Seams: Cover with tape and vapor retarder as recommended by insulation material manufacturer to maintain vapor seal.
 - 3. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to flanges and fittings.
- M. Cut insulation according to manufacturer's written instructions to prevent compressing insulation to less than 75 percent of its nominal thickness.
- N. Install vapor-retarder mastic on equipment scheduled to receive vapor retarders. Overlap insulation facing at seams and seal with vapor-retarder mastic and pressure-sensitive tape having same facing as insulation. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-retarder seal.
- O. Insulate the following indoor equipment:
 - 1. Chilled-water air separators (small tanks).
 - 2. Chilled-water centrifugal pump housings.
 - 3. Heating hot-water air separators (small tanks).

4. Steam-to-water converters, not factory insulated.
5. Deaerators, not factory insulated.

P. Omit insulation from the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.4 INDOOR TANK AND VESSEL INSULATION APPLICATION

A. Blankets, Board, and Block Applications for Tanks and Vessels: Secure insulation with adhesive and anchor pins and speed washers.

1. Apply adhesives according to manufacturer's recommended coverage rates per square foot, for 100 percent coverage of tank and vessel surfaces.
2. Groove and score insulation materials to fit as closely as possible to the equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joint. Stagger end joints.
3. Protect exposed corners with secured corner angles.
4. Install adhesive-attached or self-adhesive anchor pins and speed washers on sides of tanks and vessels as follows:
 - a. Do not weld anchor pins to ASME-labeled pressure vessels.
 - b. On tank and vessel, 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c. in both directions.
 - c. Do not overcompress insulation during installation.
 - d. Cut and miter insulation segments to fit curved sides and dome heads of tanks and vessels.
5. Impale insulation over anchor pins and attach speed washers.
6. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing
7. Secure each layer of insulation with stainless-steel bands.
8. Stagger joints between insulation layers at least 3 inches (75 mm).
9. Apply insulation in removable segments on equipment access doors and other elements that require frequent removal for service.
10. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
11. Apply vapor-retarder mastic to open joints, breaks, and punctures for insulation indicated to receive vapor retarder.

B. Flexible Elastomeric Thermal Insulation Applications for Tanks and Vessels: Apply insulation over entire surface of tanks and vessels according to the manufacturer's written instructions.

1. Apply 100 percent coverage of adhesive to surface with manufacturer's recommended adhesive.

2. Seal longitudinal seams and end joints.

3.5 FIELD-APPLIED JACKET APPLICATION

- A. Apply glass-cloth jacket where indicated, directly over bare insulation or insulation with factory-applied jackets.
 1. Apply jacket smooth and tight to surface with 2-inch (50-mm) overlap at seams and joints.
 2. Embed glass cloth between two 0.062-inch- (1.6-mm-) thick coats of jacket manufacturer's recommended adhesive.
 3. Completely encapsulate insulation with jacket, leaving no exposed raw insulation.
- B. Foil and Paper Jackets: Apply foil and paper jackets where indicated.
 1. Draw jacket material smooth and tight.
 2. Apply lap or joint strips with the same material as jacket.
 3. Secure jacket to insulation with manufacturer's recommended adhesive.
 4. Apply jackets with 1-1/2-inch (40-mm) laps at longitudinal seams and 3-inch- (75-mm-) wide joint strips at end joints.
 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-retarder mastic.
- C. PVC Jackets: Apply jacket with longitudinal seams along top and bottom of tanks and vessels for horizontal applications. Secure and seal seams and end joints with manufacturer's welding adhesive.
 1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along the seam and joint edge.
- D. Aluminum Jackets: Secure jackets according to jacket manufacturer's written instructions.

3.6 FINISHES

- A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

3.7 FIELD QUALITY CONTROL

- A. Inspection: Owner will engage a qualified inspection agency to perform the following field quality-control inspections, after installing insulation materials, jackets, and finishes, to determine compliance with requirements:
- B. Inspection: Engage a qualified inspection agency to perform the following field quality-control inspections, after installing insulation materials, jackets, and finishes, to determine compliance with requirements:

- C. Inspection: Perform the following field quality-control inspections, after installing insulation materials, jackets, and finishes, to determine compliance with requirements:
 - 1. Inspect pumps and tanks randomly selected by Architect.
 - 2. Remove insulation and covers from two chilled-water pumps or one percent of chilled-water pumps, whichever is greater.
 - 3. Remove insulation and covers from two small tanks or one percent of small tanks, whichever is greater.
- D. Insulation applications will be considered defective if sample inspection reveals noncompliance with requirements. Remove defective Work and replace with new materials according to these Specifications.
- E. Reinstall insulation and covers on pumps and tanks uncovered for inspection according to these Specifications.

3.8 EQUIPMENT APPLICATIONS

- A. Insulation materials and thicknesses are specified in schedules at the end of this Section.
- B. Materials and thicknesses for systems listed below are specified in schedules at the end of this Section.

3.9 INTERIOR TANK AND VESSEL INSULATION APPLICATION SCHEDULE

- A. Equipment: Chilled-water air separators.
 - 1. Operating Temperature: 35 to 75 deg F (2 to 24 deg C).
 - 2. Insulation Material: **Cellular glass, with jacket.**
 - 3. Insulation Thickness: 1-1/2".
 - 4. Field-Applied Jacket: Aluminum.
 - a. Aluminum Thickness: **0.032 inch (0.8 mm).**
 - b. Corrugation Dimension: **1-1/4 by 1/4 inch (32 by 6 mm).**
 - 5. Vapor Retarder Required: **Yes.**
 - 6. Finish: **None.**
- B. Equipment: Domestic hot-water storage tanks, not factory insulated.
 - 1. Operating Temperature: 55 to 140 deg F (13 to 60 deg C).
 - 2. Insulation Material: **Mineral fiber.**
 - 3. Insulation Thickness: 1-1/2".
 - 4. Field-Applied Jacket: Aluminum.
 - a. Aluminum Thickness: **0.032 inch (0.8 mm).**
 - b. Corrugation Dimension: **1-1/4 by 1/4 inch (32 by 6 mm).**
 - 5. Vapor Retarder Required: **No.**

6. Finish: **None**.
- C. Equipment: Heating hot-water air separators.
1. Operating Temperature: 100 to 200 deg F (38 to 93 deg C).
 2. Insulation Material: **Mineral fiber**.
 3. Insulation Thickness: 1-1/2".
 4. Field-Applied Jacket: Aluminum.
 - a. Aluminum Thickness: **0.032 inch (0.8 mm)**.
 - b. Corrugation Dimension: **1-1/4 by 1/4 inch (32 by 6 mm)**.
 5. Vapor Retarder Required: **No**.
 6. Finish: **None**.
- D. Equipment: Heating hot-water heat exchangers and steam-to-water converters.
1. Operating Temperature: 100 to 450 deg F (38 to 232 deg C).
 2. Insulation Material: **Calcium silicate**.
 3. Insulation Thickness: 2".
 4. Field-Applied Jacket: Aluminum.
 - a. Aluminum Thickness: **0.032 inch (0.8 mm)**.
 - b. Corrugation Dimension: **1-1/4 by 1/4 inch (32 by 6 mm)**.
 5. Vapor Retarder Required: **No**.
 6. Finish: **None**.
- E. Equipment: Heating hot-water heat exchangers, steam-to-water converters, and deaerators.
1. Operating Temperature: 100 to 450 deg F (38 to 232 deg C).
 2. Insulation Material: **Calcium silicate**.
 3. Insulation Thickness: 2".
 4. Field-Applied Jacket: Aluminum.
 - a. Aluminum Thickness: **0.032 inch (0.8 mm)**.
 - b. Corrugation Dimension: **1-1/4 by 1/4 inch (32 by 6 mm)**.
 5. Vapor Retarder Required: **No**.
 6. Finish: **None**.

END OF SECTION 15082

SECTION-15083
PIPE INSULATION

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 preformed, rigid and flexible pipe insulation; insulating cements; field-applied jackets; accessories and attachments; and sealing compounds.
- B. Related Sections include the following:
 - 1. Division 15 Section "Duct Insulation" for insulation for ducts and plenums.
 - 2. Division 15 Section "Hangers and Supports" for pipe insulation shields and protection saddles.

1.3 SUBMITTALS

- A. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details for the following:
 - 1. Application of protective shields, saddles, and inserts at pipe hangers for each type of insulation and hanger.
 - 2. Insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 - 3. Removable insulation at piping specialties and equipment connections.
 - 4. Application of field-applied jackets.
- C. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets with requirements indicated. Include dates of tests.
- D. Installer Certificates: Signed by the Contractor certifying that installers comply with requirements.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the U.S. Department of Labor, Bureau of Apprenticeship and Training.
- B. Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency.
 - 1. Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread rating of 75 or less, and smoke-developed rating of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification 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 insulation application.
- C. Coordinate installation and testing of steam or electric heat tracing.

1.7 SCHEDULING

- A. Schedule insulation application after testing piping systems and, where required, after installing and testing heat-trace tape. Insulation application may begin on segments of piping that have satisfactory test results.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Mineral-Fiber Insulation:
 - a. CertainTeed Manson.
 - b. Knauf FiberGlass GmbH.
 - c. Owens-Corning Fiberglas Corp.

- d. Schuller International, Inc.
- 2. Flexible Elastomeric Thermal Insulation: (use for refrigerant piping only)
 - a. Armstrong World Industries, Inc.
 - b. Rubatex Corp.

2.2 INSULATION MATERIALS

- A. Mineral-Fiber Insulation: Glass fibers bonded with a thermosetting resin complying with the following:
 - 1. Preformed Pipe Insulation: Comply with ASTM C 547, Type 1, with factory-applied, all-purpose, vapor-retarder jacket.
 - 2. Blanket Insulation: Comply with ASTM C 553, Type II, without facing.
 - 3. Fire-Resistant Adhesive: Comply with MIL-A-3316C in the following classes and grades:
 - a. Class 1, Grade A for bonding glass cloth and tape to unfaced glass-fiber insulation, for sealing edges of glass-fiber insulation, and for bonding lagging cloth to unfaced glass-fiber insulation.
 - b. Class 2, Grade A for bonding glass-fiber insulation to metal surfaces.
 - 4. Vapor-Retarder Mastics: Fire- and water-resistant, vapor-retarder mastic for indoor applications. Comply with MIL-C-19565C, Type II.
 - 5. Mineral-Fiber Insulating Cements: Comply with ASTM C 195.
 - 6. Expanded or Exfoliated Vermiculite Insulating Cements: Comply with ASTM C 196.
 - 7. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.
- B. Flexible Elastomeric Thermal Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
 - 1. Adhesive: As recommended by insulation material manufacturer.
 - 2. Ultraviolet-Protective Coating: As recommended by insulation manufacturer.

2.3 ACCESSORIES AND ATTACHMENTS

- A. Glass Cloth and Tape: Comply with MIL-C-20079H, Type I for cloth and Type II for tape. Woven glass-fiber fabrics, plain weave, presized a minimum of 8 oz./sq. yd. (270 g/sq. m).
 - 1. Tape Width: 4 inches (100 mm).
- B. Bands: 3/4 inch (19 mm) wide, in one of the following materials compatible with jacket:
 - 1. Stainless Steel: ASTM A 666, Type 304; 0.020 inch (0.5 mm) thick.
- C. Wire: 0.062-inch (1.6-mm), soft-annealed, stainless steel.

2.4 VAPOR RETARDERS

- A. Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

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.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry pipe and fitting surfaces. Remove materials that will adversely affect insulation application.

3.3 GENERAL APPLICATION REQUIREMENTS

- A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.
- B. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each piping system.
- C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Apply insulation with longitudinal seams at top and bottom of horizontal pipe runs.
- E. Apply 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. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.
- H. Keep insulation materials dry during application and finishing.
- I. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.
- J. Apply insulation with the least number of joints practical.

- K. Apply insulation over fittings, valves, and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated. Refer to special instructions for applying insulation over fittings, valves, and specialties.
- L. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic.
 - 1. Apply insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor retarders are indicated, extend insulation on anchor legs at least **12 inches (300 mm)** from point of attachment to pipe and taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
 - 3. Install insert materials and apply insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by the insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect the jacket from tear or puncture by the hanger, support, and shield.
- M. Insulation Terminations: For insulation application where vapor retarders are indicated, taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
- N. Apply adhesives and mastics at the manufacturer's recommended coverage rate.
- O. Apply insulation with integral jackets as follows:
 - 1. Pull jacket tight and smooth.
 - 2. Circumferential Joints: Cover 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 and spaced **4 inches (100 mm)** o.c.
 - 3. Longitudinal Seams: Overlap jacket seams at least **1-1/2 inches (40 mm)**. Apply 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 **4 inches (100 mm)** o.c.
 - a. Exception: Do not staple longitudinal laps on insulation having a vapor retarder.
 - 4. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to flanges, unions, valves, and fittings.
 - 5. At penetrations in jackets for thermometers and pressure gages, fill and seal voids with vapor-retarder mastic.
- P. Roof Penetrations: Apply insulation for interior applications to a point even with top of roof flashing.
 - 1. Seal penetrations with vapor-retarder mastic.
 - 2. Apply insulation for exterior applications tightly joined to interior insulation ends.
 - 3. Extend metal jacket of exterior insulation outside roof flashing at least **2 inches (50 mm)** below top of roof flashing.
 - 4. Seal metal jacket to roof flashing with vapor-retarder mastic.

- Q. Exterior Wall Penetrations: For penetrations of below-grade exterior walls, terminate insulation flush with mechanical sleeve seal. Seal terminations with vapor-retarder mastic.
- R. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and floors.
- S. Floor Penetrations: Apply insulation continuously through floor assembly.
 - 1. For insulation with vapor retarders, seal insulation with vapor-retarder mastic where floor supports penetrate vapor retarder.

3.4 MINERAL-FIBER INSULATION APPLICATION

- A. Apply insulation to straight pipes and tubes as follows:
 - 1. Secure each layer of preformed pipe insulation to pipe with wire, tape, or bands without deforming insulation materials.
 - 2. Where vapor retarders are indicated, seal longitudinal seams and end joints with vapor-retarder mastic. Apply vapor retarder to ends of insulation at intervals of **15 to 20 feet (4.5 to 6 m)** to form a vapor retarder between pipe insulation segments.
 - 3. For insulation with factory-applied jackets, secure laps with outward clinched staples at **6 inches (150 mm)** o.c.
 - 4. For insulation with factory-applied jackets with vapor retarders, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by the insulation material manufacturer and seal with vapor-retarder mastic.
- B. Apply insulation to flanges as follows:
 - 1. Apply preformed pipe insulation to outer diameter of pipe flange.
 - 2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
 - 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
 - 4. Apply canvas jacket material with manufacturer's recommended adhesive, overlapping seams at least **1 inch (25 mm)**, and seal joints with vapor-retarder mastic.
- C. Apply insulation to fittings and elbows as follows:
 - 1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
 - 2. When premolded insulation elbows and fittings are not available, apply mitered sections of pipe insulation, or glass-fiber blanket insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire, tape, or bands.
 - 3. Cover fittings with standard PVC fitting covers.
 - 4. Cover fittings with heavy PVC fitting covers. Overlap PVC covers on pipe insulation jackets at least **1 inch (25 mm)** at each end. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.

3.5 FLEXIBLE ELASTOMERIC THERMAL INSULATION APPLICATION

- A. Apply insulation to straight pipes and tubes as follows:
 - 1. Follow manufacturer's written instructions for applying insulation.
 - 2. Seal longitudinal seams and end joints with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.
- B. Apply insulation to flanges as follows:
 - 1. Apply pipe insulation to outer diameter of pipe flange.
 - 2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the 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 the same thickness as pipe insulation.
 - 4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.
- C. Apply insulation to fittings and elbows as follows:
 - 1. Apply mitered sections of pipe insulation.
 - 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.
- D. Apply insulation to valves and specialties as follows:
 - 1. Apply preformed valve covers manufactured of the same material as pipe insulation and attached according to the manufacturer's written instructions.
 - 2. Apply cut segments of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, fabricate removable sections of insulation arranged to allow access to stainer basket.
 - 3. Apply insulation to flanges as specified for flange insulation application.
 - 4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

3.6 PIPING SYSTEM APPLICATIONS

- A. Insulation materials and thicknesses are specified in schedules at the end of this Section.
- B. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:
 - 1. Flexible connectors.
 - 2. Vibration-control devices.
 - 3. Fire-suppression piping.
 - 4. Drainage piping located in crawl spaces, unless otherwise indicated.
 - 5. Below-grade piping, unless otherwise indicated.
 - 6. Chrome-plated pipes and fittings, unless potential for personnel injury.
 - 7. Air chambers, unions, strainers, check valves, plug valves, and flow regulators.

3.7 FIELD QUALITY CONTROL

- A. Inspection: Owner will engage a qualified inspection agency to perform the following field quality-control inspections, after installing insulation materials, jackets, and finishes, to determine compliance with requirements:
- B. Inspection: Perform the following field quality-control inspections, after installing insulation materials, jackets, and finishes, to determine compliance with requirements:
 - 1. Inspect fittings and valves randomly selected by Architect.
 - 2. Remove fitting covers from 20 elbows or 1 percent of elbows, whichever is less, for various pipe sizes.
 - 3. Remove fitting covers from 20 valves or 1 percent of valves, whichever is less, for various pipe sizes.
- C. Insulation applications will be considered defective if sample inspection reveals noncompliance with requirements. Remove defective Work and replace with new materials according to these Specifications.
- D. Reinstall insulation and covers on fittings and valves uncovered for inspection according to these Specifications.

3.8 INSULATION APPLICATION SCHEDULE, GENERAL

- A. Refer to insulation application schedules for required insulation materials, vapor retarders, and field-applied jackets.
- B. Application schedules identify piping system and indicate pipe size ranges and material, thickness, and jacket requirements.

3.9 INTERIOR INSULATION APPLICATION SCHEDULE

- A. Service: Domestic and Heating Hot water supply and return piping.
 - 1. Operating Temperature: 60 to 180 deg F (15 to 82 deg C).
 - 2. Insulation Material: Mineral fiber.
 - 3. Field-Applied Jacket: None.
 - 4. Vapor Retarder Required: No.
 - 5. Finish: None.
 - 6. Insulation Thickness: Apply the following insulation thicknesses:
 - a. Copper Pipe, 3/4" to 1-1/2": 1" (Domestic hot water or heating hot water)
 - b. Copper Pipe, 2" to 4": 1-1/2" (Domestic hot water or heating hot water)
 - c. Steel Pipe, 3/4" to 1-1/2":
 - d. Steel Pipe, 2" to 4": 1-1/2"
- B. Service: Condensate drain piping.

1. Operating Temperature: 35 to 75 deg F (2 to 24 deg C).
2. Insulation Material: Flexible elastomeric.
3. Insulation Thickness: 1"
4. Field-Applied Jacket: None.
5. Vapor Retarder Required: Yes.
6. Finish: None.

C. Service: Refrigerant suction.

1. Operating Temperature: 35 to 50 deg F (2 to 10 deg C).
2. Insulation Material: Flexible elastomeric.
3. Insulation Thickness: Apply the following insulation thicknesses:
 - a. Copper Pipe, 3/8" To 5/8": 1"
 - b. Copper Pipe, 7/8" To 1-3/8": 1-1/2"
 - c. Copper Pipe, 1-5/8" To 2-1/8": 2"
4. Field-Applied Jacket: None.
5. Vapor Retarder Required: Yes.
6. Finish: None.

D. Domestic Cold Water: With preformed fittings.

1. Field-Applied Jacket: None.
2. Vapor Retarder Required: Yes.
3. Finish None.
4. 1/2" to 1-1/2" : 1"
5. 2" to 4" : 1-1/2"

E. Service: Chilled-water supply and return.

1. Operating Temperature: 35 to 75 deg F (2 to 24 deg C).
2. Insulation Material: Mineral fiber
3. Insulation Thickness: Apply the following insulation thicknesses:
 - a. Steel Pipe, 3/4" to 1-1/2": 1-1/2"
 - b. Steel Pipe, 2" to 4": 1-1/2"
4. Field-Applied Jacket: None
5. Vapor Retarder Required: Yes.
6. Finish None.

END OF SECTION 15083

SECTION-15100 VALVES

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 general duty valves common to several mechanical piping systems.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Special purpose valves are specified in Division 15 piping system Sections.
 - 2. Valve tags and charts are specified in Division 15 Section "Mechanical Identification."

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 valve type. Include body material, valve design, pressure and temperature classification, end connection details, seating materials, trim material and arrangement, dimensions and required clearances, and installation instructions. Include list indicating valve and its application.
- C. Maintenance data for valves to include in the operation and maintenance manual specified in Division 1. Include detailed manufacturer's instructions on adjusting, servicing, disassembling, and repairing.

1.4 QUALITY ASSURANCE

- A. Single-Source Responsibility: Comply with the requirements specified in Division 1 Section "Materials and Equipment," under "Source Limitations" Paragraph.
- B. ASME Compliance: Comply with ASME B31.9 for building services piping and ASME B31.1 for power piping.
- C. MSS Compliance: Comply with the various MSS Standard Practice documents referenced.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, and weld ends.
3. Set globe and gate 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 indoors and maintain valve temperature higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use a sling to handle large valves. Rig to avoid damage to exposed parts. Do not use hand-wheels and stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Ball Valves:

- a. Conbraco Industries, Inc.; Apollo Division.
- b. Hammond Valve Corporation.
- c. Milwaukee Valve Company, Inc.
- d. NIBCO Inc.
- e. Stockham Valves & Fittings, Inc.

2. Plug Valves:

- a. Grinnell Corp.
- b. Huber: J.M. Huber Corp.; Flow Control Division (Resun Valves).
- c. NIBCO Inc.
- d. Stockham Valves & Fittings, Inc.

3. Butterfly Valves:

- a. Center Line, Mark Controls Corporation.
- b. General Signal; DeZurik Unit.
- c. Hammond Valve Corporation.
- d. Keystone Valve USA, Inc.
- e. Stockham Valves & Fittings, Inc.

4. Swing Check Valves:
 - a. Cla-Val Co.
 - b. Crane Company; Valves and Fitting Division.
 - c. Hammond Valve Corporation.
 - d. Lunkenheimer/Cincinnati Valve Co.
 - e. Milwaukee Valve Company, Inc.
 - f. Stockham Valves & Fittings, Inc.
5. Wafer Check Valves: (use wafer check valves in all pump discharge piping.)
 - a. Cla-Val Co.
 - b. Conbraco Industries, Inc.; Apollo Division.
 - c. Hammond Valve Corporation.
 - d. Keystone Valve USA, Inc.
 - e. Milwaukee Valve Company, Inc.
 - f. Stockham Valves & Fittings, Inc.

2.2 BASIC, COMMON FEATURES

- A. Design: Rising stem or rising outside screw and yoke stems, except as specified below.
 1. Nonrising stem valves may be used only where headroom prevents full extension of rising stems.
- B. Pressure and Temperature Ratings: As indicated in the "Application Schedule" of Part 3 of this Section and as required to suit system pressures and temperatures.
- C. Sizes: Same size as upstream pipe, unless otherwise indicated.
- D. Operators: Use specified operators and handwheels, except provide the following special operator features:
 1. Handwheels: For valves other than quarter turn.
 2. Lever Handles: For quarter-turn valves 6 inches (DN150) and smaller, except for plug valves, which shall have square heads. Furnish Owner with 1 wrench for every 10 plug valves.
- E. Extended Stems: Where insulation is indicated or specified, provide extended stems arranged to receive insulation.
- F. Bypass and Drain Connections: Comply with MSS SP-45 bypass and drain connections.
- G. Threads: ASME B1.20.1.
- H. Flanges: ASME B16.1 for cast iron, ASME B16.5 for steel, and ASME B16.24 for bronze valves.
- I. Solder Joint: ASME B16.18.

1. Caution: Where soldered end connections are used, use solder having a melting point below **840 deg F (450 deg C)** for globe, and check valves; below **421 deg F (216 deg C)** for ball valves.

2.3 BALL VALVES

- A. Ball Valves, **4 Inches (DN100)** and Smaller: MSS SP-110, Class 150, **600-psi (4140-kPa)** CWP, ASTM B 584 bronze body and bonnet, 2-piece construction; chrome-plated brass ball, standard port for **1/2-inch (DN15)** valves and smaller and conventional port for **3/4-inch (DN20)** valves and larger; blowout proof; bronze or brass stem; teflon seats and seals; threaded or soldered end connections:
 1. Operator: Vinyl-covered steel lever handle.

2.4 PLUG VALVES

- A. Plug Valves: MSS SP-78, **175-psi (1200-kPa)** CWP, ASTM A 126 cast-iron body and bonnet, cast-iron plug, Buna N, Viton, or teflon packing, flanged or grooved end connections:
 1. Operator: Square head with 1 wrench for every 10 valves.

2.5 BUTTERFLY VALVES

- A. Butterfly Valves: MSS SP-67, **200-psi (1380-kPa)** CWP, **150-psi (1035- kPa)** maximum pressure differential, ASTM A 126 cast-iron body and bonnet, extended neck, stainless-steel stem, field-replaceable EPDM or Buna N sleeve and stem seals, or lug style:
 1. Disc Type: Aluminum bronze.
 2. Operator for Sizes **2 Inches (DN50)** to **6 Inches (DN150)**: Standard lever handle with memory stop.

2.6 CHECK VALVES

- A. Swing Check Valves, **2-1/2 Inches (DN65)** and Smaller: MSS SP-80; Class 125, **200-psi (1380-kPa)** CWP, or Class 150, **300-psi (2070-kPa)** CWP; horizontal swing, Y-pattern, ASTM B 62 cast-bronze body and cap, rotating bronze disc with rubber seat or composition seat, threaded or soldered end connections:
- B. Swing Check Valves, **3 Inches (DN80)** and Larger: MSS SP-71, Class 125, **200-psi (1380-kPa)** CWP, ASTM A 126 cast-iron body and bolted cap, horizontal-swing bronze disc, flanged or grooved end connections.
- C. Wafer Check Valves: Class 125, **200-psi (1380-kPa)** CWP, ASTM A 126 cast-iron body, bronze disc/plates, stainless-steel pins and springs, Buna N seals, installed between flanges.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance of valves. Do not proceed with installation until unsatisfactory conditions have been corrected.
- B. 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.
- C. Operate valves from fully open to fully closed positions. Examine guides and seats made accessible by such operation.
- D. Examine threads on valve and mating pipe for form and cleanliness.
- E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Check gasket material for proper size, material composition suitable for service, and freedom from defects and damage.
- F. Do not attempt to repair defective valves; replace with new valves.

3.2 INSTALLATION

- A. Install valves as indicated, according to manufacturer's written instructions.
- B. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate the general arrangement of piping, fittings, and specialties.
- C. Install valves with unions or flanges at each piece of equipment arranged to allow servicing, maintenance, and equipment removal without system shutdown.
- D. Locate valves for easy access and provide separate support where necessary.
- E. Install valves in horizontal piping with stem at or above the center of the pipe.
- F. Install valves in a position to allow full stem movement.
- G. Installation of Check Valves: Install for proper direction of flow as follows:
 - 1. Wafer Check Valves: Horizontal or vertical position, between flanges.

3.3 SOLDERED CONNECTIONS

- A. Cut tube square and to exact lengths.
- B. Clean end of tube to depth of valve socket with steel wool, sand cloth, or a steel wire brush to a bright finish. Clean valve socket.
- C. Apply proper soldering flux in an even coat to inside of valve socket and outside of tube.
- D. Open valves to fully open position. Remove center of all ball valves before soldering.

- E. Remove the cap and disc holder of swing check valves having composition discs.
- F. Insert tube into valve socket, making sure the end rests against the shoulder inside valve. Rotate tube or valve slightly to ensure even distribution of the flux.
- G. Apply heat evenly to outside of valve around joint until solder melts on contact. Feed solder until it completely fills the joint around tube. Avoid hot spots or overheating valve. Once the solder starts cooling, remove excess amounts around the joint with a cloth or brush.

3.4 THREADED CONNECTIONS

- A. Note the internal length of threads in valve ends and proximity of valve internal seat or wall to determine how far pipe should be threaded into valve.
- B. Align threads at point of assembly.
- C. Apply appropriate tape or thread compound to the external pipe threads, except where dry seal threading is specified.
- D. Assemble joint, wrench tight. Wrench on valve shall be on the valve end into which the pipe is being threaded.

3.5 FLANGED CONNECTIONS

- A. Align flange surfaces parallel.
- B. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly with a torque wrench.
- C. For dead-end service, butterfly valves require flanges both upstream and downstream for proper shutoff and retention.

3.6 VALVE END SELECTION

- A. Select valves with the following ends or types of pipe/tube connections:
 - 1. Copper Tube Size, 2-1/2 Inches (DN65) and Smaller: Solder ends, except provide threaded ends for heating hot water and low-pressure steam service.
 - 2. Steel Pipe Sizes, 2-1/2 Inches (DN65) and Smaller: Threaded.
 - 3. Steel Pipe Sizes, 3 Inches (DN80) and Larger: Flanged.

3.7 APPLICATION SCHEDULE

- A. General Application: Use ball, and butterfly valves for shutoff duty; globe, ball, and butterfly for throttling duty. Refer to piping system Specification Sections for specific valve applications and arrangements.
- B. Domestic Water Systems, Chilled and Hot Water Piping System: Use the following valve types:
 - 1. Ball Valves: Class 150, 600-psi (4140-kPa) CWP, with stem extension.
 - 2. Plug Valves: Neoprene-faced plug, Buna N packing.
 - 3. Globe Valves: Class 125, bronze or cast-iron body to suit piping system, and bronze or teflon disc.
 - 4. Butterfly Valves: Nickel-plated ductile iron, aluminum bronze, or elastomer-coated ductile iron disc; EPDM or Buna N sleeve and stem seals.
 - 5. Bronze Swing Check: Class 125, with rubber seat.
 - 6. Check Valves: Class 150, wafer type as indicated.

3.8 ADJUSTING

- A. Adjust or replace packing after piping systems have been tested and put into service, but before final adjusting and balancing. Replace valves if leak persists.

END OF SECTION 15100

SECTION-15121
PIPE EXPANSION FITTINGS AND LOOPS

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 pipe expansion fittings and loops for mechanical piping systems, and the following:
 - 1. Pipe bends and loops.
 - 2. Guides and anchors.

1.3 PERFORMANCE REQUIREMENTS

- A. Compatibility: Products suitable for piping system fluids, materials, working pressures, and temperatures.
- B. Capability: Absorb 200 percent of maximum piping expansion between anchors.

1.4 SUBMITTALS

- A. Product Data: For each type of expansion fitting indicated.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer.
 - 1. Design Calculations: For thermal expansion of piping systems and selection and design of expansion fittings and loops.
 - 2. Anchor Details: Detail fabrication of each indicated. Show dimensions and methods of assembly.
 - 3. Alignment Guide Details: Detail field assembly and anchorage.
- C. Welding Certificates: Copies of certificates for welding procedures and personnel.
- D. Schedule: Indicate manufacturer's number, size, location, and features for each expansion fitting and loop.

1.5 QUALITY ASSURANCE

- A. Engineering Responsibility: Design and preparation of Shop Drawings and calculations for expansion fittings and loops by a qualified professional engineer.
 - 1. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of expansion fittings and loops that are similar to those indicated for this Project in material, design, and extent.
- B. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

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. Slip Expansion Joints:
 - a. Adsko Manufacturing Corp.
 - b. Advanced Thermal Systems, Inc.
 - c. Hyspan Precision Products, Inc.
 - 2. Guides:
 - a. Adsko Manufacturing Corp.
 - b. Advanced Thermal Systems, Inc.
 - c. B-Line Systems, Inc.
 - d. Flex-Weld, Inc.
 - e. Grinnell Corp.
 - f. Hyspan Precision Products, Inc.
 - g. Metraflex Co.

2.2 GUIDES

- A. Steel, factory fabricated, with bolted two-section outer cylinder and base for alignment of piping and two-section guiding spider for bolting to pipe.

2.3 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M.

- B. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel, hex head.
- C. Washers: ASTM F 844, steel, plain, flat washers.
- D. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened portland cement concrete, and tension and shear capacities appropriate for application.
 - 1. Stud: Threaded, zinc-coated carbon steel.
 - 2. Expansion Plug: Zinc-coated steel.
 - 3. Washer and Nut: Zinc-coated steel.
- E. Chemical Fasteners: Insert-type-stud bonding system anchor for use with hardened portland cement concrete, and tension and shear capacities appropriate for application.
 - 1. Bonding Material: ASTM C 881, Type IV, Grade 3, two-component epoxy resin suitable for surface temperature of hardened concrete where fastener is to be installed.
 - 2. Stud: ASTM A 307, zinc-coated carbon steel with continuous thread on stud, unless otherwise indicated.
 - 3. Washer and Nut: Zinc-coated steel.
- F. Concrete: Portland cement mix, 3000 psi (20.7 MPa) minimum. Refer to Division 3 Section "Cast-in-Place Concrete" for formwork, reinforcement, and concrete.
- G. Grout: ASTM C 1107, Grade B, factory-mixed and -packaged nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout.
 - 2. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 3. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 EXPANSION FITTING INSTALLATION

- A. Install expansion fittings according to manufacturer's written instructions.
- B. Install expansion fittings in sizes matching pipe size in which they are installed.
- C. Align expansion fittings to avoid end-loading and torsional stress.

3.2 PIPE BEND AND LOOP INSTALLATION

- A. Install pipe bends and loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.
- B. Attach pipe bends and loops to anchors.

1. Steel Anchors: Attach by welding. Comply with ASME B31.9 and ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
2. Concrete Anchors: Attach by fasteners. Follow fastener manufacturer's written instructions.

3.3 SWING CONNECTIONS

- A. Connect risers and branch connections to mains with at least five pipe fittings, including tee in main.
- B. Connect risers and branch connections to terminal units with at least four pipe fittings, including tee in riser.
- C. Connect mains and branch connections to terminal units with at least four pipe fittings, including tee in main.

3.4 GUIDE INSTALLATION

- A. Install guides on piping adjoining expansion fittings and loops.
- B. Attach guides to pipe and secure to building structure.

3.5 ANCHOR INSTALLATION

- A. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.
- B. Fabricate and install steel anchors by welding steel shapes, plates, and bars to piping and to structure. Comply with ASME B31.9 and AWS D1.1.
- C. Construct concrete anchors of poured-in-place concrete of dimensions indicated and include embedded fasteners.
- D. Install pipe anchors according to expansion fitting manufacturer's written instructions if expansion fittings are indicated.
- E. Use grout to form flat bearing surfaces for expansion fittings, guides, and anchors installed on or in concrete.

3.6 PAINTING

- A. Touching Up: 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. Touching Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 9 Section "Painting."
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 15121

SECTION 15122 - METERS AND GAGES

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 meters and gages for mechanical systems and water meters installed outside the building.
- B. Related Sections include the following:
 - 1. Division 15 Section "Steam and Condensate Piping" for steam and condensate meters.
 - 2. Mechanical equipment Sections that specify meters and gages as part of factory-fabricated equipment.

1.3 SUBMITTALS

- A. Product Data: Include scale range, ratings, and calibrated performance curves for each meter, gage, fitting, specialty, and accessory specified.
- B. Shop Drawings: Include schedule indicating manufacturer's number, scale range, fittings, and location for each meter and gage.
- C. Product Certificates: Signed by manufacturers of meters and gages certifying accuracies under specified operating conditions and compliance with specified requirements.
- D. Shop Drawings: For brackets for duct-mounting thermometers.
- E. Maintenance Data: For meters and gages to include in maintenance manuals specified in Division 1. Include data for the following:
 - 1. Flowmeters.
 - 2. Water meters.

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. Liquid-in-Glass Thermometers:
 - a. Dresser Industries, Inc.; Instrument Div.; Weksler Instruments Operating Unit.
 - b. Palmer Instruments, Inc.
 - c. Trerice: H. O. Trerice Co.
 - d. Weiss Instruments, Inc.
 - 2. Pressure Gages:
 - a. Dresser Industries, Inc.; Instrument Div.; Ashcroft Commercial Sales Operation.
 - b. Dresser Industries, Inc.; Instrument Div.; Weksler Instruments Operating Unit.
 - c. Trerice: H. O. Trerice Co.
 - d. Weiss Instruments, Inc.
 - 3. Test Plugs:
 - a. Peterson Equipment Co., Inc.
 - b. Sisco Manufacturing Co.
 - 4. Turbine Flowmeters:
 - a. Bailey-Fischer & Porter Co.
 - b. Baird Controls, Inc.
 - c. George Fischer Signet, Inc.
 - d. Onicon, Inc.
 - 5. Water Meters:
 - a. ABB Water Meters, Inc.
 - b. Badger Meter, Inc.; Industrial Div. (Milwaukee, WI).
 - c. Grinnell Corp.; Mueller Co.; Hersey Products Div.
 - d. Master Meter, Inc.
 - e. Schlumberger Industries, Inc.; Water Div.

2.2 THERMOMETERS, GENERAL

- A. Scale Range: Temperature ranges for services listed are as follows:
 - 1. Domestic Hot Water: 30 to 240 deg F, with 2-degree scale divisions (0 to 115 deg C, with 1-degree scale divisions).
 - 2. Domestic Cold Water: 0 to 100 deg F, with 2-degree scale divisions (minus 18 to plus 38 deg C, with 1-degree scale divisions).
 - 3. Hot Water: 30 to 300 deg F, with 2-degree scale divisions (0 to 150 deg C, with 1-degree scale divisions).

4. Condenser Water: 0 to 160 deg F, with 2-degree scale divisions (minus 18 to plus 70 deg C, with 1-degree scale divisions).
5. Chilled Water: 0 to 100 deg F, with 2-degree scale divisions (minus 18 to plus 38 deg C, with 1-degree scale divisions).
6. Steam and Condensate: 50 to 400 deg F, with 5-degree scale divisions (10 to 205 deg C, with 3-degree scale divisions).

2.3 LIQUID-IN-GLASS THERMOMETERS

- A. Description: ASTM E 1.
- B. Case: Die cast and aluminum finished in baked-epoxy enamel, glass front, spring secured, 9 inches (230 mm) long.
- C. Adjustable Joint: Finish to match case, 180-degree adjustment in vertical plane, 360-degree adjustment in horizontal plane, with locking device.
- D. Tube: Red reading, organic-liquid filled with magnifying lens.
- E. Scale: Satin-faced nonreflective aluminum with permanently etched markings.
- F. Stem: Brass for separable socket; of length to suit installation.

2.4 SEPARABLE SOCKETS

- A. Description: Fitting with protective socket for installation in threaded pipe fitting to hold fixed thermometer stem.
 1. Material: Brass, for use in copper piping.
 2. Material: Stainless steel, for use in steel piping.
 3. Extension-Neck Length: Nominal thickness of 2 inches (50 mm), but not less than thickness of insulation. Omit extension neck for sockets for piping not insulated.
 4. Insertion Length: To extend to one-third of diameter of pipe.
 5. Cap: Threaded, with chain permanently fastened to socket.
 6. Heat-Transfer Fluid: Oil or graphite.

2.5 THERMOMETER WELLS

- A. Description: Fitting with protective well for installation in threaded pipe fitting to hold test thermometer.
 1. Material: Brass, for use in copper piping.
 2. Material: Stainless steel, for use in steel piping.
 3. Extension-Neck Length: Nominal thickness of 2 inches (50 mm), but not less than thickness of insulation. Omit extension neck for wells for piping not insulated.
 4. Insertion Length: To extend to one-third of diameter of pipe.
 5. Cap: Threaded, with chain permanently fastened to socket.
 6. Heat-Transfer Fluid: Oil.

2.6 PRESSURE GAGES

- A. Description: ASME B40.1, phosphor-bronze bourdon-tube type with bottom connection; dry type, unless liquid-filled-case type is indicated.
- B. Case: Drawn brass with 4-1/2-inch- (115-mm-) diameter, glass lens.
- C. Connector: Brass, NPS 1/4 (DN8).
- D. Scale: White-coated aluminum with permanently etched markings.
- E. Accuracy: Grade A, plus or minus 1 percent of middle 50 percent of scale.
- F. Range: Comply with the following:
 - 1. Vacuum: 30 inches Hg of vacuum to 15 psig of pressure (100 kPa of vacuum to 103 kPa of pressure).
 - 2. Fluids under Pressure: Two times the operating pressure.

2.7 PRESSURE-GAGE FITTINGS

- A. Valves: NPS 1/4 (DN8) brass or stainless-steel needle type.
- B. Syphons: NPS 1/4 (DN8) coil of brass tubing with threaded ends.

2.8 TEST PLUGS

- A. Description: Nickel-plated, brass-body test plug in NPS 1/2 (DN15) fitting.
- B. Body: Length as required to extend beyond insulation.
- C. Pressure Rating: 500 psig (3450 kPa) minimum.
- D. Core Inserts: Two self-sealing valves, suitable for inserting 1/8-inch (3-mm) OD probe from dial-type thermometer or pressure gage.
- E. Core Material for Air, Water, Oil, and Gas: 20 to 200 deg F (Minus 7 to plus 93 deg C), chlorosulfonated polyethylene synthetic rubber.
- F. Test-Plug Cap: Gasketed and threaded cap, with retention chain or strap.
- G. Test Kit: Pressure gage and adapter with probe, two bimetal dial thermometers, and carrying case.
 - 1. Pressure Gage and Thermometer Ranges: Approximately two times the system's operating conditions.

2.9 TURBINE FLOWMETERS (Onicon Model F-1201)

- A. Description: Insertion type; measures flow with Analog output.
 - 1. Construction: 316 stainless-steel body and turbine or impeller.
 - 2. Pressure Rating: 400 psig (2760 kPa) minimum.
 - 3. Temperature Rating: 200 deg F (110 deg C) minimum.
 - 4. Supply Voltage: 24 VDC.
 - 5. Analog Output: DC Linearity: 0.1% of span, Current output: 4-20 mA.
 - 6. Accuracy: Plus or minus 2 percent.

2.10 WATER METERS

- A. Description: AWWA C700, displacement type, bronze case. Registers flow in gallons (liters) or cubic feet (cubic meters) as required.
- B. Description: AWWA C701, turbine type. Registers flow in gallons (liters) or cubic feet (cubic meters) as required.

PART 3 - EXECUTION

3.1 METER AND GAGE INSTALLATION, GENERAL

- A. Install meters, gages, and accessories according to manufacturer's written instructions for applications where used.

3.2 THERMOMETER INSTALLATION

- A. Install thermometers and adjust vertical and tilted positions.
- B. Install in the following locations:
 - 1. Inlet and outlet of each hydronic zone.
 - 2. Inlet and outlet of each chiller.
 - 3. Inlet and outlet of each hydronic coil in air-handling units and built-up central systems.
 - 4. Inlet and outlet of each hydronic heat exchanger.
- C. Install separable sockets in vertical position in piping tees where fixed thermometers are indicated.
 - 1. Install with socket extending to one-third of diameter of pipe.
 - 2. Fill sockets with oil and secure caps.

3.3 PRESSURE-GAGE INSTALLATION

- A. Install pressure gages in piping tees with pressure-gage valve located on pipe at most readable position.
- B. Install dry-type pressure gages in the following locations:

1. Discharge of each pressure-reducing valve.
 2. Chilled-water and condenser-water inlets and outlets of chillers.
- C. Install liquid-filled-type pressure gages at suction and discharge of each pump.
- D. Install pressure-gage needle valve and snubber in piping to pressure gages.
1. Exception: Install syphon instead of snubber in piping to steam pressure gages.

3.4 FLOWMETER INSTALLATION

- A. Install flowmeters and components according to manufacturer's written instructions.

3.5 WATER METER INSTALLATION

- A. Install water meters, piping, and specialties according to AWWA M6.
1. Install displacement-type water meters with shutoff valve on water meter inlet. Install valve on water meter outlet and valved bypass around meter.
 2. Install compound-type water meters with shutoff valves on water meter inlet and outlet and on valved bypass around meter.

3.6 ROUGHING-IN FOR WATER METERS

- A. Install roughing-in piping and specialties for water meter installation according to utility's instructions and requirements.

3.7 CONNECTIONS

- A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping and specialties. The following are specific connection requirements:
1. Install meters and gages adjacent to machines and equipment to allow service and maintenance.
 2. Connect flowmeter transmitters to BAS.
- B. Make electrical connections to power supply and electrically operated meters and devices.
- C. Ground electrically operated meters.
1. 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.
- D. Install electrical connections for power and devices.

- E. Electrical power, wiring, and connections are specified in Division 16 Sections.

3.8 ADJUSTING AND CLEANING

- A. Calibrate meters according to manufacturer's written instructions, after installation.
- B. Adjust faces of meters and gages to proper angle for best visibility.
- C. Clean windows of meters and gages and clean factory-finished surfaces. Replace cracked and broken windows, and repair scratched and marred surfaces with manufacturer's touchup paint.

END OF SECTION 15122

SECTION 15170 - MOTORS

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 basic requirements for factory-installed and field-installed motors.
- B. Related Sections include the following:
 - 1. Division 15 Sections for application of motors and reference to specific motor requirements for motor-driven equipment.

1.3 SUBMITTALS

- A. Product Data: Show nameplate data and ratings; characteristics; mounting arrangements; size and location of winding termination lugs, conduit entry, and grounding lug; and coatings.

1.4 QUALITY ASSURANCE

- A. Comply with NFPA 70.
- B. Listing and Labeling: Provide motors specified in this Section that are listed and labeled.
 - 1. Terms "Listed and Labeled": As defined in the National Electrical Code, Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.

PART 2 - PRODUCTS

2.1 BASIC MOTOR REQUIREMENTS

- A. Basic requirements apply to mechanical equipment motors, unless otherwise indicated.
- B. Motors 1/2 HP and Larger: Polyphase.
- C. Motors Smaller than 1/2 HP: Single phase.
- D. Frequency Rating: 60 Hz.

- E. Voltage Rating: Determined by voltage of circuit to which motor is connected.
- F. Service Factor: According to NEMA MG 1, unless otherwise indicated.
- G. Capacity and Torque Characteristics: Rated for continuous duty and sufficient to start, accelerate, and operate connected loads at designated speeds, in indicated environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.
- H. Enclosure: Open dripproof, unless otherwise indicated.

2.2 POLYPHASE MOTORS

- A. Description: NEMA MG 1, medium induction motor.
 - 1. Design Characteristics: NEMA MG 1, Design B, unless otherwise indicated.
 - 2. Energy-Efficient Design: EEIE-1
 - 3. Stator: Copper windings, unless otherwise indicated. Multispeed motors have separate winding for each speed.
 - 4. Rotor: Squirrel cage, unless otherwise indicated.
 - 5. Bearings: Double-shielded, prelubricated ball bearings suitable for radial and thrust loading.
 - 6. Temperature Rise: Match insulation rating, unless otherwise indicated.
 - 7. Insulation: Class F, unless otherwise indicated.
- B. Motors Used with Variable-Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
 - 1. Critical vibration frequencies are not within operating range of controller output.
 - 2. Temperature Rise: Match rating for Class B insulation.
 - 3. Insulation: Class H.
 - 4. Thermal Protection: Where indicated, conform to NEMA MG 1 requirements for thermally protected motors.
- C. Rugged-Duty Motors: Where indicated, motors are totally enclosed with 1.25 minimum service factor, greased bearings, integral condensate drains, and capped relief vents. Windings are insulated with nonhygroscopic material. External finish is chemical-resistant paint over corrosion-resistant primer.
- D. Source Quality Control: Perform the following routine tests according to NEMA MG 1:
 - 1. Measurement of winding resistance.
 - 2. No-load readings of current and speed at rated voltage and frequency.
 - 3. Locked rotor current at rated frequency.
 - 4. High-potential test.
 - 5. Alignment.

2.3 SINGLE-PHASE MOTORS

- A. Type: As indicated or selected by manufacturer from one of the following, to suit starting torque and other requirements of specific motor application.
 - 1. Permanent-split capacitor.
 - 2. Split-phase start, capacitor run.
 - 3. Capacitor start, capacitor run.
- B. Shaded-Pole Motors: Do not use, unless motors are smaller than 1/20 hp.
- C. Thermal Protection: Where indicated or required, internal protection automatically opens power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal protection device automatically resets when motor temperature returns to normal range, unless otherwise indicated.
- D. Bearings: Ball-bearing type for belt-connected motors and other motors with high radial forces on motor shaft. Sealed, prelubricated sleeve bearings for other single-phase motors.

PART 3 - EXECUTION

3.1 ADJUSTING

- A. Use adjustable motor mounting bases for belt-driven motors.
- B. Align pulleys and install belts.
- C. Tension according to manufacturer's written instructions.

END OF SECTION 15170

SECTION-15194
FUEL GAS PIPING

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 fuel gas piping, specialties, and accessories within the building.
- B. Related Sections include the following:
 - 1. Division 2 Section "Natural Gas Distribution" for natural gas service piping, specialties, and accessories outside the building.
 - 2. Division 15 Section "Meters and Gages" for pressure gages.

1.3 PROJECT CONDITIONS

- A. Gas System Pressure: One pressure range. Not more than 5.0 psig (34.5 kPa).
- B. Gas System Pressures: Two pressure ranges. Primary pressure is more than 0.5 psig (3.45 kPa) but not more than 2.0 psig (13.8 kPa), and is reduced to secondary pressure of 0.5 psig (3.45 kPa) or less.
- C. Gas System Pressures: Two pressure ranges. Primary pressure is more than 5.0 psig (34.5 kPa) and is reduced to secondary pressure of more than 6 in. wg.
- D. Design values of fuel gas supplied for these systems are as follows:
 - 1. Nominal Heating Value: 1000 Btu/cu. ft. (37.3 MJ/cu. m).
 - 2. Nominal Specific Gravity: 0.6.
 - 3. Nominal Heating Value: 2675 Btu/cu. ft. (100.0 MJ/cu. m).
 - 4. Nominal Specific Gravity: 1.6.

1.4 SUBMITTALS

- A. Product Data: For the following:
 - 1. Corrugated, stainless-steel tubing systems. Include associated components.
 - 2. Specialty valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.

3. Pressure regulators. Include pressure rating, capacity, and settings of selected models.

- B. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
- C. Maintenance Data: For natural gas specialties and accessories to include in maintenance manuals specified in Division 1.

1.5 QUALITY ASSURANCE

- A. Electrical Components and Devices: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. ANSI Standard: Comply with ANSI Z223.1, "National Fuel Gas Code."
- C. FM Standard: Provide components listed in FM's "Fire Protection Approval Guide" if specified to be FM approved.
- D. IAS Standard: Provide components listed in IAS's "Directory of A. G. A. and C. G. A Certified Appliances and Accessories" if specified to be IAS listed.
- E. UL Standard: Provide components listed in UL's "Gas and Oil Equipment Directory" if specified to be UL listed.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Handling Flammable Liquids: Remove and legally dispose of liquids from drips in existing gas piping. Handle cautiously to avoid spillage and ignition. Notify fuel gas supplier. Handle flammable liquids used by Installer with proper precautions and do not leave on premises from end of one day to beginning of next day.

1.7 COORDINATION

- A. 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 two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Architect's written permission.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Gas Valves, NPS 2 (DN 50) and Smaller:
 - a. Crane Valves.
 - b. Milwaukee Valve Co., Inc.
 - c. Mueller Co.; Mueller Gas Products Div.
 - d. Nibco, Inc.
2. Plug Valves, NPS 2-1/2 (DN 65) and Larger:
 - a. Milliken Valve Co., Inc.
 - b. Nordstrom Valves, Inc.
 - c. Olson Technologies, Inc.; Homestead Valve Div.
3. Electrically Operated Gas Valves: (FMA and UL Listed)
 - a. Atkomatic Valve Co., Inc.
 - b. Maxon, Inc.
 - c. Magnatrol Valve Corp.
 - d. Parker Hannifin Corp.; Climate & Industrial Controls Group; Skinner Valve Div.
4. Line Pressure Regulators:
 - a. Eclipse Combustion, Inc.
 - b. Fisher Controls International, Inc.
 - c. Maxitrol Co.
 - d. Richards Industries, Inc.; Jordan Valve Div.
 - e. Schlumberger Industries; Gas Div.

2.2 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.3 PIPES, TUBES, FITTINGS, AND JOINING MATERIALS

- A. Steel Pipe: ASTM A 53; Type E or S; Grade B; Schedule 40; black.
 1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern, with threaded ends according to ASME B1.20.1.
 2. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends according to ASME B1.20.1.
 3. Cast-Iron Flanges and Flanged Fittings: ASME B16.1, Class 125.
 4. Steel Welding Fittings: ASME B16.9, wrought steel or ASME B16.11, forged steel.
 5. Steel Threaded Fittings: ASME B16.11, forged steel with threaded ends according to ASME B1.20.1.
 6. Joint Compound and Tape: Suitable for natural gas.
 7. Steel Flanges and Flanged Fittings: ASME B16.5.
 8. Gasket Material: Thickness, material, and type suitable for natural gas.

- B. Hard Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B), water tube, drawn temper.
 - 1. Copper Fittings: ASME B16.22, wrought copper, streamlined pattern.
 - 2. Brazing Filler Metals: AWS A5.8, Silver Classification BAg-1. Filler metal containing phosphorus is prohibited.
 - 3. Bronze Flanges and Flanged Fittings: ASME B16.24, Class 150.
 - 4. Gasket Material: Thickness, material, and type suitable for natural gas.
- C. Soft Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B), water tube, annealed temper.
 - 1. Copper Fittings: ASME B16.22, wrought copper, streamlined pattern.
 - 2. Brazing Filler Metals: AWS A5.8, Silver Classification BAg-1. Filler metal containing phosphorus is prohibited.
- D. Transition Fittings: Type, material, and end connections to match piping being joined.
- E. Common Joining Materials: Refer to Division 15 Section "Basic Mechanical Materials and Methods" for joining materials not in this Section.

2.4 PIPING SPECIALTIES

- A. Flexible Connectors: ANSI Z21.24, copper alloy.

2.5 SPECIALTY VALVES

- A. Valves, NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.
- B. Valves, NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.
- C. Gas Stops: Bronze body with AGA stamp, plug type with bronze plug and flat or square head, ball type with chrome-plated brass ball and lever handle, or butterfly valve with stainless-steel disc and fluorocarbon elastomer seal and lever handle; 2-psig (13.8-kPa) minimum pressure rating.
- D. Gas Valves, NPS 2 (DN 50) and Smaller: ASME B16.33 and IAS-listed bronze body and 125-psig (860-kPa) pressure rating.
 - 1. Tamperproof Feature: Include design for locking.
- E. Plug Valves, NPS 2-1/2 (DN 65) and Larger: ASME B16.38 and MSS SP-78 cast-iron, lubricated plug valves, with 125-psig (860-kPa) pressure rating.
 - 1. Tamperproof Feature: Include design for locking.
- F. Electrically Operated Gas Valves: UL 429, bronze, or cast-iron body solenoid valve; 120-V ac, 60 Hz, Class B, continuous-duty molded coil. Include NEMA ISC 6, Type 4, coil enclosure and electrically opened and closed dual coils. Valve position shall normally be closed.

2.6 PRESSURE REGULATORS

- A. Description: Single stage and suitable for fuel gas service. Include steel jacket and corrosion-resistant components, elevation compensator, and atmospheric vent.
 - 1. NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.
 - 2. NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.
 - 3. Line Pressure Regulators: ANSI Z21.80 with 5-psig- (34.5-kPa-) minimum inlet pressure rating.
 - 4. Appliance Pressure Regulators: ANSI Z21.18. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
- B. Pressure Regulator Vents: Factory- or field-installed, corrosion-resistant screen in opening if not connected to vent piping.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Close equipment shutoff valves before turning off fuel gas to premises or section of piping. Perform leakage test as specified in "Field Quality Control" Article to determine that all equipment is turned off in affected piping section.
- B. Comply with ANSI Z223.1, "Prevention of Accidental Ignition" Paragraph.

3.2 PIPING APPLICATIONS

- A. Flanges, unions, transition, and special fittings with pressure ratings same as or higher than system pressure rating may be used in applications below, unless otherwise indicated.
- B. Fuel Gas Piping, 0.5 psig (3.45 kPa) or Less: Use the following:
 - 1. NPS 1/2 (DN 15) and Smaller: NPS 3/4 (DN 20) steel pipe, malleable-iron threaded fittings, and threaded joints.
 - 2. NPS 1/2 (DN 15) and Smaller: Hard copper tube, copper fittings, and brazed joints.
 - a. Option: Soft copper tube, copper fittings, and brazed joints may be used for runouts at individual appliances.
- C. Fuel Gas Piping 2 to 5 psig (13.8 to 34.5 kPa): Use the following:
 - 1. NPS 2 (DN 50) and Smaller: Steel pipe, malleable-iron threaded fittings, and threaded joints.
 - 2. NPS 2 (DN 50) and Smaller: Steel pipe, steel welding fittings, and welded joints.
 - 3. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Steel pipe, malleable-iron threaded fittings, and threaded joints.

3.3 VALVE APPLICATIONS

- A. Appliance Shutoff Valves for Pressure 0.5 to 2 psig (3.45 to 13.8 kPa): Gas stop or gas valve.
- B. Appliance Shutoff Valves for Pressure 2 to 5 psig (13.8 to 34.5 kPa): Gas valve.
- C. Piping Line Valves, NPS 2 (DN 50) and Smaller: Gas valve.
- D. Piping Line Valves, NPS 2-1/2 (DN 65) and Larger: Plug valve or general-duty valve.

3.4 PIPING INSTALLATION

- A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping installation requirements.
- B. Concealed Locations: Except as specified below, install concealed gas piping in airtight conduit constructed of Schedule 40, seamless, black steel pipe with welded joints. Vent conduit to outside and terminate with screened vent cap.
 - 1. Above-Ceiling Locations: Gas piping may be installed in accessible spaces, subject to approval of authorities having jurisdiction, whether or not such spaces are used as plenums. Do not locate valves above ceilings.
 - 2. In Partitions: Do not install concealed piping in solid partitions. Protect tubing from physical damage when installed inside partitions or hollow walls.
 - a. Exception: Tubing passing through partitions or walls.
 - 3. In Walls: Gas piping with welded joints and protective wrapping specified in "Protective Coating" Article in Part 2 may be installed in masonry walls, subject to approval of authorities having jurisdiction.
 - 4. Prohibited Locations: Do not install gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
 - a. Exception: Accessible above-ceiling space specified above.
- C. Drips and Sediment Traps: Install drips at points where condensate may collect. Include outlets of service meters. Locate where readily accessible for cleaning and emptying. Do not install where condensate would be subject to freezing.
 - 1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use minimum-length nipple of 3 pipe diameters, but not less than 3 inches (75 mm) long, and same size as connected pipe. Install with space between bottom of drip and floor for removal of plug or cap.
- D. Install fuel gas piping at uniform grade of 0.1 percent slope upward toward risers.
- E. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

- F. Connect branch piping from top or side of horizontal piping.
- G. Install unions in pipes NPS 2 (DN 50) and smaller, adjacent to each valve, at final connection to each piece of equipment, and elsewhere as indicated. Unions are not required on flanged devices.
- H. Install strainer on inlet of each line pressure regulator and automatic and electrically operated valve.
- I. Install pressure gage downstream from each line pressure regulator.
- J. Install flanges on valves, specialties, and equipment having NPS 2-1/2 (DN 65) and larger connections.
- K. Install vent piping for gas pressure regulators and gas trains, extend outside building, and vent to atmosphere. Terminate vents with turned-down, reducing-elbow fittings with corrosion-resistant insect screens in large end.
- L. Install containment conduits for gas piping within building, in gastight conduits extending minimum of 4 inches (100 mm) outside building, and vented to atmosphere. Terminate vents with turned-down, reducing-elbow fittings with corrosion-resistant insect screens in large end. Prepare and paint outside of conduits with coal-tar, epoxy-polyamide paint according to SSPC-Paint 16.

3.5 JOINT CONSTRUCTION

- A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.
- B. Use materials suitable for fuel gas.
 - 1. Brazed Joints: Make with brazing alloy with melting point greater than 1000 deg F (540 deg C). Brazing alloys containing phosphorus are prohibited.

3.6 HANGER AND SUPPORT INSTALLATION

- A. Refer to Division 15 Section "Hangers and Supports" for pipe hanger and support devices.
- B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
 - 1. NPS 1 (DN 25) and Smaller: Maximum span, 96 inches (2438 mm); minimum rod size, 3/8 inch (10 mm).
 - 2. NPS 1-1/4 (DN 32): Maximum span, 108 inches (2743 mm); minimum rod size, 3/8 inch (10 mm).
 - 3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): Maximum span, 108 inches (2743 mm); minimum rod size, 3/8 inch (10 mm).
 - 4. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): Maximum span, 10 feet (3 m); minimum rod size, 1/2 inch (13 mm).

- C. Install hangers for horizontal hard copper tubing with the following maximum spacing and minimum rod sizes:
 - 1. NPS 3/8 (DN 10): Maximum span, 48 inches (1219 mm); minimum rod size, 3/8 inch (10 mm).
 - 2. NPS 1/2 and NPS 5/8 (DN 15 and DN 18): Maximum span, 72 inches (1829 mm); minimum rod size, 3/8 inch (10 mm).
 - 3. NPS 3/4 and NPS 7/8 (DN 20 and DN 22): Maximum span, 84 inches (2134 mm); minimum rod size, 3/8 inch (10 mm).
 - 4. NPS 1 (DN 25): Maximum span, 96 inches (2438 mm); minimum rod size, 3/8 inch (10 mm).

3.7 CONNECTIONS

- A. Drawings indicate general arrangement of fuel gas piping, fittings, and specialties.
- B. Install piping adjacent to appliances to allow service and maintenance.
- C. Connect piping to appliances using gas with shutoff valves and unions. Install valve upstream from and within 72 inches (1800 mm) of each appliance. Install union downstream from valve.
- D. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance using gas.
- E. Ground equipment.
 - 1. 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.
 - 2. Do not use gas pipe as grounding electrode.

3.8 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each service meter, pressure regulator, and specialty valve.
 - 1. Text: In addition to name of identified unit, distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.
 - 2. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for nameplates and signs.

3.9 PAINTING

- A. Use materials and procedures in Division 9 Section "Painting," "Exterior Paint Schedule" Article, "Ferrous Metal" Paragraph, "Full-Gloss, Alkyd-Enamel Finish" Subparagraph.
- B. Paint exterior service meters, pressure regulators, and specialty valves.

1. Color: Gray.
- C. Paint piping.
 1. Color: Yellow.

3.10 FIELD QUALITY CONTROL

- A. Inspect, test, and purge piping according to ANSI Z223.1, Part 4 "Inspection, Testing, and Purging," and requirements of authorities having jurisdiction.
- B. Repair leaks and defects with new materials and retest system until satisfactory results are obtained.
- C. Report test results promptly and in writing to Architect and authorities having jurisdiction.
- D. Verify capacities and pressure ratings of service meters, pressure regulators, valves, and specialties.
- E. Verify correct pressure settings for pressure regulators.
- F. Verify that specified piping tests are complete.

3.11 ADJUSTING

- A. Adjust controls and safety devices. Replace damaged and malfunctioning controls and safety devices.

END OF SECTION 15194

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 plumbing fixtures and related components.
- B. Related Sections include the following:
 - 1. Division 15 Section "Emergency Plumbing Fixtures."
 - 2. Division 15 Section "Drinking Fountains and Water Coolers."
 - 3. Division 15 Section "Plumbing Specialties" for backflow preventers and specialty fixtures not in this Section.

1.3 DEFINITIONS

- A. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
- B. Fitting: Device that controls flow of water into or out of 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.

1.4 SUBMITTALS

- A. Product Data: Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports and indicate materials and finishes, dimensions, construction details, and flow-control rates for each type of fixture indicated.
- B. Shop Drawings: Diagram power, signal, and control wiring and differentiate between manufacturer-installed and field-installed wiring.
- C. Maintenance Data: For plumbing fixtures to include in maintenance manuals specified in Division 1.

1.5 QUALITY ASSURANCE

- A. 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.
- 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. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; about plumbing fixtures for people with disabilities.
- D. Regulatory Requirements: Comply with requirements in U.S. Architectural & Transportation Barriers Compliance Board's "Uniform Federal Accessibility Standards (UFAS), 1985-494-187" about plumbing fixtures for people with disabilities.
- E. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- F. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- G. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- H. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
 - 1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
 - 2. Hand Sinks: NSF 2 construction.
 - 3. Porcelain-Enameled, Formed-Steel Fixtures: ASME A112.19.4M.
 - 4. Vitreous-China Fixtures: ASME A112.19.2M.
 - 5. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.
 - 6. Water-Closet, Flushometer Tank Trim: ASSE 1037.
- I. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:
 - 1. Faucet Hose: ASTM D 3901.
 - 2. Faucets: ASME A112.18.1M.
 - 3. Hose-Connection Vacuum Breakers: ASSE 1011.
 - 4. Hose-Coupling Threads: ASME B1.20.7.
 - 5. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
 - 6. NSF Materials: NSF 61.
 - 7. Pipe Threads: ASME B1.20.1.
 - 8. Supply and Drain Fittings: ASME A112.18.1M.
- J. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:
 - 1. Atmospheric Vacuum Breakers: ASSE 1001.

2. Brass and Copper Supplies: ASME A112.18.1M.
3. Manual-Operation Flushometers: ASSE 1037.
4. Tubular Brass Drainage Fittings and Piping: ASME A112.18.1M.

K. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Disposers: ASSE 1008 and UL 430.
2. Floor Drains: ASME A112.21.1M.
3. Hose-Coupling Threads: ASME B1.20.7.
4. Off-Floor Fixture Supports: ASME A112.6.1M.
5. Pipe Threads: ASME B1.20.1.
6. Plastic Toilet Seats: ANSI Z124.5.
7. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.6 COORDINATION

- A. Coordinate roughing-in and final plumbing fixture locations, and verify that fixtures can be installed to comply with original design and referenced standards.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. For fixture descriptions in other Part 2 articles where the subparagraph titles "Manufacturers" introduce a list of manufacturers and their products or manufacturers only, the following requirements apply for product selection:
1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified in other Part 2 articles.

2.2 LAVATORY FAUCETS

- A. Lavatory Faucet: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes and outlet with spout and fixture receptor.
1. Products:
 - a. Chicago.
 - b. American Standard
 - c. Kohler
 - d. Delta
 2. Maximum Flow Rate: 2.2 gpm , unless otherwise indicated. 0.5 GPM for public use.
 3. Body Material: Cast brass.
 4. Finish: Polished chrome plate.
 5. Type: See Fixture Schedule.
 6. Centers: 4 inches (102 mm), 8 inches (203 mm). See Fixture Schedule.
 7. Mounting: Deck, exposed.
 8. Handle(s): Lever, Wrist blade, 4 inches (100 mm).
 9. Inlet(s): NPS 3/8 (DN 10) tubing, plain end, NPS 3/8 (DN 10) tubing, with NPS 1/2 (DN 15) male adaptor.

10. Spout: See Fixture Schedule.
11. Spout Outlet: Aerator Spray, 0.5 gpm (1.9 L/min.).
12. Drain: Grid.

2.3 SINK FAUCETS

- A. Sink Faucet: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes and outlet with spout and fixture receptor.
 1. Manufacturers:
 - a. Chicago
 - b. American Standard
 - c. Kohler
 - d. Delta
 2. Maximum Flow Rate: 2.2 gpm (9.5 L/min.), unless otherwise indicated.
 3. Body Material: Cast brass.
 4. Finish: Polished chrome plate.
 5. Type: Kitchen faucet without spray, Service sink faucet with stops in shanks, vacuum breaker, hose-thread outlet, and pail hook.
 6. Mixing Valve: Two-lever handle.
 7. Backflow Protection Device for Hose Outlet: Not required.
 8. Centers: 4 inches (102 mm). 8 inches (203 mm). See Fixture Schedule.
 9. Mounting: Deck, exposed.
 10. Handle[s]: Lever, Wrist blade, 4 inches (100 mm).
 11. Inlet[s]: NPS 3/8 (DN 10) plain-end tubing, NPS 3/8 (DN 10) tubing with NPS 1/2 (DN 15) male adapter.
 12. Spout: See Fixture Schedule.
 13. Spout Outlet: Aerator.
 14. Vacuum Breaker: Not required.
 15. Drain: See Fixture Schedule.

2.4 FLUSHOMETERS

- A. Flushometer: Cast-brass body with corrosion-resistant internal components, non-hold-open feature, control stop with check valve, vacuum breaker, and copper or brass tubing, and polished chrome-plated finish on exposed parts.
 1. Manufacturers:
 - a. Sloan Regal
 - b. Zurn
 - c. Delaney
 2. Internal Design: Diaphragm.
 3. Style: Exposed.
 4. Inlet Size: NPS 1 (DN 25).
 5. Trip Mechanism: Oscillating, lever-handle.
 6. Consumption: 1.6 gal./flush (6.0 L/flush).
 7. Tailpiece Size: NPS 1-1/2 (DN 40) length to top of bowl.
 8. Bedpan Washer: Not required.

2.5 TOILET SEATS

- A. Toilet Seat: Solid plastic.
 - 1. Manufacturers:
 - a. Olsonite
 - b. Church
 - c. Bemis
 - 2. Configuration: Open front without cover.
 - 3. Size: Elongated
 - 4. Class: Standard commercial.
 - 5. Hinge Type: See Fixture Schedule.
 - 6. Color: White.

2.6 PROTECTIVE SHIELDING GUARDS

- A. Protective Shielding Guard: Manufactured, plastic enclosure for covering for hot- and cold-water supplies and trap and drain piping and complying with ADA requirements.
 - 1. Manufacturers:
 - a. McGuire Mfg. Co.
 - b. Trubro, Inc.

2.7 FIXTURE SUPPORTS

- A. Water-Closet Support: Water-closet combination carrier designed for accessible and standard mounting height. Include single or double, vertical or horizontal, hub-and-spigot or hubless 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.
 - 1. Manufacturers:
 - a. Jay R. Smith Mfg. Co.
 - b. Tyler Pipe/Wade Division
 - c. Zurn Industries
 - d. MIFAB, Co.
- B. Urinal Support: Type I, urinal carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture. Include steel uprights with feet.
 - 1. Manufacturers:
 - a. Jay R. Smith Mfg. Co.
 - b. Tyler Pipe/Wade Division
 - c. Zurn Industries
 - d. MIFAB, Co.
 - 2. Accessible Fixture Support: Include rectangular steel uprights and supply support.
- C. Lavatory Support: Type II, lavatory carrier with concealed arms and tie rod. Include steel uprights with feet.
 - 1. Manufacturers:
 - a. Jay R. Smith Mfg. Co.
 - b. Tyler Pipe/Wade Division
 - c. Zurn Industries
 - d. MIFAB Co.
 - 2. Accessible Fixture Support: Include rectangular steel uprights.

2.8 WATER CLOSETS

- A. Water Closets: Accessible, wall and Wall-hanging, back-outlet, vitreous-china fixture designed for flushometer valve operation.
1. Products:
 - a. American Standard, Inc.
 - b. Kohler Co.
 - c. U.S. Industries, Eljer Plumbingware Div.
 2. Style: Flushometer valve.
 - a. Bowl Type: Elongated with siphon-jet design.
 - 1) Design Consumption: 1.6 gal./flush (6 L/flush).
 - b. Color: White.
 3. Flushometer: See Fixture Schedule.
 4. Toilet Seat: See Fixture Schedule.
 5. Fixture Support: Water-closet support combination carrier.
- B. Water Closets: Accessible, floor-mounting, floor-outlet, vitreous-china fixture designed for flushometer valve operation.
1. Products:
 - a. American Standard, Inc.
 - b. Kohler Co.
 - c. U.S. Industries, Eljer Plumbingware Div.
 2. Style: Flushometer valve.
 - a. Bowl Type: Elongated with siphon-jet design. Include bolt caps matching fixture.
 - b. Height: Accessible.
 - c. Design Consumption: 1.6 gal./flush (6 L/flush).
 - d. Color: White.
 3. Flushometer: See Fixture Schedule.
 4. Toilet Seat: See Fixture Schedule.

2.9 URINALS

- A. Urinals: Accessible, wall-hanging, back-outlet, vitreous-china fixture designed for flushometer valve operation.
1. Products:
 - a. American Standard, Inc.
 - b. Kohler Co.
 - c. U.S. Industries, Eljer Plumbingware Div.
 2. Type: Siphon jet.
 3. Strainer or Trapway: Integral cast strainer with integral trap.
 4. Design Consumption: 1 gal./flush (3.8 L/flush).
 5. Color: White.
 6. Supply Spud Size: NPS 3/4 (DN 20).
 7. Outlet Size: NPS 2 (DN 50).
 8. Flushometer: See Fixture Schedule.
 9. Fixture Support: Urinal chair carrier. See Fixture Schedule.

2.10 LAVATORIES

- A. Lavatories: Accessible, wall-hanging, vitreous-china fixture.
 - 1. Available Products:
 - 2. Products:
 - a. Kohler Co.
 - b. U.S. Industries, Eljer Plumbingware Div.
 - c. American Standard, Inc.
 - 3. Type: Ledge back.
 - 4. Size: Rectangular. See Fixture Schedule.
 - 5. Faucet Hole Punching: Three, 4-inch (102-mm) centers, holes.
 - 6. Faucet Hole Location: Top.
 - 7. Color: White.
 - 8. Faucet: Lavatory for separate drain.
 - 9. Supplies: NPS 3/8 (DN 10) chrome-plated copper with stops.
 - 10. Drain: Grid.
 - 11. Drain Piping: NPS 1-1/4 (DN 32) chrome-plated cast-brass trap; NPS 1-1/4 (DN 32) 0.045-inch- thick tubular brass waste to wall; and wall escutcheon.
 - 12. Protective Shielding Guard[s]: See Fixture Schedule.
 - 13. Fixture Support: Lavatory See Fixture Schedule.
- B. Lavatories: Accessible Counter-mounting vitreous-china fixture.
 - 1. Products:
 - a. Kohler Co.
 - b. U.S. Industries, Eljer Plumbingware Div.
 - c. American Standard, Inc.
 - 2. Type: Self rimming.
 - 3. Oval Lavatory Size: See Fixture Schedule.
 - 4. Faucet Hole Punching: Three, 4-inch (102-mm) centers, holes.
 - 5. Faucet Hole Location: Top.
 - 6. Color: White.
 - 7. Faucet: Lavatory for separate drain.
 - 8. Supplies: NPS 3/8 (DN 10) chrome-plated copper with stops.
 - 9. Drain: Grid.
 - 10. Drain Piping: NPS 1-1/4 (DN 32) chrome-plated cast-brass trap; NPS 1-1/4 (DN 32) 0.045-inch- (1.1-mm-) thick tubular brass waste to wall; and wall escutcheon.
 - 11. Protective Shielding Guard[s]: See Fixture Schedule.

2.11 KITCHEN SINKS

- A. Kitchen Sinks: Residential, counter-mounting, enameled, cast-iron fixture.
 - 1. Products:
 - a. Kohler Co.
 - b. U.S. Industries, Eljer Plumbingware Div.
 - c. American Standard, Inc.
 - 2. Overall Size: See Fixture Schedule.
 - 3. Number of Compartments: Two.
 - 4. First Compartment: With 3-1/2-inch (89-mm) crumb cup.
 - 5. First Compartment Location: Right.
 - 6. Second Compartment: Located on opposite side of first compartment; with 3-1/2-inch (89-mm) crumb cup.

7. Sink Faucet: See Fixture Schedule.
8. Supplies: NPS 1/2 (DN 15) chrome-plated copper with stops.
9. Drain Piping: NPS 1-1/2 (DN 40) chrome-plated cast-brass trap, 0.045-inch- (1.1-mm-) thick tubular brass waste to wall, [**continuous waste**,] and wall escutcheon[s].

2.12 SERVICE BASINS

- A. Service Basins: Flush-to-wall, floor-mounting precast terrazzo basin with rim guard.
 1. Products:
 - a. Acorn Engineering Co.
 - b. Florestone Products Co.
 - c. Precast Terrazzo Enterprises, Inc.
 - d. Stern-Williams Co., Inc.
 2. Shape: Square.
 3. Size: 24 by 24 inches (610 by 610 mm).
 4. Height: 12 inches (305 mm).
 5. Tiling Flange: Not required.
 6. Color: Not applicable.
 7. Faucet: Sink. See Fixture Schedule.
 8. Drain: Grid with NPS 3 (DN 80) outlet.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for water soil and for waste piping systems and supports to verify actual locations and sizes of piping connections and that locations and types of supports match those indicated, before plumbing fixture installation. Use manufacturer's roughing-in data if roughing-in data are not indicated.
- B. Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FIXTURE INSTALLATION

- A. Assemble fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. For wall-hanging fixtures, install off-floor supports affixed to building substrate.
 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-hanging 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-hanging 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 counter-mounting fixtures in and attached to casework.
- H. Install fixtures level and plumb according to manufacturers' written instructions and roughing-in drawings.
- I. 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 valve if stops are not specified with fixture. Refer to Division 15 Section "Valves" for general-duty valves.
- J. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
- K. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.
- L. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.
- M. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.
- N. Install toilet seats on water closets.
- O. 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.
- P. Install water-supply, flow-control fittings with specified flow rates in fixture supplies at stop valves.
- Q. 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.
- R. Install shower, flow-control fittings with specified maximum flow rates in shower arms.
- S. Install traps on fixture outlets.
 - 1. Exception: Omit trap on fixtures with integral traps.
 - 2. Exception: Omit trap on indirect wastes, unless otherwise indicated.
- T. Install disposer in outlet of sinks indicated to have disposer. Install switch where indicated or in wall adjacent to sink if location is not indicated.

- U. Install hot-water dispensers in back top surface of sink or in counter with spout over sink.
- V. 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. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for escutcheons.
- W. Set service basins in leveling bed of cement grout. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for grout.
- X. Seal joints between fixtures and walls, floors, and counters using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Refer to Division 7 Section "Joint Sealants" for sealant and installation requirements.

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 water supplies from water distribution piping to fixtures.
- C. Connect drain piping from fixtures to drainage piping.
- D. Supply and Waste Connections to Plumbing Fixtures: Connect fixtures with water supplies, stops, risers, traps, and waste piping. Use size fittings required to match fixtures. Connect to plumbing piping.
- E. Supply and Waste Connections to Fixtures and Equipment Specified in Other Sections: Connect fixtures and equipment with water supplies, stops, risers, traps, and waste piping specified. Use size fittings required to match fixtures and equipment. Connect to plumbing piping.
- F. Ground equipment.
 - 1. 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.

3.4 FIELD QUALITY CONTROL

- A. Verify that installed fixtures are categories and types specified for locations where installed.
- B. Check that fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed 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.
- E. Install fresh batteries in sensor-operated mechanisms.

3.5 ADJUSTING

- A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Operate and adjust controls. Replace damaged and malfunctioning units and controls.
- C. Adjust water pressure at faucets, and flushometer valves to produce proper flow and stream.
- D. 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.

3.7 PROTECTION

- A. Provide protective covering for installed fixtures and fittings.
- B. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 15410

SECTION 15411 - WATER DISTRIBUTION PIPING

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 water distribution piping from locations indicated to fixtures and equipment inside building.
- B. Related Sections include the following:
 - 1. Division 15 Section "Meters and Gages" for water meters, thermometers, pressure gages, and fittings.
 - 2. Division 15 Section "Meters and Gages" for thermometers, pressure gages, and fittings.
 - 3. Division 15 Section "Plumbing Specialties" for water distribution piping specialties.

1.3 DEFINITIONS

- A. Water Service Piping: Water piping outside building that conveys water to building.
- B. Service Entrance Piping: Water piping at entry into building between water service piping and water distribution piping.
- C. Water Distribution Piping: Water piping inside building that conveys water to fixtures and equipment throughout the building.
- D. The following are industry abbreviations for plastic piping materials:
 - 1. CPVC: Chlorinated polyvinyl chloride.
 - 2. NP: Nylon.
 - 3. PB: Polybutylene.
 - 4. PE: Polyethylene.
 - 5. PP: Polypropylene.
 - 6. PVC: Polyvinyl chloride.

1.4 SYSTEM PERFORMANCE REQUIREMENTS

- A. Provide components and installation capable of producing piping systems with the following minimum working-pressure ratings, unless otherwise indicated:
 - 1. Combined Fire-Protection and Domestic, Service Entrance Piping: 250 psig (1725 kPa).

2. Service Entrance Piping: 100 psig (690 kPa).
3. Water Distribution Piping: 80 psig (550 kPa).

1.5 SUBMITTALS

- A. Water Samples, Test Results, and Reports: Specified in "Field Quality Control" and "Cleaning" articles.

1.6 QUALITY ASSURANCE

- A. Provide listing/approval stamp, label, or other marking on piping made to specified standards.
- B. Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.
- C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic potable-water piping components. Include marking "NSF-pw" on plastic potable-water piping.
- D. Comply with NSF 61, "Drinking Water System Components--Health Effects," Sections 1 through 9 for potable-water piping and components.

PART 2 - PRODUCTS

2.1 PIPES AND TUBES

- A. General: Applications of the following pipe and tube materials are indicated in Part 3 "Piping Applications" Article.
- B. Hard Copper Tube: ASTM B 88, Types L water tube, drawn temper.
- C. Galvanized Steel Pipe: ASTM A 53, Type E or S, Grade A or B, Schedule 40.
- D. Galvanized, Steel Pipe Nipples: ASTM A 733, made of ASTM A 53 or ASTM A 106, Schedule 40, seamless, steel pipe.
- E. CPVC Plastic Pipe: ASTM F 441, Schedules 40 and 80.
- F. CPVC Plastic Pipe System: ASTM D 2846, SDR 11, pipe and tube.

2.2 PIPE AND TUBE FITTINGS

- A. General: Applications of the following pipe and tube fitting materials are indicated in Part 3 "Piping Applications" Article.
- B. Copper, Solder-Joint Pressure Fittings: ASME B16.18 cast-copper alloy or ASME B16.22 wrought copper.

- C. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.
- D. Copper Unions: ASME B16.18, cast-copper-alloy, hexagonal-stock body with ball-and-socket joint, metal-to-metal seating surfaces, and solder-joint, threaded, or solder-joint and threaded ends. Include threads conforming to ASME B1.20.1 on threaded ends.
- E. Malleable-Iron Unions: ASME B16.39, Class 150, hexagonal-stock body with ball-and-socket joint, metal-to-metal bronze seating surfaces, and female threaded ends with threads according to ASME B1.20.1. Furnish Class 300 unions if required to match piping.

2.3 JOINING MATERIALS

- A. General: Applications of the following piping joining materials are indicated in Part 3 "Piping Applications" Article.
- B. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for commonly used joining materials.
- C. Solder: ASTM B 32, Alloy Sn95, Sn94, or E; lead free.
- D. Brazing Filler Metal: AWS A5.8, BCuP, copper phosphorus or BAg, silver classification.

2.4 VALVES

- A. Refer to Division 15 Section "Valves" for general-duty valves.
- B. Refer to Division 15 Section "Plumbing Specialties" for special-duty valves.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Transition and special fittings with pressure ratings at least equal to piping pressure rating may be used in applications below, unless otherwise indicated.
- B. Flanges may be used on aboveground piping, unless otherwise indicated.
- C. Aboveground, Water Distribution Piping: Use the following:
 - 1. 1-1/2-Inch NPS (DN40) and Smaller: Hard copper tube, Type L (Type B); copper, solder-joint fittings; and soldered joints.
 - 2. 2-Inch NPS (DN50): Hard copper tube, Type L (Type B); copper, solder-joint fittings; and soldered joints.
 - 3. 2-1/2- to 3-1/2-Inch NPS (DN65 to DN90): Hard copper tube, Type L (Type B); copper, solder-joint fittings; and soldered joints.

4. 4- to 6-Inch NPS (DN100 to DN150): Hard copper tube, Type L (Type B) with grooved ends; copper, grooved-end fittings; and copper, keyed couplings.

3.2 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 ball, or butterfly valves.
 2. Throttling Duty: Use globe, ball, or butterfly valves.

3.3 PIPING INSTALLATION, GENERAL

- A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping installation.

3.4 WATER DISTRIBUTION PIPING INSTALLATION

- A. Install piping with 0.25 percent slope downward toward drain.
- B. Install piping level without pitch.

3.5 JOINT CONSTRUCTION

- A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

3.6 VALVE INSTALLATION

- A. Sectional Valves: Install sectional valves close to main on each branch and riser serving plumbing fixtures or equipment, and where indicated. Use ball valves for piping 2-inch NPS (DN50) and smaller. Use butterfly valves for piping 2-1/2-inch NPS (DN65) and larger.
- B. Shutoff Valves: Install shutoff valve on each water supply to equipment, on each supply to plumbing fixtures without supply stops, and where indicated. Use ball valves for piping 2-inch NPS (DN50) and smaller. Use butterfly valves for piping 2-1/2-inch NPS (DN65) and larger.
- C. Drain Valves: 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.
 2. Install stop-and-waste drain valves where indicated.
- D. Balancing Valves: Install in each hot-water circulation return branch, discharge side of each pump and circulator, and where indicated. Use ball valve for piping 2-inch NPS (DN50) and

smaller and butterfly valve for piping 2-1/2-inch NPS (DN65) and larger. Refer to Division 15 Section "Plumbing Specialties" for balancing valves.

- E. Calibrated Balancing Valves: Install in each hot-water circulation return branch, discharge side of each pump and circulator, and where indicated. Refer to Division 15 Section "Plumbing Specialties" for calibrated balancing valves.

3.7 HANGER AND SUPPORT INSTALLATION

- A. Refer to Division 15 Section "Hangers and Supports" for pipe hanger and support devices. Install the following:
 - 1. Riser clamps, MSS Type 8 or Type 42, for vertical runs.
 - 2. Adjustable steel clevis hangers, MSS Type 1, for individual, straight, horizontal runs 100 feet (30 m) and less.
- 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 one size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.
- E. Install hangers for copper tubing with the following maximum spacing and minimum rod diameters:
 - 1. 3/4-Inch NPS (DN20) and Smaller: Maximum horizontal spacing, 60 inches (1500 mm) with 3/8-inch (10-mm) minimum rod diameter; maximum vertical spacing, 10 feet (3 m).
 - 2. 1-Inch NPS (DN25): Maximum horizontal spacing, 72 inches (1800 mm) with 3/8-inch (10-mm) minimum rod diameter; maximum vertical spacing, 10 feet (3 m).
 - 3. 1-1/4-Inch NPS (DN32): Maximum horizontal spacing, 72 inches (1800 mm) with 3/8-inch (10-mm) minimum rod diameter; maximum vertical spacing, 10 feet (3 m).
 - 4. 1-1/2 and 2-Inch NPS (DN40 and DN50): Maximum horizontal spacing, 96 inches (2400 mm) with 3/8-inch (10-mm) minimum rod diameter; maximum vertical spacing, 10 feet (3 m).
 - 5. 2-1/2-Inch NPS (DN65): Maximum horizontal spacing, 108 inches (2700 mm) with 1/2-inch (13-mm) minimum rod diameter; maximum vertical spacing, 10 feet (3 m).
 - 6. 3-Inch NPS (DN80): Maximum horizontal spacing, 10 feet (3 m) with 1/2-inch (13-mm) minimum rod diameter; maximum vertical spacing, 10 feet (3 m).
 - 7. 3-1/2-Inch NPS (DN90): Maximum horizontal spacing, 10 feet (3 m) with 1/2-inch (13-mm) minimum rod diameter; maximum vertical spacing, 10 feet (3 m).
 - 8. 4- and 5-Inch NPS (DN100 and DN125): Maximum horizontal spacing, 10 feet (3 m) with 1/2-inch (13-mm) minimum rod diameter; maximum vertical spacing, 10 feet (3 m).
 - 9. 6-Inch NPS (DN150): Maximum horizontal spacing, 10 feet (3 m) with 5/8-inch (16-mm) minimum rod diameter; maximum vertical spacing, 10 feet (3 m).
 - 10. 8-Inch NPS (DN200): Maximum horizontal spacing, 10 feet (3 m) with 3/4-inch (19-mm) minimum rod diameter; maximum vertical spacing, 10 feet (3 m).
- F. Install hangers for steel piping with the following maximum spacing and minimum rod diameters:

1. 1-1/4-Inch NPS (DN32) and Smaller: Maximum horizontal spacing, 84 inches (2100 mm) with 3/8-inch (10-mm) minimum rod diameter; maximum vertical spacing, 15 feet (4.5 m).
2. 1-1/2-Inch NPS (DN40): Maximum horizontal spacing, 108 inches (2700 mm) with 3/8-inch (10-mm) minimum rod diameter; maximum vertical spacing, 15 feet (4.5 m).
3. 2-Inch NPS (DN50): Maximum horizontal spacing, 10 feet (3 m) with 3/8-inch (10-mm) minimum rod diameter; maximum vertical spacing, 15 feet (4.5 m).
4. 2-1/2-Inch NPS (DN65): Maximum horizontal spacing, 11 feet (3.4 m) with 1/2-inch (13-mm) minimum rod diameter; maximum vertical spacing, 15 feet (4.5 m).
5. 3- and 3-1/2-Inch NPS (DN80 and DN90): Maximum horizontal spacing, 12 feet (3.7 m) with 1/2-inch (13-mm) minimum rod diameter; maximum vertical spacing, 15 feet (4.5 m).
6. 4- and 5-Inch NPS (DN100 and DN125): Maximum horizontal spacing, 12 feet (3.7 m) with 5/8-inch (16-mm) minimum rod diameter; maximum vertical spacing, 15 feet (4.5 m).
7. 6-Inch NPS (DN150): Maximum horizontal spacing, 12 feet (3.7 m) with 3/4-inch (19-mm) minimum rod diameter; maximum vertical spacing, 15 feet (4.5 m).
8. 8- through 12-Inch NPS (DN200 through DN300): Maximum horizontal spacing, 12 feet (3.7 m) with 7/8-inch (22-mm) minimum rod diameter; maximum vertical spacing, 15 feet (4.5 m).

- G. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.8 CONNECTIONS

- A. Connect service entrance piping to exterior water service piping. Use transition fitting to join dissimilar piping materials.
- B. Connect water distribution piping to service entrance piping at shutoff valve, and extend to and connect to the following:
1. Water Heaters: Connect cold-water supply and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
 2. Plumbing Fixtures: Connect hot- and cold-water supply piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 15 Section "Plumbing Fixtures."
 3. Equipment: Connect hot- and cold-water supply piping as indicated. Provide shutoff valve and union for each connection. Use flanges instead of unions for connections 2-1/2-inch NPS (DN65) and larger.

3.9 FIELD QUALITY CONTROL

- A. Inspect water distribution piping as follows:
- B. Inspect service entrance piping and water distribution piping as follows:
1. Do not enclose, cover, or put piping into operation until it is 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 for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
 3. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
 4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- C. Test water distribution piping as follows:
- D. Test service entrance piping and water distribution piping as follows:
1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 2. Leave uncovered and unconcealed new, altered, extended, or replaced water piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved.
 3. 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 4 hours. Leaks and loss in test pressure constitute defects that must be repaired.
 4. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
 5. Prepare reports for tests and required corrective action.

3.10 CLEANING

- A. Clean and disinfect service entrance piping and water distribution piping as follows:
1. Purge new piping and parts of existing water piping that have been altered, extended, or repaired before using.
 2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed, procedure 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 3 hours.

- c. Flush system with clean, potable water until chlorine is no longer in water coming from system after the standing time.
 - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows contamination.
- B. Prepare and submit reports for purging and disinfecting activities.
- C. Clean interior of piping system. Remove dirt and debris as work progresses.

3.11 COMMISSIONING

- A. Fill water piping. Check components to determine that they are not air bound and that piping is full of water.
- B. Perform the following steps before putting into 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 that cartridges are clean and ready for use.
- C. Check plumbing equipment and verify proper settings, adjustments, and operation. Do not operate water heaters before filling with water.
- D. Check plumbing specialties and verify proper settings, adjustments, and operation.
 - 1. Water-Pressure Regulators: Set outlet pressure at 80 psig (550 kPa) maximum, unless otherwise indicated.

END OF SECTION 15411

SECTION 15420 - DRAINAGE AND VENT PIPING

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 sanitary drainage and vent piping, and storm drainage piping inside building and to locations indicated.
- B. Related Sections include the following:
 - 1. Division 15 Section "Plumbing Specialties" for drainage and vent piping system specialties.

1.3 DEFINITIONS

- A. Sewerage Piping: Building sewer piping outside building that conveys sanitary sewage from building.
- B. Drainage Piping: Building sewer piping outside building that conveys storm drainage from building.
- C. Service Entrance Piping: Drainage piping at entry into building between outside building sewer piping and inside drainage piping.
- D. Drainage and Vent Piping: Piping inside building that conveys waste water and vapors from fixtures and equipment throughout the building.
- E. Force-Main Piping: Drainage piping, under pressure.
- F. The following are industry abbreviations for plastic and other piping materials:
 - 1. ABS: Acrylonitrile-butadiene-styrene.
 - 2. EPDM: Ethylene-propylene-diene polymer, rubber.
 - 3. NBR: Acrylonitrile-butadiene rubber.
 - 4. PVC: Polyvinyl chloride.

1.4 SYSTEM PERFORMANCE REQUIREMENTS

- A. Provide components and installation capable of producing piping systems with the following minimum working-pressure ratings, unless otherwise indicated:

1. Soil, Waste, and Vent Systems: 10-foot head of water (30 kPa).
2. Storm Drainage Systems: 10-foot head of water (30 kPa).
3. Sewage, Force-Main Piping Systems: 100 psig (690 kPa).

1.5 SUBMITTALS

- A. Test Results and Reports: Specified in "Field Quality Control" Article.

1.6 QUALITY ASSURANCE

- A. Provide listing/approval stamp, label, or other marking on piping made to specified standards.
- B. Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.
- C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping; "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.

PART 2 - PRODUCTS

2.1 PIPES AND TUBES

- A. General: Applications of the following pipe and tube materials are indicated in Part 3 "Piping Applications" Article.
- B. Hub-and-Spigot, Cast-Iron Soil Pipe: ASTM A 74, Service and Extra Heavy classes. Include ASTM C 564 rubber gasket, with dimensions required for pipe class, for each hub.
- C. Hubless, Cast-Iron Soil Pipe: ASTM A 888 or CISPI 301.
- D. Hard Copper Tube: ASTM B 88, Types L water tube, drawn temper.

2.2 PIPE AND TUBE FITTINGS

- A. General: Applications of the following pipe and tube fitting materials are indicated in Part 3 "Piping Applications" Article.
- B. Threaded-Fitting, End Connections: ASME B1.20.1.
- C. Hub-and-Spigot, Cast-Iron, Soil-Pipe Fittings: ASTM A 74, Service and Extra Heavy classes, hub and spigot. Include ASTM C 564 rubber gasket, with dimensions required for pipe class, for each hub.
- D. Hubless, Cast-Iron, Soil-Pipe Fittings: CISPI 301.

- E. Copper, Solder-Joint Pressure Fittings: ASME B16.18 cast-copper alloy or ASME B16.22 wrought copper. Furnish wrought-copper fittings if indicated.
- F. Copper Unions: ASME B16.18, cast-copper-alloy, hexagonal-stock body with ball-and-socket joint, metal-to-metal seating surfaces, and solder-joint, threaded, or solder-joint and threaded ends.
- G. Malleable-Iron Unions: ASME B16.39, Class 150, hexagonal-stock body with ball-and-socket joint, metal-to-metal bronze seating surfaces, and female threaded ends with threads according to ASME B1.20.1.
- H. Cast-Iron, Threaded Fittings: ASME B16.4, Class 125, galvanized, standard pattern.
- I. Cast-Iron, Threaded Drainage Fittings: ASME B16.12, galvanized, recessed, drainage pattern.
- J. Cast-Iron, Threaded Flanges: ASME B16.1, Class 125.
- K. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311 drain, waste, and vent pipe patterns.
- L. PVC Plastic, Tubular Fittings: ASTM F 409 drainage pattern, with ends as required for application.

2.3 JOINING MATERIALS

- A. General: Applications of the following piping joining materials are indicated in Part 3 "Piping Applications" Article.
- B. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for commonly used joining materials.
- C. Solder: ASTM B 32, Alloy Sn95, Sn94, or E; lead free.
- D. Hubless, Cast-Iron, Soil-Piping Couplings: ASTM C 1277 assembly of metal housing, corrosion-resistant fasteners, and ASTM C 564 rubber sleeve or gasket with integral, center pipe stop. Include the following:
 - 1. Heavy-Duty, FM-Approved, Stainless-Steel Couplings: ASTM A 666, Type 304, stainless-steel housing; and stainless-steel clamps. Include gasket or bushing.
 - a. Clamp Width: 3 inches (75 mm) wide with 2 clamps, for piping 1-1/2- to 4-inch NPS (DN40 to DN100).
 - b. Clamp Width: 4 inches (100 mm) wide with 2 clamps, for piping 5- to 10-inch NPS (DN125 to DN250).
- E. Transition Couplings: Coupling or other manufactured fitting same size as, with pressure rating at least equal to, and with ends compatible with piping to be joined.

- F. Flexible, Transition Couplings for Underground, Nonpressure Piping: ASTM C 1173 with elastomeric sleeve. Include ends same sizes as piping to be joined and include corrosion-resistant metal band on each end.
1. Sleeve Type for Plain-End Piping: Rubber or elastomeric sleeve and stainless-steel band assembly, fabricated to match outside diameters of piping to be joined. Include the following:
 - a. Sleeves for Cast-Iron Soil Piping: ASTM C 564 rubber.
 - b. Sleeves for Plastic Piping: ASTM F 477 elastomeric seal.
 - c. Sleeves for Dissimilar Piping: Compatible with piping materials to be joined.
 - d. Bands: Stainless steel, one at each pipe insert.
 2. Gasket Type for Dissimilar-End Piping: Rubber or elastomeric compression gasket, made to match inside diameter of pipe or hub, and outside diameter of adjoining pipe. Include the following:
 - a. Gaskets for Cast-Iron Soil Piping: ASTM C 564 rubber.
 - b. Gaskets for Plastic Piping: ASTM F 477 elastomeric seal.
 - c. Gaskets for Dissimilar Piping: Compatible with piping materials to be joined.

2.4 VALVES

- A. Refer to Division 15 Section "Valves" for general-duty valves. Use valves specified for "Domestic Water Systems" applications.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Transition and special fittings with pressure ratings at least equal to piping pressure rating may be used in applications below, unless otherwise indicated.
- B. Flanges may be used on aboveground piping, unless otherwise indicated.
- C. Aboveground, Soil, Waste, and Vent Piping: Use the following:
1. 1-1/2-Inch NPS (DN40): Hubless, cast-iron soil pipe; hubless, cast-iron, soil-pipe fittings; and one of the following hubless, cast-iron, soil-piping couplings:
 - a. Couplings: Heavy-duty, FM-approved, Type 304, stainless steel.
 2. 2- to 4-Inch NPS (DN50 to DN100): Hubless, cast-iron soil pipe; hubless, cast-iron, soil-pipe fittings; and one of the following hubless, cast-iron, soil-piping couplings:
 - a. Couplings: Heavy-duty, FM-approved, Type 304, stainless steel.
 3. 5- and 6-Inch NPS (DN125 and DN150): Hubless, cast-iron soil pipe; hubless, cast-iron, soil-pipe fittings; and one of the following hubless, cast-iron, soil-piping couplings:
 - a. Couplings: Heavy-duty, FM-approved, Type 304, stainless steel.
- D. Underground, Soil, Waste, and Vent Piping: Use the following:
- a. Schedule 40 PVC

3.2 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 ball, or butterfly valves.
 - 2. Throttling Duty: Use globe, ball, or butterfly valves.

3.3 PIPING INSTALLATION, GENERAL

- A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping installation.

3.4 SERVICE ENTRANCE PIPING INSTALLATION

- A. Refer to Division 2 Section "Sewerage and Drainage" for sanitary and storm sewer piping.
- B. Extend building sanitary drain piping and connect to sanitary sewer piping in sizes and locations indicated for service entrances into building. Install cleanout and extension to grade at connections of building sanitary drains with building sanitary sewers.
- C. Install cast-iron sleeve with water stop and mechanical sleeve seal at each pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for sleeves and mechanical sleeve seals.

3.5 DRAINAGE AND VENT PIPING INSTALLATION

- A. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- B. Make changes in direction for drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not make change in direction of flow greater than 90 degrees. Use proper size of standard increasers and reducers if different sizes of piping are connected. Reducing size of drainage piping in direction of flow is prohibited.
- C. Lay buried building drain piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- D. Install drainage and vent piping at the following minimum slopes, unless otherwise indicated:

1. Sanitary Building Drain: 2 percent downward in direction of flow for piping 3-inch NPS (DN80) and smaller; 1 percent downward in direction of flow for piping 4-inch NPS (DN100) and larger.
 2. Horizontal, Sanitary Drainage Piping: 2 percent downward in direction of flow.
 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- E. Sleeves are not required for cast-iron soil piping passing through concrete slab on grade if slab is without membrane waterproofing.

3.6 JOINT CONSTRUCTION

- A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.
- B. Cast-Iron, Soil-Piping Joints: Make joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
1. Compression Joints: Make with rubber gasket matching class of pipe and fittings.
 2. Hubless Joints: Make with rubber gasket and sleeve or clamp.
- C. Handling of Solvent Cements, Primers, and Cleaners: Comply with procedures in ASTM F 402 for safe handling during joining of plastic pipe and fittings.

3.7 VALVE INSTALLATION

- A. Shutoff Valves: Install shutoff valve on each pump discharge and where indicated. Use ball valves for piping 2-inch NPS (DN50) and smaller. Use butterfly valves for piping 2-1/2-inch NPS (DN65) and larger.
- B. Check Valves: Install swing check valve on each pump discharge, downstream from shutoff valve.

3.8 HANGER AND SUPPORT INSTALLATION

- A. Refer to Division 15 Section "Hangers and Supports" for pipe hanger and support devices. Install the following:
1. Riser clamps, MSS Type 8 or Type 42, for vertical runs.
 2. Adjustable steel clevis hangers, MSS Type 1, for individual, straight, horizontal runs 100 feet (30 m) and less.
- 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 one size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.

- E. Install hangers for copper tubing with the following maximum spacing and minimum rod diameters:
1. 1-1/4-Inch NPS (DN32): Maximum horizontal spacing, 72 inches (1800 mm) with 3/8-inch (10-mm) minimum rod diameter; maximum vertical spacing, 10 feet (3 m).
 2. 1-1/2 and 2-Inch NPS (DN40 and DN50): Maximum horizontal spacing, 96 inches (2400 mm) with 3/8-inch (10-mm) minimum rod diameter; maximum vertical spacing, 10 feet (3 m).
 3. 2-1/2-Inch NPS (DN65): Maximum horizontal spacing, 108 inches (2700 mm) with 1/2-inch (13-mm) minimum rod diameter; maximum vertical spacing, 10 feet (3 m).
 4. 3- to 5-Inch NPS (DN80 to DN125): Maximum horizontal spacing, 10 feet (3 m) with 1/2-inch (13-mm) minimum rod diameter; maximum vertical spacing, 10 feet (3 m).
 5. 6-Inch NPS (DN150): Maximum horizontal spacing, 10 feet (3 m) with 5/8-inch (16-mm) minimum rod diameter; maximum vertical spacing, 10 feet (3 m).
 6. 8-Inch NPS (DN200): Maximum horizontal spacing, 10 feet (3 m) with 3/4-inch (19-mm) minimum rod diameter; maximum vertical spacing, 10 feet (3 m).
- F. Install hangers for cast-iron soil piping with the following maximum spacing and minimum rod diameters:
1. 1-1/2- and 2-Inch NPS (DN40 and DN50): Maximum horizontal spacing, 60 inches (1500 mm) with 3/8-inch (10-mm) minimum rod diameter; maximum vertical spacing, 15 feet (4.5 m).
 2. 3-Inch NPS (DN80): Maximum horizontal spacing, 60 inches (1500 mm) with 1/2-inch (13-mm) minimum rod diameter; maximum vertical spacing, 15 feet (4.5 m).
 3. 4- and 5-Inch NPS (DN100 and DN125): Maximum horizontal spacing, 60 inches (1500 mm) with 5/8-inch (16-mm) minimum rod diameter; maximum vertical spacing, 15 feet (4.5 m).
 4. 6-Inch NPS (DN150): Maximum horizontal spacing, 60 inches (1500 mm) with 3/4-inch (19-mm) minimum rod diameter; maximum vertical spacing, 15 feet (4.5 m).
 5. 8- through 12-Inch NPS (DN200 through DN300): Maximum horizontal spacing, 60 inches (1500 mm) with 7/8-inch (22-mm) minimum rod diameter; maximum vertical spacing, 15 feet (4.5 m).
 6. 15-Inch NPS (DN375): Maximum horizontal spacing, 60 inches (1500 mm) with 1-inch (25-mm) minimum rod diameter; maximum vertical spacing, 15 feet (4.5 m).
 7. Spacing for horizontal pipe in 10-foot (3-m) lengths may be increased to 10 feet (3 m). Spacing for fittings is limited to 60 inches (1500 mm).
- G. Install hangers for ABS and PVC plastic piping with the following maximum spacing and minimum rod diameters:
1. 1-1/2- and 2-Inch NPS (DN40 and DN50): Maximum horizontal spacing, 48 inches (1200 mm) with 3/8-inch (10-mm) minimum rod diameter; maximum vertical spacing, 48 inches (1200 mm).
 2. 4- and 5-Inch NPS (DN100 and DN125): Maximum horizontal spacing, 48 inches (1200 mm) with 5/8-inch (16-mm) minimum rod diameter; maximum vertical spacing, 48 inches (1200 mm).
 3. 6-Inch NPS (DN150): Maximum horizontal spacing, 48 inches (1200 mm) with 3/4-inch (19-mm) minimum rod diameter; maximum vertical spacing, 48 inches (1200 mm).

4. 8- through 12-Inch NPS (DN200 through DN300): Maximum horizontal spacing, 48 inches (1200 mm) with 7/8-inch (22-mm) minimum rod diameter; maximum vertical spacing, 48 inches (1200 mm).

- H. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.9 CONNECTIONS

- A. Connect service entrance piping to exterior sewerage and drainage piping. Use transition fitting to join dissimilar piping materials.
- B. Connect drainage piping to service entrance piping, and extend to and connect to the following:
 1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 15 Section "Plumbing Fixtures."
 2. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 15 Section "Plumbing Specialties."
 3. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections 2-1/2-inch NPS (DN65) and larger.

3.10 FIELD QUALITY CONTROL

- A. Inspect drainage and vent piping as follows:
 1. Do not enclose, cover, or put piping into operation until it is 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 for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
 3. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
 4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- B. Test drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedure, as follows:
 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved.
3. Roughing-In Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10 feet of head (30 kPa). Water level must not drop from 15 minutes before inspection starts through completion of inspection. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg (250 Pa). Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects using new materials and retest piping or portion thereof until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.11 CLEANING AND PROTECTING

- A. Clean interior of piping system. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.
- D. Exposed ABS and PVC Piping: Protect plumbing vents exposed to sunlight with 2 coats of water-based latex paint.

END OF SECTION 15420

SECTION 15430 - PLUMBING SPECIALTIES

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 plumbing specialties for the following:
 - 1. Water distribution systems.
 - 2. Soil, waste, and vent systems.
- B. Related Sections include the following:
 - 1. Division 15 Section "Basic Mechanical Materials and Methods" for piping joining materials, joint construction, basic installation requirements, and labeling and identifying requirements; and escutcheons, dielectric fittings, sleeves, and sleeve seals that are not in this Section.
 - 2. Division 15 Section "Valves" for general-duty ball, butterfly, check, gate, and globe valves.
 - 3. Division 15 Section "Meters and Gages" for thermometers, pressure gages, fittings, and water meters.
 - 4. Division 15 Section "Mechanical Identification" for labeling and identifying requirements.
 - 5. Division 15 Section "Water Distribution Piping" for water-supply piping and connections.
 - 6. Division 15 Section "Drainage and Vent Piping" for drainage and vent piping and connections.

1.3 SYSTEM PERFORMANCE REQUIREMENTS

- A. Provide components and installation capable of producing piping systems with following minimum working-pressure ratings, unless otherwise indicated:
 - 1. Water Distribution Piping: 125 psig (860 kPa).
 - 2. Soil, Waste, and Vent Piping: 10-foot head of water (30 kPa).

1.4 SUBMITTALS

- A. Product Data: For each plumbing specialty indicated. Include rated capacities of selected equipment and shipping, installed, and operating weights. Indicate materials, finishes, dimensions, required clearances, and methods of assembly of components; and piping and wiring connections for the following plumbing specialty products:
 - 1. Backflow preventers.
 - 2. Water regulators.
 - 3. Balancing valves.
 - 4. Strainers.
 - 5. Thermostatic water mixing valves and water tempering valves.
 - 6. Water hammer arresters.
 - 7. Trap seal primer valves and systems.
 - 8. Drain valves.
 - 9. Hose bibbs, hydrants, and sanitary post hydrants.
 - 10. Hose stations.
 - 11. Floor drains, open receptors, and trench drains.
 - 12. Air-admittance valves.
 - 13. Vent caps, vent terminals, and roof flashing assemblies.
 - 14. Sleeve penetration systems.
- B. Reports: Specified in "Field Quality Control" Article.
- C. Maintenance Data: For specialties to include in the maintenance manuals specified in Division 1. Include the following:
 - 1. Backflow preventers.
 - 2. Water filters.
 - 3. Thermostatic water mixing valves and water tempering valves.
 - 4. Trap seal primer valves and systems.
 - 5. Hose stations.
 - 6. Sanitary hydrants.
 - 7. Backwater valves.

1.5 QUALITY ASSURANCE

- A. Product Options: Drawings indicate size, profiles, dimensional requirements, and characteristics of plumbing specialties and are based on the specific types and models indicated. Other manufacturers' products with equal performance characteristics may be considered. Refer to Division 1 Section "Substitutions."
- B. Provide listing/approval stamp, label, or other marking on plumbing specialties made to specified standards.
- C. Listing and Labeling: Provide electrically operated plumbing specialties specified in this Section that are listed and labeled.
 - 1. Terms "Listed" and "Labeled": As defined in National Electrical Code, Article 100.
 - 2. Listing and Labeling Agency Qualifications: "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.

- D. Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.
- E. Comply with NFPA 70, "National Electrical Code," for electrical components.
- F. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic potable-water piping components. Include marking "NSF-pw" on plastic potable-water piping and "NSF-dwv" on plastic drain, waste, and vent piping.

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. Backflow Preventers:
 - a. Ames Co., Inc.
 - b. Cla-Val Co.
 - c. Conbraco Industries, Inc.
 - d. Watts Industries, Inc.; Water Products Div.
 - e. Zurn Industries, Inc.; Wilkins Div.
 - 2. Water Regulators:
 - a. Cla-Val Co.
 - b. Conbraco Industries, Inc.
 - c. Spence Engineering Co., Inc.
 - d. Watts Industries, Inc.; Water Products Div.
 - e. Zurn Industries, Inc.; Wilkins Div.
 - 3. Calibrated Balancing Valves:
 - a. ITT Fluid Technology Corp.; ITT Bell & Gossett Div.
 - b. Taco, Inc.
 - 4. Memory-Stop Balancing Valves:
 - a. Crane Co.; Valve Div.
 - b. Grinnell Corp.
 - c. Hammond Valve Corp.
 - d. Milwaukee Valve Co., Inc.
 - e. Nibco, Inc.
 - 5. Thermostatic Water Mixing Valves:
 - a. Leonard Valve Co.
 - b. Mark Controls Corp.; Powers Process Controls.

- c. T & S Brass and Bronze Works, Inc.
- 6. Water Tempering Valves:
 - a. Conbraco Industries, Inc.
 - b. Holby Valve Co., Inc.
 - c. Honeywell Braukmann.
 - d. Leonard Valve Co.
 - e. Sparco, Inc.
 - f. Watts Industries, Inc.; Water Products Div.
- 7. Outlet Boxes:
 - a. Acorn Engineering Co.
 - b. IPS Corp.
 - c. Oatey Co.
- 8. Washer-Supply Outlets:
 - a. B & K Industries, Inc.
 - b. Symmons Industries, Inc.
 - c. Watts Industries, Inc.; Water Products Div.
- 9. Hose Stations:
 - a. Leonard Valve Co.
 - b. Penberthy, Inc.
 - c. Strahman Valves, Inc.
 - d. T & S Brass and Bronze Works, Inc.
- 10. Hydrants:
 - a. Josam Co.
 - b. Smith: Jay R. Smith Mfg. Co.
 - c. Tyler Pipe; Wade Div.
 - d. Watts Industries, Inc.; Ancon Drain Div.
 - e. Woodford Manufacturing Co.
 - f. Zurn Industries, Inc.; Hydromechanics Div.
- 11. Sanitary Post Hydrants:
 - a. Murdock, Inc.
- 12. Water Hammer Arresters:
 - a. Amtrol, Inc.
 - b. Josam Co.
 - c. Sioux Chief Manufacturing Co., Inc.
 - d. Smith: Jay R. Smith Mfg. Co.
 - e. Sparco, Inc.
 - f. Tyler Pipe; Wade Div.
 - g. Watts Industries, Inc.; Ancon Drain Div.
 - h. Zurn Industries, Inc.; Hydromechanics Div.

13. Trap Seal Primer Valves:
 - a. Josam Co.
 - b. Precision Plumbing Products, Inc.
 - c. Smith: Jay R. Smith Mfg. Co.
 - d. Tyler Pipe; Wade Div.
 - e. Watts Industries, Inc.; Ancon Drain Div.
 - f. Zurn Industries, Inc.; Hydromechanics Div.
14. Trap Seal Primer Systems:
 - a. Precision Plumbing Products, Inc.
15. Air-Admittance Valves:
 - a. B & K Industries, Inc.
 - b. Bristol Corp.; J & B Products Div.
 - c. IPS Corp.
 - d. Oatey Co.
 - e. Sioux Chief Manufacturing Co., Inc.
 - f. Studor, Inc.
16. Roof Flashing Assemblies:
 - a. Elmdor/Stoneman Manufacturing Co.
17. Sleeve Penetration Systems:
 - a. ProSet Systems, Inc.

2.2 BACKFLOW PREVENTERS

- A. General: ASSE standard, backflow preventers, of size indicated for maximum flow rate and maximum pressure loss indicated.
 1. 2-Inch NPS (DN50) and Smaller: Bronze body with threaded ends.
 2. 2-1/2-Inch NPS (DN65) and Larger: Bronze, cast-iron, or stainless-steel body with flanged ends.
 - a. Interior Lining: AWWA C550 or FDA-approved, epoxy coating for backflow preventers having cast-iron or steel body.
 3. Interior Components: Corrosion-resistant materials.
 4. Exterior Finish: Polished chrome-plate if used in chrome-plated piping system.
 5. Strainer on inlet, if indicated.
- B. Pipe-Applied, Atmospheric-Type Vacuum Breakers: ASSE 1001, with floating disc and atmospheric vent.

- C. Hose-Connection Vacuum Breakers: ASSE 1011, nickel plated, with nonremovable and manual drain features, and ASME B1.20.7 garden-hose threads on outlet. Units attached to rough-bronze-finish hose connections may be rough bronze.
- D. Intermediate Atmospheric-Vent Backflow Preventers: ASSE 1012, suitable for continuous pressure application. Include inlet screen and 2 independent check valves with intermediate atmospheric vent.
- E. Reduced-Pressure-Principle Backflow Preventers: ASSE 1013, suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet; test cocks; and pressure-differential relief valve with ASME A112.1.2 air-gap fitting located between 2 positive-seating check valves.
 - 1. Pressure Loss: 12 psig (83 kPa) maximum, through middle one-third of flow range.
- F. Double-Check Backflow Prevention Assemblies: ASSE 1015, suitable for continuous pressure application. Include shutoff valves on inlet and outlet, and strainer on inlet; and test cocks with 2 positive-seating check valves.
 - 1. Pressure Loss: 5 psig (35 kPa) maximum, through middle one-third of flow range.
- G. Antisiphon-Pressure-Type Vacuum Breakers: ASSE 1020, suitable for continuous pressure application. Include shutoff valves, spring-loaded check valve, spring-loaded floating disc, test cocks, and atmospheric vent.
 - 1. Pressure Loss: 5 psig (35 kPa) maximum, through middle one-third of flow range.
- H. Dual-Check-Valve-Type Backflow Preventers: ASSE 1024, suitable for continuous pressure application. Include union inlet and 2 independent check valves.
- I. Dual-Check-Valve-Type Backflow Preventers: ASSE 1032, suitable for continuous pressure application for carbonated beverage dispensers. Include stainless-steel body; primary and secondary checks; ball check; intermediate atmospheric-vent port for relieving carbon dioxide; and threaded ends, 3/8-inch NPS (DN10).
- J. Laboratory Faucet Vacuum Breakers: ASSE 1035, suitable for continuous pressure application and chrome plated; consisting of primary and secondary checks; intermediate vacuum breaker; and threaded ends, 1/4- or 3/8-inch NPS (DN8 or DN10) as required.
- K. Reduced-Pressure Detector Assembly Backflow Preventers: ASSE 1047, FM approved or UL listed, and suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet. Include test cocks; pressure-differential relief valve with ASME A112.1.2 air-gap fitting located between 2 positive-seating check valves; and bypass with displacement-type water meter, valves, and reduced-pressure backflow preventer.
 - 1. Pressure Loss: 12 psig (83 kPa) maximum, through middle one-third of flow range.
- L. Double-Check Detector Assembly Backflow Preventers: ASSE 1048, FM approved or UL listed, and suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet. Include test cocks; 2 positive-seating check

valves; and bypass with displacement-type water meter, valves, and double-check backflow preventer.

1. Pressure Loss: 5 psig (35 kPa) maximum, through middle one-third of flow range.

- M. Hose-Connection Backflow Preventers: ASSE 1052, suitable for at least 3-gpm (0.19-L/s) flow and applications with up to 10-foot head (30-kPa) back pressure. Include 2 check valves; intermediate atmospheric vent; and nonremovable, ASME B1.20.7 garden-hose thread on outlet.
- N. Back-Siphonage Backflow Vacuum Breakers: ASSE 1056, suitable for continuous pressure and backflow applications. Include shutoff valves, check valve, test cocks, and vacuum vent.

2.3 BALANCING VALVES

- A. Calibrated Balancing Valves: Adjustable, with 2 readout ports and memory setting indicator. Include manufacturer's standard hoses, fittings, valves, differential pressure meter, and carrying case.
 1. 2-Inch NPS (DN50) and Smaller: Bronze body with brass ball, adjustment knob, calibrated nameplate, and threaded or solder-joint ends.
 2. 2-Inch NPS (DN50) and Smaller: Bronze, Y-pattern body with adjustment knob and threaded ends.
 3. 2-1/2-Inch NPS (DN65) and Larger: Cast-iron, Y-pattern body with bronze disc and flanged or grooved ends.
- B. Memory-Stop Balancing Valves, 2-Inch NPS (DN50) and Smaller: MSS SP-110, ball valve, rated for 400-psig (2760-kPa) minimum CWP. Include 2-piece, ASTM B 62 bronze body with standard port, chrome-plated brass ball, replaceable seats and seals, blowout-proof stem, solder-joint ends, and vinyl-covered steel handle with memory-stop device.

2.4 THERMOSTATIC WATER MIXING VALVES

- A. General: ASSE 1017, manually adjustable, thermostatic water mixing valve with bronze body. Include check stop and union on hot- and cold-water-supply inlets, adjustable temperature setting, and capacity at pressure loss as indicated.
 1. Liquid-Filled Motor, Operation and Pressure Rating: 100 psig (690 kPa) minimum.
- B. Manifolded, Thermostatic Water Mixing Valve Assemblies: Factory-fabricated unit consisting of parallel arrangement of thermostatic water mixing valves.
 1. Arrangement: One large-flow, thermostatic water mixing valve with flow-control valve, pressure regulator, inlet and outlet pressure gages, and one small-flow, thermostatic water mixing valve with flow-control valve. Include outlet thermometer, factory- or field-installed inlet and outlet valves, and other indicated options.
 2. Piping, of sizes and in arrangement indicated. Include valves and unions.
 3. Piping Component Finish: Polished chrome-plate.
 4. Cabinet: Stainless-steel box with stainless-steel hinged door.
 5. Cabinet Mounting: Recessed.

2.5 WATER TEMPERING VALVES

- A. General: Manually adjustable, thermostatically controlled water tempering valve; bronze body; and adjustable temperature setting.
- B. System Water Tempering Valves: Piston or discs controlling both hot- and cold-water flow, capable of limited antiscald protection. Include threaded inlets and outlet, capacity at pressure loss, and temperature range or setting as indicated.
 - 1. Finish: Rough bronze unless chrome-plated finish is indicated.
- C. Limited-Volume, Water Tempering Valves: Solder-joint inlets and 3/4-inch NPS (DN20) maximum outlet, with minimum capacity and maximum pressure loss as indicated.

2.6 STRAINERS

- A. Strainers: Y-pattern, unless otherwise indicated, and full size of connecting piping. Include ASTM A 666, Type 304, stainless-steel screens with 3/64-inch (1.2-mm) round perforations, unless otherwise indicated.
 - 1. Pressure Rating: 125-psig (860-kPa) minimum steam working pressure, unless otherwise indicated.
 - 2. 2-Inch NPS (DN50) and Smaller: Bronze body, with female threaded ends.
 - 3. 2-1/2-Inch NPS (DN65) and Larger: Cast-iron body, with interior AWWA C550 or FDA-approved epoxy coating and flanged ends.
 - 4. Y-Pattern Strainers: Screwed screen retainer with centered blowdown.
 - a. Drain: Factory- or field-installed, hose-end drain valve.
 - 5. Basket Strainers: Bolted flange or clamp cover, and basket with lift-out handle.
 - a. Simplex Type: Single unit, with one basket.
 - b. Drain: Factory- or field-installed, hose-end drain valve.
- B. Drainage Basket Strainers: Non-pressure-rated, cast-iron or coated-steel body; with bolted flange or clamp cover and drain with plug.
 - 1. Basket: Bronze or stainless steel with 3/16-inch- (3.2- or 4.8-mm-) diameter holes and lift-out handle.
 - 2. Female threaded ends for 2-inch NPS (DN50) and smaller, and flanged ends for 2-1/2-inch NPS (DN65) and larger.

2.7 OUTLET BOXES

- A. General: Recessed-mounting outlet boxes with fittings complying with ASME A112.18.1M. Include box with faceplate, services indicated for equipment connections, and wood-blocking reinforcement.
- B. Ice Maker Outlet Boxes: With hose connection and the following:
 - 1. Box and Faceplate: Stainless steel.

2. Box and Faceplate: Enameled or epoxy-painted steel.
 3. Shutoff Fitting: Hose bibb.
 4. Supply Fitting: 1/2-inch NPS (DN15) ball valve and 1/2-inch NPS (DN15) copper, water tubing.
- C. Reinforcement: 2-by-4-inch- or 2-by-6-inch- (38-by-89-mm- or 38-by-140-mm-), fire-retardant-treated-wood blocking between studs.

2.8 HOSE STATIONS

- A. General: Assembly with fitting complying with ASME A112.18.1M and hose-connection outlet with threads complying with ASME B1.20.7.
- B. Mixing-Valve Hose Station: Hot- and cold-water mixing valve with shutoff and check valves on inlets, hose with nozzle, and the following:
1. Cabinet: Stainless-steel enclosure with exposed valve handles, hose connection, and hose rack. Include manufacturer's standard thermometer in front.
 2. Hose-Rack Material: Stainless steel.
 3. Body Material: Bronze with stainless-steel wetted parts.
 4. Installation: Wall mounting. Include reinforcement (as indicated).
 5. Installation: Floor mounting on stainless-steel pedestal (as indicated).
 6. Supply Fittings: Two 3/4-inch NPS (DN20) ball valves and check valves and 3/4-inch NPS (DN20) copper, water tubing. Omit check valves if check stops are included with fitting.
 7. Hose: Manufacturer's standard for service fluid, temperature, and pressure; 25 feet (7.5 m) long.
 8. Nozzle: Manufacturer's standard.
- C. Reinforcement: 2-by-4-inch- or 2-by-6-inch- (38-by-89-mm- or 38-by-140-mm-), fire-retardant-treated-wood blocking between studs.

2.9 HYDRANTS

- A. Wall Hydrants: ASME A112.21.3M or ASSE 1019, nonfreeze, automatic draining, antback-flow type, key operation, with 3/4- or 1-inch NPS (DN20 or DN25) threaded or solder-joint inlet, and ASME B1.20.7 garden-hose threads on outlet. Include operating key for each hydrant.
1. Type: Projecting.
 2. Finish: Polished bronze.

2.10 TRAP SEAL PRIMER VALVES

- A. Trap Seal Primer Valves: ASSE 1018, water-supply-fed type, with the following characteristics:
1. 125-psig (860-kPa) minimum working pressure.
 2. Bronze body with atmospheric-vented drain chamber.

3. Inlet and Outlet Connections: 1/2-inch NPS (DN15) threaded, union, or solder joint.
4. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

2.11 DRAIN VALVES

- A. Hose-End Drain Valves: MSS SP-110, 3/4-inch NPS (DN20) ball valve, rated for 400-psig (2760-kPa) minimum CWP. Include 2-piece, ASTM B 62 bronze body with standard port, chrome-plated brass ball, replaceable seats and seals, blowout-proof stem, and vinyl-covered steel handle.
 1. Inlet: Threaded or solder joint.
 2. Outlet: Short-threaded nipple with ASME B1.20.7 garden-hose thread and cap.
 3. Hose-End Drain Valve Option: MSS SP-80, gate valve, Class 125, ASTM B 62 body, with 3/4-inch NPS (DN20) threaded or solder-joint inlet and ASME B1.20.7 garden-hose threads on outlet and cap. Hose bibbs are prohibited for this application.
- B. Stop-and-Waste Drain Valves: MSS SP-110, ball valve, rated for 200-psig (1380-kPa) minimum CWP ASTM B 62 bronze body, with 1/8-inch NPS (DN6) side drain outlet and cap.

2.12 MISCELLANEOUS PIPING SPECIALTIES

- A. Water Hammer Arresters: ASME A112.26.1M, ASSE 1010, or PDI-WH 201, bellows or piston type with pressurized cushioning chamber. Sizes are based on water-supply fixture units, ASME A112.26.1M sizes A through F and PDI-WH 201 sizes A through F.
- B. Hose Bibbs: Bronze body, with renewable composition disc, 3/4-inch NPS (DN15 or DN20) threaded or solder-joint inlet. Provide ASME B1.20.7 garden-hose threads on outlet and integral or field-installed, nonremovable, drainable, hose-connection vacuum breaker.
 1. Finish: Chrome or nickel plated.
 2. Operation: Wheel handle.
- C. Air-Admittance Valves: Plastic housing with mechanical-operation sealing diaphragm, designed to admit air into drainage and vent piping and to prevent transmission of sewer gas into building.
 1. Stack Vent Valve: ASSE 1050, designed for installation as terminal on soil, waste, and vent stacks, instead of stack vent extending through roof, in 2- to 4-inch NPS (DN50 to DN100).
 2. Fixture Vent Valve: ASSE 1051, designed for installation on waste piping, instead of vent connection, for single fixture, in 1-1/4- to 2-inch NPS (DN32 to DN50).
- D. Roof Flashing Assemblies: Manufactured assembly made of 4-lb/sq. ft. (20-kg/sq. m), 0.0625-inch- (1.6-mm-) thick, lead flashing collar and skirt extending at least 8 inches (200 mm) from pipe with galvanized steel boot reinforcement, and counterflashing fitting.
 1. Vent Cap: Extended model with field-installed, vandal-proof vent cap.
- E. Open Drains: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section of length to provide depth

indicated; and where indicated, increaser fitting of size indicated, joined with ASTM C 564 rubber gaskets. Size P-trap as indicated.

- F. Deep-Seal Traps: Cast iron or bronze, with inlet and outlet matching connected piping, cleanout where indicated, and trap seal primer valve connection where indicated.
 - 1. 2-Inch NPS (DN50): 4-inch- (100-mm-) minimum water seal.
 - 2. 2-1/2 Inch NPS (DN65) and Larger: 5-inch- (125-mm-) minimum water seal.
- G. Floor-Drain Inlet Fittings: Cast iron, with threaded inlet and threaded or spigot outlet, and trap seal primer valve connection.
- H. Air-Gap Fittings: ASME A112.1.2, cast iron or cast bronze, with fixed air gap, inlet for drain pipe or tube, and threaded or spigot outlet.
- I. Stack Flashing Fittings: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
- J. Vent Caps: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and set-screws to secure to vent pipe.
- K. Vent Terminals: Commercially manufactured, shop-fabricated or field-fabricated, frost-proof assembly constructed of copper, or lead-coated copper. Size to provide 1-inch (25-mm) enclosed air space between outside of pipe and inside of flashing collar extension, with counter-flashing, as indicated.

2.13 SLEEVE PENETRATION SYSTEMS

- A. Description: UL 1479, through-penetration firestop assembly consisting of sleeve and stack fitting with firestopping plug.
 - 1. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
 - 2. Stack Fitting: ASTM A 48, cast-iron, hubless-pattern, wye-branch stack fitting with neoprene O-ring at base and cast-iron plug in thermal-release harness in branch. Include PVC protective cap for plug.
 - a. Special Coating: Include corrosion-resistant interior coating on fittings for plastic chemical waste and vent stacks.

2.14 FLASHING MATERIALS

- A. Copper Sheet: ASTM B 152 (ASTM B 152M), of the following minimum weights and thicknesses, unless otherwise indicated:
 - 1. General Applications: 12 oz./sq. ft. (3.7 kg/sq. m or 0.41-mm thickness).
 - 2. Vent Pipe Flashing: 8 oz./sq. ft. (2.5 kg/sq. m or 0.27-mm thickness).

- B. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil (1-mm) minimum thickness.
- C. Fasteners: Metal compatible with material and substrate being fastened.
- D. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
- E. Solder: ASTM B 32, lead-free alloy.
- F. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.1 PLUMBING SPECIALTY INSTALLATION

- A. General: Install plumbing specialty components, connections, and devices according to manufacturer's written instructions.
- B. Install backflow preventers of type, size, and capacity indicated, at each water-supply connection to mechanical equipment and systems, and to other equipment and water systems as indicated. Comply with authorities having jurisdiction. Locate backflow preventers in same room as connected equipment. Install air-gap fitting on units with atmospheric-vent connection and pipe relief outlet drain to nearest floor drain. Do not install bypass around backflow preventer.
- C. Install pressure regulators with inlet and outlet shutoff valves and balance valve bypass. Install pressure gages on inlet and outlet.
- D. Install strainers on supply side of each control valve, pressure regulator, and solenoid valve, and where indicated.
- E. Install hose bibbs with integral vacuum breaker.
- F. Install wall hydrants with integral vacuum breaker.
- G. Install trap seal primer valves with valve outlet piping pitched down toward drain trap a minimum of one percent and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.
- H. Install backwater valves in building drain piping as indicated. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.
- I. Install expansion joints on vertical risers, stacks, and conductors as indicated.
- J. Install cleanouts in aboveground piping and building drain piping as indicated, and where not indicated, according to the following:

1. Size same as drainage piping up to 4-inch NPS (DN100). Use 4-inch NPS (DN100) for larger drainage piping unless larger cleanout is indicated.
 2. Locate at each change in direction of piping greater than 45 degrees.
 3. Locate at minimum intervals of 50 feet (15 m) for piping 4-inch NPS (DN100) and smaller and 100 feet (30 m) for larger piping.
 4. Locate at base of each vertical soil and waste stack.
- K. Install cleanout deck plates, of types indicated, with top flush with finished floor, for floor cleanouts for piping below floors.
- L. Install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall, for cleanouts located in concealed piping.
- M. Install flashing flange and clamping device with each stack and cleanout passing through floors with waterproof membrane.
- N. Install vent flashing sleeves on stacks passing through roof. Secure over stack flashing according to manufacturer's written instructions.
- O. Install frost-proof vent caps on each vent pipe passing through roof. Maintain 1-inch (25-mm) clearance between vent pipe and roof substrate.
- P. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor or as indicated. Size outlets as indicated.
- Q. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
1. Radius, 30 Inches (750 mm) or Less: Equivalent to 1 percent slope, but not less than 1/4-inch (6.35-mm) total depression.
- R. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- S. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
- T. Position floor drains for easy access and maintenance.
- U. Fasten wall-hanging plumbing specialties securely to supports attached to building substrate if supports are specified and to building wall construction if no support is indicated.
- V. Fasten recessed, wall-mounting plumbing specialties to reinforcement built into walls.
- W. Secure supplies to supports or substrate.
- X. Install individual stop valve in each water supply to plumbing specialties. Use ball, gate, or globe valve if specific valve is not indicated.
- Y. Install water-supply stop valves in accessible locations.

- Z. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.
- AA. Locate drainage piping as close as possible to bottom of floor slab supporting fixtures and drains.
- BB. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.
- CC. Include wood-blocking reinforcement for recessed and wall-mounting plumbing specialties.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties. The following are specific connection requirements:
 - 1. Install piping connections between plumbing specialties and piping specified in other Division 15 Sections.
 - 2. Install piping connections indicated between appliances and equipment specified in other Sections; connect directly to plumbing piping systems.
 - 3. Install piping connections indicated as indirect wastes from appliances and equipment specified in other Sections, to spill over receptors connected to plumbing piping systems.
- B. Install hoses between plumbing specialties and appliances as required for connections.
- C. Arrange for electric-power connections to plumbing specialties and devices that require power. Electric power is specified in Division 16 Sections.
- D. Supply Runouts to Plumbing Specialties: Install hot- and cold-water-supply piping of sizes indicated, but not smaller than required by authorities having jurisdiction.
- E. Drainage Runouts to Plumbing Specialties: Install drainage and vent piping, with approved trap, of sizes indicated, but not smaller than required by authorities having jurisdiction.
- F. Ground electric-powered plumbing specialties.
 - 1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- G. Arrange for electric-power connections to plumbing specialties and devices that require power. Electric power, wiring, and disconnect switches are specified in Division 16 Sections.

3.3 FLASHING INSTALLATION

- A. Fabricate flashing manufactured from single piece unless large pans, sumps, or other drainage shapes are required.

- B. Solder joints of copper sheets where required.
- C. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
 - 1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches (2500 mm), and skirt or flange extending at least 8 inches (200 mm) around pipe.
 - 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around sleeve.
 - 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around specialty.
- D. Set flashing on floors and roofs in solid coating of bituminous cement.
- E. Secure flashing into sleeve and specialty clamping ring or device.
- F. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 7 Section "Sheet Metal Flashing and Trim."
- G. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.
- H. Fabricate and install flashing and pans, sumps, and other drainage shapes as indicated. Install drain connection if indicated.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Provide services of factory-authorized service representative to supervise the field assembly of components and installation of grease recovery units, including piping and electrical connections, and to report results in writing.
 - 1. Test and adjust plumbing specialty controls and safeties. Replace damaged and malfunctioning controls and components.

3.5 COMMISSIONING

- A. Before startup, perform the following checks:
 - 1. System tests are complete.
 - 2. Damaged and defective specialties and accessories have been replaced or repaired.
 - 3. Clear space is provided for servicing specialties.
- B. Before operating systems, perform the following steps:
 - 1. Close drain valves, hydrants, and hose bibbs.
 - 2. Open general-duty valves to fully open position.
 - 3. Remove and clean strainers.
 - 4. Verify that drainage and vent piping are clear of obstructions. Flush with water until clear.

- C. Startup Procedures: Follow manufacturer's written instructions. If no procedures are prescribed by manufacturer, proceed as follows:
 - 1. Energize circuits for electrically operated units. Start and run units through complete sequence of operations.
- D. Adjust operation and correct deficiencies discovered during commissioning.

3.6 DEMONSTRATION

- A. Startup Services: Engage a factory-authorized service representative to perform startup services and train Owner's maintenance personnel as specified below:
 - 1. Train Owner's maintenance personnel on procedures and schedules related to startup of and servicing interceptors.
 - 2. Train Owner's maintenance personnel on procedures and schedules related to startup of and servicing grease recovery units.
 - 3. Review data in the maintenance manuals. Refer to Division 1 Section "Contract Close-out."
 - 4. Review data in the maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."
 - 5. Schedule training with Owner with at least 7 days' advance notice.

3.7 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 15430

SECTION 15485 - ELECTRIC, DOMESTIC WATER HEATERS

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 for domestic water systems:
 - 1. Commercial, electric water heaters.
 - 2. Compression tanks.
 - 3. Accessories.

1.3 SUBMITTALS

- A. Product Data: For each type and size of water heater. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.
- B. Shop Drawings: Detail water heater 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. Differentiate between manufacturer-installed and field-installed wiring.
- C. Product Certificates: Signed by manufacturers of water heaters certifying that products furnished comply with requirements.
- D. Maintenance Data: For water heaters to include in maintenance manuals specified in Division 1.
- E. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain same type of water heaters through one source from a single manufacturer.
- B. Product Options: Drawings indicate size, profiles, and dimensional requirements of water heaters and are based on specific units indicated. Other manufacturers' products complying with requirements may be considered. Refer to Division 1 Section "Substitutions."

- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. ASME Compliance: Fabricate and label water heater, hot-water storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," Division 1.
- E. ASHRAE Standards: Comply with performance efficiencies prescribed for the following:
 - 1. ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings," for commercial water heaters.
 - 2. ASHRAE 90.2, "Energy Efficient Design of New Low-Rise Residential Buildings," for household water heaters.

1.5 WARRANTY

- A. General Warranty: Special warranty 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 water heaters that fail in materials or workmanship within specified warranty period.
 - 1. Failures include heating elements and storage tanks.
 - 2. Warranty Period: From date of Substantial Completion:
 - a. Heating Elements: Five years.
 - b. Storage Tanks: 10 years.

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. Commercial, Storage, Electric Water Heaters:
 - a. Bradford White Corp.
 - b. Smith: A. O. Smith Water Products Co.
 - c. State Industries.
 - 2. Compression Tanks:

- a. Amtrol, Inc.
- b. Armstrong Pumps, Inc.
- c. Myers: F. E. Myers.
- d. Smith: A. O. Smith; Aqua-Air Div.
- e. State Industries.
- f. Taco, Inc.
- g. Zurn Industries, Inc.; Wilkins Div.

2.2 COMMERCIAL, STORAGE, ELECTRIC WATER HEATERS

- A. Description: Comply with UL 1453.
- B. Storage Tank Construction: ASME-code steel with 150-psig (1035-kPa) working-pressure rating.
 - 1. Tappings: Factory fabricated of materials compatible with tank for piping connections, relief valve, pressure gage, thermometer, drain, anode rods, and controls as required. Attach tappings to tank shell before testing and labeling.
 - a. NPS 2 (DN50) and Smaller: Threaded ends according to ASME B1.20.1, pipe threads.
 - b. NPS 2-1/2 (DN65) and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.
 - 2. Interior Finish: Materials and thicknesses complying with NSF 61, barrier materials for potable-water tank linings. Extend finish into and through tank fittings and outlets.
 - 3. Insulation: Comply with ASHRAE 90.1. Surround entire storage tank except connections and controls.
 - 4. Jacket: Steel, with enameled finish.
- C. Heating Elements: Electric, screw-in or bolt-on, immersion type arranged in multiples of three.
 - 1. Exception: Water heaters up to 9-kW input may have 2 or 3 elements.
 - 2. Staging: Input not exceeding 10-kW per step.
 - 3. Temperature Control: Adjustable, immersion thermostat.
 - 4. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
- D. Drain Valve: ASSE 1005, corrosion-resistant metal, factory installed.
- E. Anode Rods: Factory installed, magnesium.
- F. Dip Tube: Factory installed. Not required if cold-water inlet is near bottom of storage tank.
- G. Special Requirement: NSF 5 construction.

2.3 COMPRESSION TANKS

- A. Description: Steel, pressure-rated tank constructed with welded joints and factory-installed, butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
- B. Construction: 150-psig (1035-kPa) working-pressure rating.
- C. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1, pipe thread.
- D. Tank Interior Finish: Materials and thicknesses complying with NSF 61, barrier materials for potable-water tank linings. Extend finish into and through tank fittings and outlets.
- E. Tank Exterior Finish: Manufacturer's standard, unless finish is indicated.
- F. Air-Charging Valve: Factory installed.

2.4 WATER HEATER ACCESSORIES

- A. Combination Temperature and Pressure Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3. Include relieving capacity at least as great as heat input and include pressure setting less than water heater working-pressure rating. Select relief valve with sensing element that extends into tank.
 - 1. Option: Separate temperature and pressure relief valves are acceptable instead of combination relief valve.
 - 2. Exception: Omit combination temperature and pressure relief valve for tankless water heater, and furnish pressure relief valve for installation in piping.
- B. Pressure Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3. Include pressure setting less than heat-exchanger working-pressure rating.
- C. Vacuum Relief Valves: Comply with ASME PTC 25.3. Furnish for installation in piping.
 - 1. Exception: Omit if water heater has integral vacuum-relieving device.
- D. Water Heater Stands: Water heater manufacturer's factory-fabricated, steel stand for floor mounting and capable of supporting water heater and water. Include dimension that will support bottom of water heater a minimum of 18 inches (457 mm) above the floor.
- E. Drain Pans: Corrosion-resistant metal with raised edge. Include dimensions not less than base of water heater and include drain outlet not less than NPS 3/4 (DN20).
- F. Piping Manifold Kits: Water heater manufacturer's factory-fabricated inlet and outlet piping arrangement for multiple-unit installation. Include piping and valves for field assembly that is capable of isolating each water heater and of providing balanced flow through each water heater.
- G. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE 90.1 or ASHRAE 90.2.

PART 3 - EXECUTION

3.1 CONCRETE BASES

- A. Install concrete bases of dimensions indicated. Refer to Division 3 Section "Cast-in-Place Concrete" and Division 15 Section "Basic Mechanical Materials and Methods."

3.2 WATER HEATER INSTALLATION

- A. Install commercial water heaters on concrete bases.
- B. Install water heaters, level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
- C. Anchor water heaters to substrate.
- D. Install seismic restraints for water heaters. Anchor to substrate.
- E. Install temperature and pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend relief valve outlet with water piping in continuous downward pitch and discharge onto closest floor drain.
- F. Install vacuum relief valves in cold-water-inlet piping.
- G. Install vacuum relief valves in water heater storage tanks that have copper lining.
- H. Install water heater drain piping as indirect waste to spill into open drains or over floor drains. Install hose-end drain valves at low points in water piping for water heaters that do not have tank drains. Refer to Division 15 Section "Plumbing Specialties" for drain valves.
- I. Install thermometers on water heater inlet and outlet piping. Refer to Division 15 Section "Meters and Gages" for thermometers.
- J. Install pressure gages on water heater piping. Refer to Division 15 Section "Meters and Gages" for pressure gages.
- K. Assemble and install inlet and outlet piping manifold kits for multiple water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each water heater. Include shutoff valve, and thermometer in each water heater inlet and outlet, and throttling valve in each water heater outlet. Refer to Division 15 Section "Valves" for general-duty valves and Division 15 Section "Meters and Gages" for thermometers.
- L. Install piping-type heat traps on inlet and outlet piping of water heater storage tanks without integral or fitting-type heat traps.
- M. Fill water heaters with water.
- N. Charge compression tanks with air.

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to machine to allow service and maintenance.
- C. Connect hot- and cold-water piping with shutoff valves and unions. Connect hot-water-circulating piping with shutoff valve, check valve, and union.
- D. Make connections with dielectric fittings where piping is made of dissimilar metal.
- E. Electrical Connections: Power wiring and disconnect switches are specified in Division 16 Sections. Arrange wiring to allow unit service.
- F. Ground equipment.
 - 1. 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.

3.4 FIELD QUALITY CONTROL

- A. Engage a factory-authorized service representative to perform startup service.
- B. In addition to manufacturer's written installation and startup checks, perform the following:
 - 1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 2. Verify that piping system tests are complete.
 - 3. Check for piping connection leaks.
 - 4. Check for clear relief valve inlets, outlets, and drain piping.
 - 5. Check operation of circulators.
 - 6. Test operation of safety controls, relief valves, and devices.
 - 7. Energize electric circuits.
 - 8. Adjust operating controls.
 - 9. Adjust hot-water-outlet temperature settings. Do not set above 140 deg F (60 deg C) unless piping system application requires higher temperature.
 - 10. Balance water flow through manifolds of multiple-unit installations.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain water heaters.
 - 1. Train Owner's maintenance personnel on procedures for starting and stopping, troubleshooting, servicing, and maintaining equipment.
 - 2. Review data in maintenance manuals. Refer to Division 1 Section "Contract Closeout."
 - 3. Review data in maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."
 - 4. Schedule training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION 15485

SECTION 15510 HYDRONIC PIPING

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 piping systems for hot water heating and condensate drain piping. Piping materials and equipment specified in this Section include the following:
 - 1. Pipes, fittings, and specialties.
 - 2. Special-duty valves.
 - 3. Hydronic specialties.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 7 Section "Firestopping" for materials and methods for sealing pipe penetrations through fire and smoke barriers.
 - 2. Division 7 Section "Joint Sealants" for materials and methods for sealing pipe penetrations through exterior walls.
 - 3. Division 15 Section "Basic Mechanical Materials and Methods" for general piping materials and installation methods.
 - 4. Division 15 Section "Valves" for globe, ball, butterfly, and check valves.
 - 5. Division 15 Section "Meters and Gages" for thermometers, flow meters, and pressure gages.
 - 6. Division 15 Section "Hangers and Supports" for pipe supports.
 - 7. Division 15 Section "Mechanical Identification" for labeling and identifying hydronic systems.
 - 8. Division 15 Section "HVAC Pumps" for pumps, motors, and accessories for hydronic systems.
 - 9. Division 15 Section "Control Systems Equipment" for temperature-control valves and sensors.
 - 10. Division 15 Section "Testing, Adjusting, and Balancing" for hydronic system adjusting and balancing.

1.3 SYSTEM DESCRIPTION

- A. Hot Water System: The hot water supply and return piping is extended from the existing piping for the existing closed loop and existing boiler to hot water reheat coils in the RTUs as indicated. Circulation is accomplished by new hot water pump for the new system. Design flow rates and water temperatures are specified in the various equipment specifications and schedules.

Control sequences and temperature-reset schedules are specified in temperature-control specifications.

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 including rated capacities of selected models, weights (shipping, installed, and operating), furnished specialties, accessories, and installation instructions for each hydronic specialty and special-duty valve specified.
 - 1. Submit flow and pressure drop curves for diverting fittings and calibrated plug valves, based on manufacturer's testing.
- C. Shop Drawings detailing pipe anchors, special pipe support assemblies, alignment guides, and expansion joints and loops.
- D. Field test reports indicating and interpreting test results for compliance with performance requirements specified in Part 3 of this Section.
- E. Maintenance data for hydronic specialties and special-duty valves to include in the operation and maintenance manual specified in Division 1.

1.5 QUALITY ASSURANCE

- A. ASME Compliance: Comply with the following provisions:
 - 1. ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label.
 - 2. Fabricate and stamp air separators and compression tanks to comply with ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.
 - 3. Welding Standards: Qualify welding processes and operators according to ASME Boiler and Pressure Vessel Code, Section IX, "Welding and Brazing Qualifications."

1.6 COORDINATION

- A. Coordinate layout and installation of piping with equipment and with other installations.
- B. Coordinate pipe sleeve installation for foundation wall penetrations.
- C. Coordinate installation of roof curbs, equipment supports, and roof penetrations. Roof specialties are specified in Division 7 Sections.
- D. Coordinate pipe fitting pressure classes with products specified in related Sections.
- E. Coordinate installation of pipe sleeves for penetrations in exterior walls and floor assemblies. Coordinate with requirements for firestopping specified in Division 7 Section "Firestopping" for fire and smoke wall and floor assemblies.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Calibrated Plug Valves:
 - a. Armstrong Pumps, Inc.
 - b. ITT Fluid Technology Corp.; ITT Bell & Gossett.
 - c. Taco, Inc.
 2. Pressure-Reducing Valves:
 - a. Armstrong Pumps, Inc.
 - b. ITT Hoffman; ITT Fluid Handling Div.
 3. Safety Relief Valves:
 - a. Armstrong Pumps, Inc.
 - b. Conbraco Industries, Inc.
 - c. ITT Fluid Technology Corp.; ITT McDonnell & Miller.
 4. Compression Tanks:
 - a. Armstrong Pumps, Inc.
 - b. ITT Fluid Technology Corp.; ITT Bell & Gossett.
 - c. Taco, Inc.
 - d. Patterson
 5. Diaphragm-Type Compression Tanks:
 - a. Armstrong Pumps, Inc.
 - b. ITT Fluid Technology Corp.; ITT Bell & Gossett.
 - c. Patterson
 6. Air Separators:
 - a. Armstrong Pumps, Inc.
 - b. ITT Fluid Technology Corp.; ITT Bell & Gossett.
 - c. Taco, Inc.
 - d. Patterson
 - e. Spirotherm

2.2 PIPE AND TUBING MATERIALS

- A. General: Refer to Part 3 "Pipe Applications" Article for identifying where the following materials are used.
- B. Drawn-Temper Copper Tubing: **ASTM B 88, Type L** (ASTM B 88M, Type B).
- C. Steel Pipe, **2-Inch NPS** (DN50) and Smaller: ASTM A 53, Type S (seamless), Grade A, Schedule 40, plain ends.

- D. Steel Pipe, 2-1/2- to 12-Inch NPS (DN65 to DN300): ASTM A 53, Type E (electric-resistance welded), Grade A, Schedule 40, plain ends.
 - 1. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53, Schedule 40, carbon steel, seamless for 2-inch NPS (DN50) and smaller and electric-resistance welded for 2-1/2-inch NPS (DN65) and larger.

2.3 FITTINGS

- A. Wrought-Copper Fittings: ASME B16.22.
- B. Wrought-Copper Unions: ASME B16.22.
- C. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300.
- D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300.
- E. Wrought-Steel Fittings: ASTM A 234 (ASTM A 234M), Standard Weight.
- F. Wrought-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
 - 1. Material Group: 1.1.
 - 2. End Connections: Butt welding.
 - 3. Facings: Raised face.
- G. Flexible Connectors: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket; 150-psig (1035-kPa) minimum working pressure, 250 deg F (121 deg C) maximum operating temperature. Connectors shall have flanged or threaded end connections to match equipment connected and shall be capable of 3/4-inch (20-mm) misalignment.

2.4 JOINING MATERIALS

- A. Solder Filler Metals: ASTM B 32, 95-5 tin antimony.
- B. Brazing Filler Metals: AWS A5.8, Classification BAg 1 (silver).
- C. Welding Materials: Comply with Section II, Part C of ASME Boiler and Pressure Vessel Code for welding materials appropriate for wall thickness and for chemical analysis of pipe being welded.
- D. Gasket Material: Thickness, material, and type suitable for fluid to be handled; and design temperatures and pressures.

2.5 VALVES

- A. Globe, check, ball, and butterfly valves are specified in Division 15 Section "Valves."

- B. Refer to Part 3 "Valve Applications" Article for specific uses and applications for each valve specified.
- C. Calibrated Plug Valves: 125-psig (860-kPa) working pressure, 250 deg F (121 deg C) maximum operating temperature, bronze body, plug valve with calibrated orifice. Provide with connections for portable differential pressure meter with integral check valves and seals. Valve shall have integral pointer and calibrated scale to register degree of valve opening. Valves 2-inch NPS (DN50) and smaller shall have threaded connections and 2-1/2-inch NPS (DN65) valves shall have flanged connections.
- D. Pressure-Reducing Valves: Diaphragm-operated, cast-iron or brass body valve, with low inlet pressure check valve, inlet strainer removable without system shutdown, and noncorrosive valve seat and stem. Select valve size, capacity, and operating pressure to suit system. Valve shall be factory set at operating pressure and have capability for field adjustment.
- E. Safety Relief Valves: Brass or bronze body with brass and rubber, wetted, internal working parts; to suit system pressure and heat capacity; according to ASME Boiler and Pressure Vessel Code, Section IV.

2.6 HYDRONIC SPECIALTIES

- A. Manual Air Vent: Bronze body 3/4 inch NPS (DN20) ball valve with pipe nipple and at all high points and traps in piping systems.
- B. Chemical Feeder: (As indicated on drawings).
- C. Y-Pattern Strainers: 125-psig (860-kPa) working pressure; cast-iron body (ASTM A 126, Class B), flanged ends for 2-1/2-inch NPS (DN65) and larger, threaded connections for 2-inch NPS (DN50) and smaller, bolted cover, perforated Type 304 stainless-steel basket, and bottom drain connection. All water strainers shall have a ball valve with a hose connection installed for blow-down.
- D. Basket Strainers: 125-psig (860-kPa) working pressure; high-tensile cast-iron body (ASTM A 126, Class B), flanged end connections, bolted cover, perforated Type 304 stainless-steel basket, and bottom drain connection.

PART 3 - EXECUTION

3.1 PIPE APPLICATIONS

- A. Hot Water, 2-Inch NPS (DN50) and Smaller: Aboveground, use Type L (Type B) drawn-temper copper tubing with soldered joints or steel pipe with threaded joints.
- B. Hot Water, 2-1/2 Inch NPS (DN50) and Larger: Aboveground, use schedule 40 A-53 steel pipe with weld joints.
- C. Condensate Drain Lines: Type L (Type B) drawn-temper copper tubing with soldered joints.

3.2 VALVE APPLICATIONS

- A. General-Duty Valve Applications: Unless otherwise indicated, use the following valve types:
 - 1. Shutoff Duty: Use ball, and butterfly valves.
 - 2. Throttling Duty: Use globe, ball, and butterfly valves.
- B. Install shutoff-duty valves at each branch connection to supply mains, at supply connections to each piece of equipment, and elsewhere as indicated.
- C. Install throttling-duty valves at each branch connection to return mains, at return connections to each piece of equipment, and elsewhere as indicated.
- D. Install calibrated plug valves on the outlet of each heating or cooling element and elsewhere as required to facilitate system balancing.
- E. Install drain valves at low points in mains, risers, branch lines, and elsewhere as required for system drainage.
- F. Install check valves on each pump discharge and elsewhere as required to control flow direction.
- G. Install safety relief valves on hot water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Pipe discharge to floor without valves. Comply with ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, for installation requirements.
- H. Install pressure-reducing valves on hot water generators and elsewhere as required to regulate system pressure.

3.3 PIPING INSTALLATIONS

- A. Install piping according to Division 15 Section "Basic Mechanical Materials and Methods."
- B. Locate groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- C. Install drains at low points in mains, risers, and branch lines consisting of a tee fitting, **3/4-inch NPS (DN20)** ball valve, and short **3/4-inch NPS (DN20)** threaded nipple and cap.
- D. Install piping at a uniform grade of 0.2 percent upward in direction of flow.
- E. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
- F. Install branch connections to mains using tee fittings in main with takeoff out bottom of main, except for up-feed risers with takeoff out top of main line.
- G. Install unions in pipes **2-inch NPS (DN50)** and smaller, adjacent to each valve, at final connections of each piece of equipment, and elsewhere as indicated. Unions are not required at flanged connections.

- H. Install flanges on valves, apparatus, and equipment having 2-1/2-inch NPS (DN65) and larger connections.
- I. Install flexible connectors at inlet and discharge connections to pumps (except in-line pumps) and other vibration-producing equipment.
- J. Install strainers on supply side of each control valve, pressure-reducing valve, pressure-regulating valve, solenoid valve, in-line pump, and elsewhere as indicated. Install 3/4-inch NPS (DN20) nipple and ball valve with hose connection in blow-down connection of strainers 1-1/2-inch NPS (DN37) and larger.
- K. Anchor piping to ensure proper direction of expansion and contraction.

3.4 HANGERS AND SUPPORTS

- A. General: Hanger, support, and anchor devices are specified in Division 15 Section "Hangers and Supports." Conform to requirements below for maximum spacing of supports.
- B. Install the following pipe attachments:
 - 1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet (6 m) in length.
 - 2. Adjustable roller hangers for individual horizontal runs 20 feet (6 m) or longer.
 - 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal runs 20 feet (6 m) or longer, supported on a trapeze.
 - 4. Spring hangers to support vertical runs.
- C. Install hangers for steel piping with the following minimum rod sizes and maximum spacing:
 - 1. 3/4-Inch NPS (DN20): Maximum span, 7 feet (2.1 m); minimum rod size, 3/8 inch (10 mm).
 - 2. 1-Inch NPS (DN25): Maximum span, 7 feet (2.1 m); minimum rod size, 3/8 inch (10 mm).
 - 3. 1-1/2-Inch NPS (DN40): Maximum span, 9 feet (2.7 m); minimum rod size, 3/8 inch (10 mm).
 - 4. 2-Inch NPS (DN50): Maximum span, 10 feet (3 m); minimum rod size, 3/8 inch (10 mm).
 - 5. 2-1/2-Inch NPS (DN65): Maximum span, 11 feet (3.4 m); minimum rod size, 3/8 inch (10 mm).
 - 6. 3-Inch NPS (DN80): Maximum span, 12 feet (3.7 m); minimum rod size, 3/8 inch (10 mm).
 - 7. 4-Inch NPS (DN100): Maximum span, 14 feet (4.3 m); minimum rod size, 1/2 inch (13 mm).
 - 8. 6-Inch NPS (DN150): Maximum span, 17 feet (5.2 m); minimum rod size, 1/2 inch (13 mm).
 - 9. 8-Inch NPS (DN200): Maximum span, 19 feet (5.8 m); minimum rod size, 5/8 inch (16 mm).
 - 10. 10-Inch NPS (DN250): Maximum span, 20 feet (6.1 m); minimum rod size, 3/4 inch (19 mm).

11. **12-Inch NPS (DN300):** Maximum span, **23 feet (7 m)**; minimum rod size, **7/8 inch (22 mm)**.
- D. Install hangers for drawn-temper copper piping with the following minimum rod sizes and maximum spacing:
1. **3/4-Inch NPS (DN20):** Maximum span, **5 feet (1.5 m)**; minimum rod size, **3/8 inch (10 mm)**.
 2. **1-Inch NPS (DN25):** Maximum span, **7 feet (2.1 m)**; minimum rod size, **3/8 inch (10 mm)**.
 3. **1-1/2-Inch NPS (DN40):** Maximum span, **9 feet (2.7 m)**; minimum rod size, **3/8 inch (10 mm)**.
 4. **2-Inch NPS (DN50):** Maximum span, **10 feet (3 m)**; minimum rod size, **3/8 inch (10 mm)**.
 5. **2-1/2-Inch NPS (DN65):** Maximum span, **11 feet (3.4 m)**; minimum rod size, **3/8 inch (10 mm)**.
 6. **3-Inch NPS (DN80):** Maximum span, **12 feet (3.7 m)**; minimum rod size, **3/8 inch (10 mm)**.
- E. Support vertical runs at each floor.

3.5 PIPE JOINT CONSTRUCTION

- A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for joint construction requirements for soldered and brazed joints in copper tubing; threaded, welded, and flanged joints in steel piping.
- B. Mechanical Joints: Assemble joints according to fitting manufacturer's written instructions.

3.6 HYDRONIC SPECIALTIES INSTALLATION

- A. Install manual air vents at high points in system, at heat-transfer coils, and elsewhere as required for system air venting.

3.7 TERMINAL EQUIPMENT CONNECTIONS

- A. Piping size for supply and return shall be same size as equipment connections or as indicated on drawings.
- B. Install control valves in accessible locations close to equipment.

3.8 FIELD QUALITY CONTROL

- A. Testing Preparation: Prepare hydronic piping according to ASME B31.9 and as follows:
1. Leave joints, including welds, uninsulated and exposed for examination during test.
 2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.

3. Flush system with clean water. Clean strainers.
4. Isolate equipment that is not subjected to test pressure from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Flanged joints where blinds are inserted to isolate equipment need not be tested.
5. Install relief valve set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Testing: Test hydronic piping as follows:

1. Use ambient temperature water as testing medium, except where there is risk of damage due to freezing. Another liquid may be used if it is safe for workers and compatible with piping system components.
2. Use vents installed at the high points of system to release trapped air while filling system. Use drains installed at low points for complete removal of liquid.
3. Examine system to see that equipment and parts that cannot withstand test pressures are properly isolated. Examine test equipment to ensure that it is tight and that low-pressure filling lines are disconnected.
4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the design pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Check to verify that stress due to pressure at bottom of vertical runs does not exceed either 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A of ASME B31.9, Code for Pressure Piping, "Building Services Piping."
5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components as appropriate, and repeat hydrostatic test until there are no leaks.
6. Prepare written report of testing.

3.9 ADJUSTING AND CLEANING

- A. After completing system installation, including outlet fittings and devices, inspect finish. Remove burrs, dirt, and construction debris, and repair damaged finishes including chips, scratches, and abrasions.
- B. Flush hydronic piping systems with clean water. Remove, clean, and replace strainer screens. After cleaning and flushing hydronic piping system, but before balancing, remove disposable fine-mesh strainers in pump suction diffusers.
- C. Mark calibrated nameplates of pump discharge valves after hydronic system balancing has been completed, to permanently indicate final balanced position.
- D. Chemical Treatment: Provide a water analysis prepared by chemical treatment supplier to determine type and level of chemicals required to prevent scale and corrosion. Perform initial treatment after completing system testing.

3.10 COMMISSIONING

- A. Fill system and perform initial chemical treatment.

- B. Check expansion tanks to determine that they are not air bound and that system is completely full of water.
- C. Perform these steps before operating the system:
 - 1. Open valves to fully open position. Close coil bypass valves.
 - 2. Check pump for proper direction of rotation.
 - 3. Set automatic fill valves for required system pressure.
 - 4. Check air vents at high points of systems and determine if all are installed and operating freely (automatic type) or bleed air completely (manual type).
 - 5. Set temperature controls so all coils are calling for full flow.
 - 6. Check operation of automatic bypass valves.
 - 7. Check and set operating temperatures of boilers and chillers to design requirements.
 - 8. Lubricate motors and bearings.

END OF SECTION 23 21 13

SECTION-15738
SPLIT-SYSTEM AIR-CONDITIONING UNITS

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 split-system air-conditioning and heat pump units consisting of separate evaporator-fan and compressor-condenser components. Units are designed for exposed or concealed mounting, and may be connected to ducts.

1.3 SUBMITTALS

- A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Samples for Initial Selection: For units with factory-applied color finishes.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.
- F. Warranty: Special warranty specified in this Section.
- G. LEED Submittals:
 - 1. Credit EA 4: Manufacturers' product data for refrigerants, including printed statement that refrigerants are free of HCFCs.

1.4 QUALITY ASSURANCE

- A. Product Options: Drawings indicate size, profiles, and dimensional requirements of split-system units and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
- 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. Energy-Efficiency Ratio: Equal to or greater than prescribed by ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."

- D. Coefficient of Performance: Equal to or greater than prescribed by ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."
- E. Units shall be designed to operate with HCFC-free refrigerants.

1.5 COORDINATION

- A. Coordinate size and location of concrete bases for units. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork are specified in Division 3 Section "Cast-in-Place Concrete."
- B. Coordinate size, location, and connection details with roof curbs, equipment supports, and roof penetrations specified in Division 7 Section "Roof Accessories."

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

1.7 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. Filters: One set of filters for each unit.
 - 2. Fan Belts: One set of belts for each unit.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Carrier Air Conditioning; Div. of Carrier Corporation.
 - 2. Trane Company (The); Unitary Products Group.
 - 3. York International Corp.

2.2 CONCEALED EVAPORATOR-FAN COMPONENTS

- A. Chassis: Galvanized steel with flanged edges, removable panels for servicing, and insulation on back of panel.
 - 1. Insulation: Faced, glass-fiber duct liner.
 - 2. Drain Pans: Galvanized steel, with connection for drain; insulated.
- B. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with thermal-expansion valve.

- C. Electric Coil: Helical, nickel-chrome, resistance-wire heating elements with refractory ceramic support bushings; automatic-reset thermal cutout; first-stage shall be SCR modulation and other stages shall be by built-in mercury contactors; manual-reset thermal cutout; airflow proving device; and one-time fuses in terminal box for overcurrent protection.
- D. Fan: Forward-curved, double-width wheel of galvanized steel; directly connected to motor.
- E. Fan Motors: Comply with requirements in Division 15 Section "Motors."
 - 1. Special Motor Features: multispeed with three position switch and with internal thermal protection and permanent lubrication.
- F. Disposable Filters: 1 inch (25 mm) thick, in fiberboard frames.
- G. Wiring Terminations: Connect motor to chassis wiring with plug connection.

2.3 AIR-COOLED, COMPRESSOR-CONDENSER COMPONENTS

- A. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
- B. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
 - 1. Compressor Type: Scroll.
 - 2. Two-speed compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.
 - 3. Refrigerant Charge: R-22
- C. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with liquid subcooler.
- D. Heat Pump Components: Reversing valve and low-temperature air cut-off thermostat.
- E. Fan: Aluminum-propeller type, directly connected to motor.
- F. Motor: Permanently lubricated, with integral thermal-overload protection.
- G. Low Ambient Kit: Permits operation down to 45 deg F (7 deg C).
- H. Mounting Base: Polyethylene.

2.4 ACCESSORIES

- A. Control equipment and sequence of operation are specified in Division 15 Sections "HVAC Instrumentation and Controls" and "Sequence of Operation."
- B. Thermostat: Low voltage with subbase to control compressor and evaporator fan.
- C. Thermostat: Wireless infrared functioning to remotely control compressor and evaporator fan, with the following features:

1. Compressor time delay.
 2. 24-hour time control of system stop and start.
 3. Liquid-crystal display indicating temperature, set-point temperature, time setting, operating mode, and fan speed.
 4. Fan-speed selection, including auto setting.
- D. Automatic-reset timer to prevent rapid cycling of compressor.
- E. Additional Monitoring:
1. Monitor constant and variable motor loads.
 2. Monitor cooling load.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install units level and plumb.
- B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.
- C. Install ground-mounting, compressor-condenser components on 4-inch- (100-mm-) thick, reinforced concrete base; 4 inches (100 mm) larger on each side than unit. Concrete, reinforcement, and formwork are specified in Division 3 Section "Cast-in-Place Concrete." Coordinate anchor installation with concrete base.
- D. Install ground-mounting, compressor-condenser components on polyethylene mounting base.
- E. Install seismic restraints.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to unit to allow service and maintenance.
- C. Duct Connections: Duct installation requirements are specified in Division 15 Section "Metal Ducts." Drawings indicate the general arrangement of ducts. Connect supply and return ducts to split-system air-conditioning units with flexible duct connectors. Flexible duct connectors are specified in Division 15 Section "Duct Accessories."
- D. Ground equipment according to Division 16 Section "Grounding and Bonding."
- E. Electrical Connections: Comply with requirements in Division 16 Sections for power wiring, switches, and motor controls.

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Remove and replace malfunctioning units and retest as specified above.

3.4 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 15738

SECTION 15815 - METAL DUCTS

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 rectangular, round, and flat-oval metal ducts and plenums for heating, ventilating, and air-conditioning systems in pressure classes from minus 2- to plus 10-inch wg (minus 500 to plus 2490 Pa).
- B. Related Sections include the following:
 - 1. Division 7 Section "Joint Sealants" for fire-resistant sealants for use around duct penetrations and fire-damper installations in fire-rated floors, partitions, and walls.
 - 2. Division 8 Section "Access Doors" for wall- and ceiling-mounted access doors for access to concealed ducts.
 - 3. Division 10 Section "Louvers and Vents" for intake and relief louvers and vents connected to ducts and installed in exterior walls.
 - 4. Division 15 Section "Mechanical Insulation" for duct insulation.
 - 5. Division 15 Section "Duct Accessories" for dampers, sound-control devices, duct-mounted access doors and panels, turning vanes, and flexible ducts.
 - 6. Division 15 Section "Air Terminals" for constant-volume and variable-air-volume control boxes, and reheat boxes.
 - 7. Division 15 Section "Diffusers, Registers, and Grilles."
 - 8. Division 15 Section "Control Systems Equipment" for automatic volume-control dampers and operators.
 - 9. Division 15 Section "Testing, Adjusting, and Balancing" for air balancing and final adjusting of manual-volume dampers.

1.3 DEFINITIONS

- A. Thermal Conductivity and Apparent Thermal Conductivity (k-Value): As defined in ASTM C 168. In this Section, these values are the result of the formula $\text{Btu} \times \text{in.} / \text{h} \times \text{sq. ft.} \times \text{deg F}$ or $\text{W} / \text{m} \times \text{K}$ at the temperature differences specified. Values are expressed as Btu or W.
 - 1. Example: Apparent Thermal Conductivity (k-Value): 0.26 or 0.037.

1.4 SYSTEM DESCRIPTION

- A. Duct system design, as indicated, has been used to select and size air-moving and -distribution equipment and other components of air system. Changes to layout or configuration of duct sys-

tem must be specifically approved in writing by Architect. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing system total pressure.

1.5 SUBMITTALS

- A. Product Data: For sealing materials.
- B. **Shop Drawings: Show details of the following:**(these shop drawings will be required before duct fabrication should start)
 - 1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
 - 2. Duct layout indicating pressure classifications and sizes on plans.
 - 3. Fittings.
 - 4. Reinforcement and spacing.
 - 5. Seam and joint construction.
 - 6. Penetrations through fire-rated and other partitions.
 - 7. Hangers and supports, including methods for building attachment, vibration isolation, seismic restraints, and duct attachment.
- C. Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items. Show the following:
 - 1. Coordination with ceiling-mounted items, including lighting fixtures, diffusers, grilles, speakers, sprinkler heads, access panels, and special moldings.
- D. Welding Certificates: Copies of certificates indicating welding procedures and personnel comply with requirements in "Quality Assurance" Article.
- E. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
- F. Record Drawings: Indicate actual routing, fitting details, reinforcement, support, and installed accessories and devices.

1.6 QUALITY ASSURANCE

- A. Welding Standards: Qualify welding procedures and welding personnel to perform welding processes for this Project according to AWS D1.1, "Structural Welding Code--Steel," for hangers and supports; AWS D1.2, "Structural Welding Code--Aluminum," for aluminum supporting members; and AWS D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.
- B. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," unless otherwise indicated.
- C. Comply with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems," unless otherwise indicated.
 - 1. Retain paragraph below if range hood exhaust is in Project

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver sealant and firestopping materials to 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 multicomponent materials.
- B. Store and handle sealant and firestopping materials according to manufacturer's written recommendations.

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIALS

- A. Galvanized, Sheet Steel: Lock-forming quality; ASTM A 653/A 653M, G90 (Z275) coating designation; mill-phosphatized finish for surfaces of ducts exposed to view.
- B. Reinforcement Shapes and Plates: Galvanized steel reinforcement where installed on galvanized, sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- C. Tie Rods: Galvanized steel, 3/8-inch (10-mm) minimum diameter for 36-inch (900-mm) length or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.2 SEALANT MATERIALS

- A. Joint and Seam Sealants, General: The term "sealant" is not limited to materials of adhesive or mastic nature but includes tapes and combinations of open-weave fabric strips and mastics.
 - 1. Joint and Seam Tape: 4 inches (100 mm) wide; glass-fiber fabric reinforced.
 - 2. Tape Sealing System: Woven-fiber tape impregnated with a gypsum mineral compound and a modified acrylic/silicone activator to react exothermically with tape to form a hard, durable, airtight seal.
 - 3. Joint and Seam Sealant: One-part, nonsag, solvent-release-curing, polymerized butyl sealant, formulated with a minimum of 75 percent solids.
 - 4. Flanged Joint Mastics: One-part, acid-curing, silicone, elastomeric joint sealants, complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.

2.3 HANGERS AND SUPPORTS

- A. Building Attachments: Concrete inserts, do not use powder-actuated fasteners, or structural-steel fasteners appropriate for building materials.
 - 1. Exception: Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.
- B. Hanger Materials: Galvanized, sheet steel or round, threaded steel rod.
 - 1. Hangers Installed in Corrosive Atmospheres: Electrogalvanized, all-thread rod or galvanized rods with threads painted after installation.

2. Straps and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for sheet steel width and thickness and for steel rod diameters.
- C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- D. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.
 1. Supports for Galvanized-Steel Ducts: Galvanized steel shapes and plates.

2.4 RECTANGULAR DUCT FABRICATION

- A. General: Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction with galvanized, sheet steel, according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible." Comply with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G90 (Z275) coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.
- B.
 1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure classification.
 2. Materials: Free from visual imperfections such as pitting, seam marks, roller marks, stains, and discolorations.
 3. Deflection: Duct systems shall not exceed deflection limits according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
- C. Transverse Joints: Prefabricated slide-on joints and components constructed using manufacturer's guidelines for material thickness, reinforcement size and spacing, and joint reinforcement.
 1. Manufacturers:
 - a. Ductmate Industries, Inc.
- D. Static-Pressure Classifications: Unless otherwise indicated, construct ducts to the following:
 1. Supply Ducts: 3-inch wg (750 Pa).
 2. Return Ducts: 2-inch wg (500 Pa), negative pressure.
 3. Exhaust Ducts: 3-inch wg (750 Pa), negative pressure.
- E. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches (480 mm) and larger and 0.0359 inch (0.9 mm) thick or less, with more than 10 sq. ft. (0.93 sq. m) of un-braced panel area, unless ducts are lined.
- F. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles. Fabricate edge facings at the following locations:
 1. Fan discharges.

2. Intervals of lined duct preceding unlined duct.
3. Upstream edges of transverse joints in ducts where air velocities are greater than 2500 fpm (12.7 m/s) or where indicated.

2.5 ROUND AND FLAT-OVAL DUCT FABRICATION

- A. General: Diameter as applied to flat-oval ducts in this Article is the diameter of the size of round duct that has a circumference equal to perimeter of a given size of flat-oval duct.
- B. Round Ducts: Fabricate supply ducts of galvanized steel according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
- C. Flat-Oval Ducts: Fabricate supply ducts with standard spiral lock seams or with butt-welded longitudinal seams according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
- D. Double-Wall (Insulated) Ducts: Fabricate double-wall (insulated) ducts with an outer shell and an inner liner. Dimensions indicated on internally insulated ducts are inside dimensions.
 1. Thermal Conductivity (k-Value): 0.26 at 75 deg F (0.037 at 24 deg C) mean temperature.
 2. Outer Shell: Base outer-shell metal thickness on actual outer-shell dimensions. Fabricate outer-shell lengths 2 inches (50 mm) longer than inner shell and insulation, and in metal thickness specified for single-wall duct.
 3. Insulation: 1-inch- (25-mm-) thick fibrous-glass insulation, unless otherwise indicated. Terminate insulation where internally insulated duct connects to single-wall duct or uninsulated components. Terminate insulation and reduce outer duct diameter to inner liner diameter.
 4. Solid Inner Liner: Fabricate round and flat-oval inner liners with solid sheet metal of thickness listed below:
 5. Perforated Inner Liner: Fabricate round and flat-oval inner liners with sheet metal having 3/32-inch- (2.4-mm-) diameter perforations, with an overall open area of 23 percent. Use the following sheet metal thicknesses and seam construction:
 - a. Ducts 3 to 8 Inches (75 to 200 mm) in Diameter: 0.019 inch (0.5 mm) with standard spiral seam construction.
 - b. Ducts 9 to 42 Inches (225 to 1070 mm) in Diameter: 0.019 inch (0.5 mm) with single-rib spiral seam construction.
 - c. Ducts 44 to 60 Inches (1120 to 1525 mm) in Diameter: 0.022 inch (0.55 mm) with single-rib spiral seam construction.
 - d. Ducts 62 to 88 Inches (1575 to 2235 mm) in Diameter: 0.034 inch (0.85 mm) with standard spiral seam construction.
 6. Maintain concentricity of liner to outer shell by mechanical means. Retain insulation from dislocation by mechanical means.

2.6 ROUND AND FLAT-OVAL SUPPLY AND EXHAUST FITTING FABRICATION

- A. 90-Degree Tees and Laterals and Conical Tees: Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," with metal thicknesses specified for longitudinal seam straight duct.
- B. Diverging-Flow Fittings: Fabricate with a reduced entrance to branch taps with no excess material projecting from body onto branch tap entrance.
- C. Elbows: Fabricate in die-formed, gored, pleated, or mitered construction. Fabricate bend radius of die-formed, gored, and pleated elbows one and one-half times elbow diameter. Unless elbow construction type is indicated, fabricate elbows as follows:
 - 1. Mitered-Elbow Radius and Number of Pieces: Welded construction complying with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.
 - 2. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from minus 2- to plus 2-inch wg (minus 500 to plus 500 Pa):
 - a. Ducts 3 to 26 Inches (75 to 660 mm) in Diameter: 0.028 inch (0.7 mm).
 - b. Ducts 27 to 36 Inches (685 to 915 mm) in Diameter: 0.034 inch (0.85 mm).
 - c. Ducts 37 to 50 Inches (940 to 1270 mm) in Diameter: 0.040 inch (1.0 mm).
 - d. Ducts 52 to 60 Inches (1320 to 1525 mm) in Diameter: 0.052 inch (1.3 mm).
 - e. Ducts 62 to 84 Inches (1575 to 2130 mm) in Diameter: 0.064 inch (1.6 mm).
 - 3. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from 2- to 10-inch wg (500 to 2490 Pa):
 - a. Ducts 3 to 14 Inches (75 to 355 mm) in Diameter: 0.028 inch (0.7 mm).
 - b. Ducts 15 to 26 Inches (380 to 660 mm) in Diameter: 0.034 inch (0.85 mm).
 - c. Ducts 27 to 50 Inches (685 to 1270 mm) in Diameter: 0.040 inch (1.0 mm).
 - d. Ducts 52 to 60 Inches (1320 to 1525 mm) in Diameter: 0.052 inch (1.3 mm).
 - e. Ducts 62 to 84 Inches (1575 to 2130 mm) in Diameter: 0.064 inch (1.6 mm).
 - 4. Flat-Oval Mitered Elbows: Welded construction with same metal thickness as longitudinal seam flat-oval duct.
 - 5. 90-Degree, Two-Piece, Mitered Elbows: Use only for supply systems, or exhaust systems for material-handling classes A and B; and only where space restrictions do not permit using 1.5 bend radius elbows. Fabricate with single-thickness turning vanes.
 - 6. Round Elbows, 8 Inches (200 mm) and Smaller: Fabricate die-formed elbows for 45- and 90-degree elbows and pleated elbows for 30, 45, 60, and 90 degrees only. Fabricate nonstandard bend-angle configuration or nonstandard diameter elbows with gored construction.
 - 7. Round Elbows, 9 through 14 Inches (225 through 355 mm): Fabricate gored or pleated elbows for 30, 45, 60, and 90 degrees, unless space restrictions require a mitered elbow. Fabricate nonstandard bend-angle configuration or nonstandard diameter elbows with gored construction.
 - 8. Round Elbows, Larger Than 14 Inches (355 mm), and All Flat-Oval Elbows: Fabricate gored elbows, unless space restrictions require a mitered elbow.
 - 9. Die-Formed Elbows for Sizes through 8 Inches (200 mm) and All Pressures: 0.040 inch (1.0 mm) thick with two-piece welded construction.
 - 10. Round Gored-Elbow Metal Thickness: Same as non-elbow fittings specified above.

11. Flat-Oval Elbow Metal Thickness: Same as longitudinal seam flat-oval duct specified above.
 12. Pleated Elbows for Sizes through 14 Inches (355 mm) and Pressures through 10-Inch wg (2490 Pa): 0.022 inch (0.55 mm).
- D. Double-Wall (Insulated) Fittings: Fabricate double-wall (insulated) fittings with an outer shell and an inner liner. Dimensions indicated on internally insulated ducts are inside dimensions.
1. Thermal Conductivity (k-Value): 0.26 at 75 deg F (0.037 at 24 deg C) mean temperature.
 2. Outer Shell: Base outer-shell metal thickness on actual outer-shell dimensions. Fabricate outer-shell lengths 2 inches (50 mm) longer than inner shell and insulation. Use the same metal thicknesses for outer duct as for uninsulated fittings.
 3. Insulation: 1-inch- (25-mm-) thick fibrous-glass insulation, unless otherwise indicated. Terminate insulation where internally insulated duct connects to single-wall duct or uninsulated components. Terminate insulation and reduce outer duct diameter to nominal single-wall size.
 4. Solid Inner Liner: Fabricate round and flat-oval inner liners with solid sheet metal of thickness listed below:
 5. Perforated Inner Liner: Fabricate round and flat-oval inner liners with sheet metal having 3/32-inch- (2.4-mm-) diameter perforations, with an overall open area of 23 percent. Use the following sheet metal thicknesses:
 - a. Ducts 3 to 34 Inches (75 to 865 mm) in Diameter: 0.028 inch (0.7 mm).
 - b. Ducts 35 to 58 Inches (890 to 1475 mm) in Diameter: 0.034 inch (0.85 mm).
 - c. Ducts 60 to 88 Inches (1525 to 2235 mm) in Diameter: 0.040 inch (1.0 mm).
 6. Maintain concentricity of liner to outer shell by mechanical means. Retain insulation from dislocation by mechanical means.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION, GENERAL

- A. Duct installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of ducts, fittings, and accessories.
- B. Construct and install each duct system for the specific duct pressure classification indicated.
- C. Install round and flat-oval ducts in lengths not less than 12 feet (3.7 m), unless interrupted by fittings.
- D. Install ducts with fewest possible joints.
- E. Install fabricated fittings for changes in directions, changes in size and shape, and connections.
- F. Install couplings tight to duct wall surface with a minimum of projections into duct.
- G. Install ducts, unless otherwise indicated, vertically and horizontally, parallel and perpendicular to building lines; avoid diagonal runs.

- H. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- I. Install ducts with a clearance of 1 inch (25 mm), plus allowance for insulation thickness.
- J. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions, unless specifically indicated.
- K. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.
- L. Electrical Equipment Spaces: Route ductwork to avoid passing through transformer vaults and electrical equipment spaces and enclosures.
- M. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same metal thickness as duct. Overlap opening on four sides by at least 1-1/2 inches (38 mm).
- N. Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire damper, sleeve, and firestopping sealant. Fire and smoke dampers are specified in Division 15 Section "Duct Accessories." Firestopping materials and installation methods are specified in Division 7 Section "Firestopping."

3.2 SEAM AND JOINT SEALING

- A. General: Seal all duct seams and joints according to the duct pressure class indicated and as described in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
- B. Seal externally insulated ducts before insulation installation.

3.3 HANGING AND SUPPORTING

- A. Install rigid round, rectangular, and flat-oval metal duct with support systems indicated in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
- B. Support horizontal ducts within 24 inches (600 mm) of each elbow and within 48 inches (1200 mm) of each branch intersection.
- C. Support vertical ducts at a maximum interval of 16 feet (5 m) and at each floor.
- D. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.
- E. Install concrete inserts before placing concrete.

3.4 CONNECTIONS

- A. Connect equipment with flexible connectors according to Division 15 Section "Duct Accessories."
- B. For branch, outlet and inlet, and terminal unit connections, comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

3.5 FIELD QUALITY CONTROL

- A. Disassemble, reassemble, and seal segments of systems as required to accommodate leakage testing and as required for compliance with test requirements.
- B. Conduct tests, in presence of Architect, at static pressures equal to maximum design pressure of system or section being tested. If pressure classifications are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure. Give seven days' advance notice for testing.
- C. Determine leakage from entire system or section of system by relating leakage to surface area of test section.
- D. Maximum Allowable Leakage: Comply with requirements for Leakage Classification 3 for round and flat-oval ducts, Leakage Classification 12 for rectangular ducts in pressure classifications less than and equal to 2-inch wg (500 Pa) (both positive and negative pressures), and Leakage Classification 6 for pressure classifications from 2- to 10-inch wg (500 to 2490 Pa).
- E. Remake leaking joints and retest until leakage is less than maximum allowable.
- F. Leakage Test: Perform tests according to SMACNA's "HVAC Air Duct Leakage Test Manual."

3.6 ADJUSTING

- A. Adjust volume-control dampers in ducts, outlets, and inlets to achieve design airflow.
- B. Refer to Division 15 Section "Testing, Adjusting, and Balancing" for detailed procedures.

3.7 CLEANING

- A. After completing system installation, including outlet fittings and devices, inspect the system. Vacuum ducts before final acceptance to remove dust and debris.

END OF SECTION 15815

SECTION 15820 - DUCT ACCESSORIES

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. Manual-volume dampers.
 - 2. Fire and smoke dampers.
 - 3. Turning vanes.
 - 4. Duct-mounted access doors and panels.
 - 5. Flexible ducts.
 - 6. Flexible connectors.
 - 7. Duct accessory hardware.
- B. Related Sections include the following:
 - 1. Division 8 Section "Access Doors" for wall- and ceiling-mounted access doors and panels.
 - 2. Division 10 Section "Louvers and Vents" for intake and relief louvers and vents connected to ducts and installed in exterior walls.
 - 3. Division 15 Section "Air Terminals" for constant-volume and variable-air-volume control boxes, and reheat boxes.
 - 4. Division 15 Section "Diffusers, Registers, and Grilles."
 - 5. Division 15 Section "Control Systems Equipment" for electric and pneumatic damper actuators.
 - 6. Division 16 Section "Fire Alarm Systems" for duct-mounted fire and smoke detectors.

1.3 SUBMITTALS

- A. Product Data: For the following:
 - 1. Manual-volume dampers.
 - 2. Fire and smoke dampers.
 - 3. Duct-mounted access doors and panels.
 - 4. Flexible ducts.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loadings, required clearances, method of field assembly, components, location, and size of each field connection. Detail the following:
 - 1. Special fittings and manual- and automatic-volume-damper installations.

2. Fire- and smoke-damper installations, including sleeves and duct-mounted access doors and panels.
- C. Product Certificates: Submit certified test data on dynamic insertion loss; self-noise power levels; and airflow performance data, static-pressure loss, dimensions, and weights.

1.4 QUALITY ASSURANCE

- A. NFPA Compliance: Comply with the following NFPA standards:
 1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
 2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIALS

- A. Galvanized, Sheet Steel: Lock-forming quality; ASTM A 653/A 653M, G90 (Z275) coating designation; mill-phosphatized finish for surfaces of ducts exposed to view.
- B. Carbon-Steel Sheets: ASTM A 366/A 366M, cold-rolled sheets, commercial quality, with oiled, exposed matte finish.
- C. Extruded Aluminum: 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, 3/8-inch (10-mm) minimum diameter for 36-inch (900-mm) length or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.2 MANUAL-VOLUME DAMPERS

- A. General: Factory fabricated with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.
 1. Pressure Classifications of 3-Inch wg (750 Pa) or Higher: End bearings or other seals for ducts with axles full length of damper blades and bearings at both ends of operating shaft.
- B. Standard Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, standard leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.
 1. Steel Frames: Hat-shaped, galvanized, sheet steel channels, minimum of 0.064 inch (1.62 mm) thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls; and flangeless frames where indicated for installing in ducts.
 2. Roll-Formed Steel Blades: 0.064-inch- (1.62-mm-) thick, galvanized, sheet steel.

3. Blade Axles: Nonferrous.
 4. Tie Bars and Brackets: Galvanized steel.
- C. Low-Leakage Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, low-leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.
- D. High-Performance Low-Leakage Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, low-leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.
1. Steel Frames: Hat-shaped, galvanized steel channels, minimum of 0.064 inch (1.62 mm) thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls; and flangeless frames where indicated for installing in ducts.
 2. Steel Blades: 0.052-inch- (1.3-mm-) thick, galvanized, sheet steel; airfoil shaped.
 3. Blade Seals: Dual-durometer vinyl on blade edges; metallic compression on jambs.
 4. Blade Axles: Nonferrous.
 5. Tie Bars and Brackets: Galvanized steel.
- E. Jackshaft: 1-inch- (25-mm-) diameter, galvanized steel pipe rotating within a pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
1. Length and Number of Mountings: Appropriate to connect linkage of each damper of a multiple-damper assembly.
- F. Damper Hardware: 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. Include center hole to suit damper operating-rod size. Include elevated platform for insulated duct mounting.

2.3 FIRE DAMPERS

- A. General: Labeled to UL 555.
- B. Fire Rating: One and one-half and three hours.
- C. Frame: SMACNA Type B with blades out of airstream; fabricated with roll-formed, 0.034-inch- (0.85-mm-) thick galvanized steel; with mitered and interlocking corners.
- D. Mounting Sleeve: Factory- or field-installed galvanized, sheet steel.
1. Minimum Thickness: 0.138 inch (3.5 mm) thick and length to suit application.
 2. Exceptions: Omit sleeve where damper frame width permits direct attachment of perimeter mounting angles on each side of wall or floor, and thickness of damper frame complies with sleeve requirements.
- E. Mounting Orientation: Vertical or horizontal as indicated.
- F. 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.

- G. Horizontal Dampers: Include a blade lock and stainless-steel negator closure spring.
- H. Fusible Link: Replaceable, 165 or 212 deg F (74 or 100 deg C) rated as indicated.

2.4 TURNING VANES

- A. Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
- B. Manufactured Turning Vanes: Fabricate of 1-1/2-inch- (38-mm-) wide, curved blades set 3/4 inch (19 mm) o.c.; support with bars perpendicular to blades set 2 inches (50 mm) o.c.; and set into side strips suitable for mounting in ducts.

2.5 DUCT-MOUNTED ACCESS DOORS AND PANELS

- A. General: Fabricate doors and panels airtight and suitable for duct pressure class.
- B. Frame: Galvanized, sheet steel, with bend-over tabs and foam gaskets.
- C. Door: Double-wall, galvanized, sheet metal construction with insulation fill and thickness, and number of hinges and locks as indicated for duct pressure class. Include vision panel where indicated. Include 1-by-1-inch (25-by-25-mm) butt or piano hinge and cam latches.
- D. Seal around frame attachment to duct and door to frame with neoprene or foam rubber.
- E. Insulation: 1-inch- (25-mm-) thick, fibrous-glass board.

2.6 FLEXIBLE CONNECTORS

- A. General: Flame-retarded or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.
- B. Metal-Edged Connectors: Factory fabricated with a strip of fabric 5-3/4 inches (146 mm) wide attached to two 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) aluminum sheets. Select metal compatible with connected ducts.
- C. Transverse Metal-Edged Connectors: Factory fabricated with a strip of fabric 3-1/2 inches (89 mm) wide attached to two strips of 4-3/8-inch- (111-mm-) wide, 0.028-inch- (0.7-mm-) thick, galvanized, sheet steel or 0.032-inch (0.8-mm) aluminum sheets. Select metal compatible with connected ducts.
- D. Conventional, Indoor System Flexible Connector Fabric: Glass fabric double coated with polychloroprene.
 - 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.

- E. Conventional, Outdoor System Flexible Connector Fabric: Glass fabric double coated with a synthetic-rubber, weatherproof coating resistant to the sun's ultraviolet rays and ozone environment.
 - 1. Minimum Weight: 26 oz./sq. yd. (880 g/sq. m).
 - 2. Tensile Strength: 530 lbf/inch (93 N/mm) in the warp, and 440 lbf/inch (77 N/mm) in the filling.
- F. High-Temperature System Flexible Connectors: Glass fabric coated with silicone rubber and having a minimum weight of 16 oz./sq. yd. (542 g/sq. m) and tensile strength of 285 lbf/inch (50 N/mm) in the warp, and 185 lbf/inch (32 N/mm) in the filling.
- G. High-Corrosive-Environment System Flexible Connectors: Glass fabric coated with a chemical-resistant coating.
 - 1. Minimum Weight: 14 oz./sq. yd. (474 g/sq. m).
 - 2. Tensile Strength: 450 lbf/inch (79 N/mm) in the warp, and 340 lbf/inch (60 N/mm) in the filling.

2.7 FLEXIBLE DUCTS

- A. General: Comply with UL 181, Class 1, maximum length allowed is 36-inch (915-mm.).
- B. Flexible Ducts, Insulated: Factory-fabricated, insulated, round duct, with an outer jacket enclosing 1-1/2-inch- (38-mm-) thick, glass-fiber insulation around a continuous inner liner.
 - 1. Reinforcement: Steel-wire helix encapsulated in inner liner.
 - 2. Outer Jacket: Glass-reinforced, silver Mylar with a continuous hanging tab, integral fibrous-glass tape, and nylon hanging cord.
 - 3. Inner Liner: Polyethylene film.
- C. Pressure Rating: 6-inch wg (1500 Pa) positive, 1/2-inch wg (125 Pa) negative.

2.8 ACCESSORY HARDWARE

- A. Flexible Duct Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action, in sizes 3 to 18 inches (75 to 450 mm) to suit duct size.
- 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 shown in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts and NAIMA's "Fibrous Glass Duct Construction Standards" for fibrous-glass ducts.

- B. Install volume dampers in duct.
- C. Install fire and smoke dampers according to manufacturer's UL-approved written instructions.
 - 1. Install fusible links in fire dampers.
- D. Install duct access panels for access to both sides of duct coils. Install duct access panels downstream from volume dampers, fire dampers, turning vanes, and equipment.
 - 1. Install duct access panels to allow access to interior of ducts for cleaning, inspecting, adjusting, and maintaining accessories and terminal units.
 - 2. Install access panels on side of duct where adequate clearance is available.
- E. Label access doors according to Division 15 Section "Mechanical Identification."

3.2 ADJUSTING

- A. Adjust duct accessories for proper settings.
- B. Adjust fire and smoke dampers for proper action.
- C. Final positioning of manual-volume dampers is specified in Division 15 Section "Testing, Adjusting, and Balancing."

END OF SECTION 15820

SECTION 15838-POWER VENTILATORS

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. Utility set fans.
 - 2. Centrifugal roof ventilators for Kitchen grease exhaust hood and dish washer hood.

1.3 PERFORMANCE REQUIREMENTS

- A. Project Altitude: Base air ratings on actual site elevations.
- 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 gages 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. Differentiate between manufacturer-installed and field-installed 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 roof penetration requirements and reflected ceiling plans drawn to scale and coordinating roof penetrations and units mounted above ceiling. Show the following:
 - 1. Roof framing and support members relative to duct penetrations.
- D. Maintenance Data: For power ventilators to include in maintenance manuals specified in Division 1.

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 standards.
- D. UL Standard: Power ventilators shall comply with UL 705.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver fans as factory-assembled unit, to the extent allowable by shipping limitations, with protective crating and covering.
- B. Disassemble and reassemble units, as required for moving to 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 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 set for each belt-driven unit.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Utility Set Fans:
 - a. Bayley Fans, Lau Commercial Industrial Fans/Lau Industries.
 - b. Cook, Loren Company.
 - c. ILG Industries, Inc./American Coolair Corp.
 - d. New York Blower Company (The).
 - e. Greenheck Fan Corp.
 - 2. Centrifugal Roof Ventilators:
 - a. Cook, Loren Company.
 - b. Greenheck Fan Corp.

2.2 UTILITY SET FANS

- A. Description: Belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, and accessories. Fan shall be Class II construction.
- B. Housing: Fabricated of steel with side sheets fastened with a welded to scroll sheets.
 - 1. Housing Discharge Arrangement: Adjustable to eight standard positions.
- C. Fan Wheels: Single-width, single inlet; welded to cast-iron or cast-steel hub and spun-steel inlet cone, with hub keyed to shaft.
 - 1. Blade Materials: Steel.
 - 2. Blade Type: Backward inclined.
- D. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
- E. Shaft Bearings: Prelubricated and sealed, self-aligning, pillow-block-type ball bearings with ABMA 9, L₅₀ of 200,000 hours.
- F. Belt Drives: Factory mounted, with final alignment and belt adjustment made after installation.
 - 1. Service Factor Based on Fan Motor: 1.5.
 - 2. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with motors larger than 5 hp. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
 - 3. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
 - 4. Belt Guards: Fabricate of steel for motors mounted on outside of fan cabinet.
- G. Accessories:

1. Backdraft Dampers: Gravity actuated with counterweight and interlocking aluminum blades and felt edges in steel frame installed on fan discharge.
2. Access Doors: Gasketed doors with latch-type handles.
3. Drain Connections: NPS 3/4 (DN 20) threaded coupling drain connection installed at lowest point of housing.
4. Weather Hoods: Weather resistant with stamped vents over motor and drive compartment.

H. Coatings: Powder-baked enamel.

2.3 CENTRIFUGAL ROOF VENTILATORS

- A. Description: Belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories. Fan shall be Class II construction and UL listed for grease hood service. Provide exhaust fan with grease cup.
- B. Housing: Removable, spun-aluminum, dome top and outlet baffle; square, one-piece, aluminum base with venturi inlet cone.
1. Upblast Units: Provide spun-aluminum discharge baffle to direct discharge air upward, with rain and snow drains and grease collector with grease cup.
- C. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.
- D. Belt-Driven Drive Assembly: Resiliently mounted to housing, with the following features:
1. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
 2. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
 3. Pulleys: Cast-iron, adjustable-pitch motor pulley.
 4. Fan and motor isolated from exhaust airstream.
- E. Accessories:
1. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
- F. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch- (40-mm-) thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch (40-mm) wood nailer. Size as required to suit roof opening and fan base.
1. Configuration: Built-in raised cant and mounting flange.
 2. Overall Height 18 inches (450 mm).
 3. Metal Liner: Galvanized steel.
 4. Vented Curb: Unlined with louvered vents in vertical sides.

2.4 Motors: Motors shall be E-energy efficient, 1750 rpm with voltage as specified.

- A. Comply with requirements in Division 15 Section "Motors."
- B. Enclosure Type: Guarded dripproof.

2.5 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 power ventilators level and plumb.
- B. Secure roof-mounting fans to roof curbs with cadmium-plated hardware. Refer to Division 7 Section "Roof Accessories" for installation of roof curbs.
- C. Install units with clearances for service and maintenance.
- D. Label units 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 power ventilators to allow service and maintenance.
- C. Ground equipment.
- D. 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.

3.3 FIELD QUALITY CONTROL

- A. Equipment Startup Checks:
 - 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. Verify lubrication for bearings and other moving parts.
6. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.

B. Starting Procedures:

1. Energize motor and adjust fan to indicated rpm.
2. Measure and record motor voltage and amperage.

C. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.

D. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Refer to Division 15 Section "Testing, Adjusting, and Balancing" for testing, adjusting, and balancing procedures.

F. Replace fan and motor pulleys as required to achieve design airflow.

G. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.

3.4 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Adjust belt tension.
- C. Lubricate bearings.

3.5 CLEANING

- A. On completion of installation, internally clean fans according to manufacturer's written instructions. Remove foreign material and construction debris. Vacuum fan wheel and cabinet.
- B. After completing system installation, including outlet fitting and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain power ventilators.
 - 1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.
 - 2. Review data in maintenance manuals. Refer to Division 1 Section "Closeout Procedures."
 - 3. Review data in maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."
 - 4. Schedule training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION 15838

SECTION 15855 - DIFFUSERS, REGISTERS, AND GRILLES

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 ceiling- and wall-mounted diffusers, registers, and grilles.
- B. Related Sections include the following:
 - 1. Division 10 Section "Louvers and Vents" for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts.
 - 2. Division 15 Section "Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.
 - 3. Division 15 Section "Testing, Adjusting, and Balancing" for balancing diffusers, registers, and grilles.

1.3 DEFINITIONS

- A. Diffuser: Circular, square, or rectangular air distribution outlet, generally located in the ceiling and comprised of deflecting members discharging supply air in various directions and planes and arranged to promote mixing of primary air with secondary room air.
- B. Grille: A louvered or perforated covering for an opening in an air passage, which can be located in a sidewall, ceiling, or floor.
- C. Register: A combination grille and damper assembly over an air opening.

1.4 SUBMITTALS

- A. Product Data: For each model indicated, include the following:
 - 1. Data Sheet: For each type of air outlet and inlet, and accessory furnished; indicate construction, finish, and mounting details.
 - 2. Performance Data: Include throw and drop, static-pressure drop, and noise ratings for each type of air outlet and inlet.
 - 3. Schedule of diffusers, registers, and grilles indicating drawing designation, room location, quantity, model number, size, and accessories furnished.
 - 4. Assembly Drawing: For each type of air outlet and inlet; indicate materials and methods of assembly of components.

- B. Coordination Drawings: Reflected ceiling plans and wall elevations drawn to scale to show locations and coordination of diffusers, registers, and grilles with other items installed in ceilings and walls.

1.5 QUALITY ASSURANCE

- A. Product Options: Drawings and schedules indicate specific requirements of diffusers, registers, and grilles and are based on the specific requirements of the systems indicated. Other manufacturers' products with equal performance characteristics may be considered. Refer to Division 1 Section "Substitutions."
- B. NFPA Compliance: Install diffusers, registers, and grilles according to NFPA 90A, "Standard for the Installation of Air-Conditioning and Ventilating Systems."

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

- A. Diffusers, registers, and grilles are scheduled on Drawings.

2.2 SOURCE QUALITY CONTROL

- A. Testing: Test performance according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb, according to manufacturer's written instructions, Coordination Drawings, original design, and referenced standards.
- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practicable. For units installed in lay-in ceiling panels, locate units in the center of the panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

- C. Install diffusers, registers, and grilles with airtight connection to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

3.4 CLEANING

- A. After installation of diffusers, registers, and grilles, inspect exposed finish. Clean exposed surfaces to remove burrs, dirt, and smudges. Replace diffusers, registers, and grilles that have damaged finishes.

END OF SECTION 15855

SECTION 15900
HVAC INSTRUMENTATION AND CONTROLS

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 control equipment for HVAC systems and all components for addition to the facility, including control components for terminal heating and cooling units not supplied with factory-wired controls.

1.3 SYSTEM DESCRIPTION

- A. Control system consists of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, accessories, to control the addition and existing mechanical systems. Add pneumatic and interlock wiring components to existing system as indicated on the drawings.

1.4 SEQUENCE OF OPERATION

AIR COOLED CHILLER:

The stand-alone microprocessor based chiller control panel furnished with the chiller shall monitor and control the chiller in a stand-alone mode. The new chiller shall operate in parallel with the existing chiller. The local chiller shall perform the following chiller plant control strategies and support the specified monitoring and diagnostics.

Chiller start/stop - The local chiller control panel shall enable and disable the chiller based upon outside air temperatures of 60°F (adj.).

Chiller ambient lockout –The chiller operation shall be based upon an operator defined ambient temperature limit.

Chilled water pump control – Each chiller shall automatically enable it's primary chilled water pump.

CHILLED WATER PUMP SEQUENCE OF OPERATION:

The Primary and Secondary chilled water pumps are normally enabled and disabled by zone demand for chilled water. H-O-A switch on pump starter shall be kept in the "AUTO" position. "HAND" and "OFF" shall be used only for maintenance.

The primary and secondary chilled water pumps will be energized when the outside air temperature is above 60 degrees Fahrenheit (adj.) and space zone temperatures are calling for cooling.

Upon proof of flows, the lead chiller will be enabled and will operate under its packaged control system. The lead chiller shall operate for 20 minutes (adj.) to maintain a stable water temperature; if the chilled water supply temperature rises above a setpoint of 42°F; the lag chiller shall be enabled and shall remain enabled for 15 minutes (adj.) after started. As the chilled water temperature decreases and the supply water temperature remains at 42°F (adj.); the lag chiller shall be disabled and remain disabled for 15 minutes before being disabled. The chiller with the most run time shall be the lag chiller.

The RPM of the secondary chilled water pumps shall be determined by differential pressure transmitter located as indicated on the drawings. differential setpoint is 15 psig (adj.). The transmitter shall be a "smart" zeroing type. (Reference Rosemont).

When the chiller shuts down, the Primary chilled water pump will remain energized for two minutes (adj.). The control system shall stage the lead/lag of the secondary chilled water pumps based on an adjustable schedule. The secondary chilled water pumps shall be enabled when any air handling or fan coil unit is in the low limit or freeze protection mode of operation and remain enabled until the low-limit is reset.

AIR HANDLING UNIT CONTROL SEQUENCE:

All control power shall be from the emergency electrical panel.

The AHU and neutral air units shall be powered from the emergency electrical power panel and normally run continually. H-O-A switch in the starter shall be kept in the "Auto" position. "Hand" and "Off" shall be used only for maintenance.

On a rise in space temperature, the AHU chilled water valve is modulated open. The reverse will occur on a fall in temperature (setpoint is 72°F adj.). On a decrease in space temperature, the hot water valve shall modulate to maintain space temperature; on an increase in temperature; the reverse shall occur. The deadband between cooling and heating shall be 2°F (adj.)

The 100% neutral air heat reclaim unit control sequence; on a rise in discharge air temperature, the unit's chilled water valve is modulated open. On a rise in discharge wet-bulb temperature; the chilled water valve shall modulate to maintain a 57°Fwb temperature. The reverse will occur on a fall in temperature or humidity (setpoint is 68°F/57wbF adj.). On a decrease in discharge air temperature, the hot water reheat valve shall modulate to maintain discharge air temperature; on an increase in temperature; the reverse shall occur. The deadband between cooling and heating shall be 2°F (adj.). When the outside temperature is below 45°F(adj.); the hot water reheat valve shall modulate to maintain a discharge temperature of 68°F.

Unit freeze protection all units: If the temperature falls below 38 degrees fahrenheit, the unit supply air fan shall shut off and the outside air dampers shall close. The chilled and hot water control valves shall open. A signal shall be sent to the chilled water and hot water pumps to be enabled and remain enabled until the low limit is reset.

A float switch located in the AHU drain pan shall disable the unit when energized.

When smoke is detected by the unit duct smoke detectors shown on the drawings in the return air and supply air duct, the supply air fan shall shut-off; control/smoke dampers shall and an alarm signal shall be transmitted to the fire alarm system.. The AHU unit shall restart when the fire alarm circuit is reset and all control/smoke dampers, and valves shall return to their normal position.

An emergency disable switch (EPO) located in the new nurses station shall disable the AHU units and when reset, the units shall return to their normal positions.

FAN COIL TERMINAL UNIT WITH HOT WATER REHEAT:

The fan coil units shall normally run continually. These units are powered from the emergency electrical panel.

On a rise in space temperature, the fan coil unit chilled water valve is modulated open. The reverse will occur on a fall in temperature (setpoint is 72°F adj.). On a decrease in space temperature, the hot water valve shall modulate to maintain space temperature; on an increase in temperature; the reverse shall occur. The deadband between cooling and heating shall be 2°F (adj.)

Unit freeze protection all units: If the temperature falls below 38 degrees Fahrenheit, the unit supply air fan shall shut off. The chilled and hot water control valves shall open. A signal shall be sent to the chilled water and hot water pumps to be enabled and remain enabled until the low limit is reset.

A float switch located in the fan coil unit drain pan shall disable the unit when energized.

When smoke or fire alarm system is in alarm; the supply air fan shall shut-off. The fan coil units shall restart when the fire alarm circuit is reset and valves shall return to their normal position.

An emergency disable switch (EPO) located in the new nurses station shall disable the fan coil units and when reset, the units shall return to their normal positions.

1.5 SUBMITTALS

- A. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.
 - 1. Each control device labeled with setting or adjustable range of control.
- 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. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.
 - 2. Wiring Diagrams: Power, signal, and point to point control wiring. Differentiate between manufacturer-installed and field-installed wiring.
 - 3. Details of control panel faces, including controls, instruments, and labeling.
 - 4. Written description of sequence of operation.
 - 5. Schedule of dampers including size, leakage, and flow characteristics.
 - 6. Schedule of valves including leakage and flow characteristics.
- C. Match color and type of existing of thermostat and cover.
- D. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
- E. Maintenance Data: For systems to include in maintenance manuals specified in Division 1. Include the following:
 - 1. Maintenance instructions and lists of spare parts for each type of control device and compressed-air station.
 - 2. Interconnection wiring diagrams with identified and numbered system components and devices.
 - 3. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
 - 4. Calibration records and list of set points.
- F. Qualification Data: For firms and persons specified in "Quality Assurance" Article.

- G. Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors. Revise Shop Drawings to reflect actual installation and operating sequences.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is an authorized representative of the automatic control system manufacturer for both installation and maintenance of units required for this Project.
- B. Manufacturer Qualifications: A firm experienced in manufacturing automatic temperature-control systems similar to those indicated for this Project and with a record of successful in-service performance.
- 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 90A, "Installation of Air Conditioning and Ventilation Systems."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to unit manufacturer.

1.8 COORDINATION

- A. Coordinate location of thermostats, humidistat, and other exposed control sensors with plans and room details before installation.
- B. Coordinate supply of conditioned electrical circuits for control units and operator workstation.
- C. Coordinate equipment with Division 16 Section "Panelboards" to achieve compatibility with starter coils and annunciation devices.
- D. Coordinate equipment with Division 16 Section "Motor-Control Centers" to achieve compatibility with motor starters and annunciation devices.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following: (existing control system is Johnson Controls)
 - 1. Control Systems Components:
 - a. Johnson Controls, Inc.; Controls Group.
 - b. Parker Hannifin Corp.; Skinner Valve Division.
- B. Central (Master) Control Panels: Fully enclosed, steel-rack-type cabinet with locking doors or locking removable backs. Match finish of panels.

- C. Local Control Panels: Unitized cabinet with suitable brackets for wall or floor mounting, located adjacent to each system under automatic control. Provide common keying for all panels.
1. Fabricate panels of **0.06-inch- (1.5-mm-)** thick, furniture-quality steel, or extruded-aluminum alloy, totally enclosed, with hinged doors and keyed lock and with manufacturer's standard shop-painted finish.

2.2 SENSORS

A. Pneumatic Transmitters: Vibration and corrosion resistant.

1. Space-Temperature Sensors: Linear-output type, **50 to 100 deg F (10 to 38 deg C)** range, with blank locking covers matching room thermostats.
2. Room Return-Air Temperature Sensors: Linear-output type with bimetal sensing element and corrosion-proof construction, **50 to 100 deg F (10 to 38 deg C)** range, designed to be mounted in light troffers.
3. Duct-Mounted or Immersion-Type Temperature Sensors: Range as required for **3- to 15-psig (21- to 103-kPa)** output signal.
4. Temperature Transmitters: Rigid-stem type with bimetal sensing elements, unless averaging is required, **3- to 15-psig (21- to 103-kPa)** output signal.
 - a. Averaging-Element Sensors: Single- or multiple-unit capillary elements.
 - b. Tamperproof Sensors: Corrosion-resistant construction, suitable for mounting on vibrating surface with exposed capillary protected with temperature-compensated armor or protective tubing.
 - c. Pipe-Mounted Temperature-Sensing Elements: Rod-and-tube type, with separable wells filled with heat-conductive compound, mounting bracket.
 - d. Outdoors: Provide bulb shield with mounting bracket.
5. Space and Duct Humidity Transmitters: One pipe, directly proportional, with minimum sensing span of 20 to 80 percent relative humidity for **3- to 15-psig (21- to 103-kPa)** output signal, corrosion resistant and temperature compensated, and with factory-calibrated adjustment.
 - a. Space Mounting: With covers to match thermostats.
6. Differential-Pressure Transmitters: One pipe, direct acting for gas, liquid, or steam service; pressure sensor and transmitter of linear-output type; with range of **0 to 50 psig (0 to 344 kPa)**, and **3- to 15-psig (21- to 103-kPa)** output signal.
7. Differential-Air-Pressure Transmitters: One pipe, direct acting, double bell, unidirectional with suitable range for expected input, and temperature compensated.
 - a. Accuracy: 5 percent of full range and 2 percent of full scale at midrange.
 - b. Output Signal: **3 to 15 psig (21 to 103 kPa)**.

B. Equipment operation sensors as follows:

1. Status Inputs for Fans: Differential-pressure switch with adjustable range of **0 to 5 inches wg (0 to 1243 Pa)**.
2. Status Inputs for Pumps: Differential-pressure switch piped across pump with adjustable pressure-differential range of **8 to 60 psig (55 to 414 kPa)**.
3. Status Inputs for Electric Motors: Current-sensing relay with current transformers, adjustable and set to 175 percent of rated motor current.

- C. Digital-to-Pneumatic Transducers: Convert plus or minus 12-V dc pulse-width-modulation outputs, or continuous proportional current or voltage to 0 to 20 psig (0 to 138 kPa).
- D. Pneumatic Valve/Damper Position Indication: Potentiometer mounted in enclosure with adjustable crank-arm assembly connected to damper to transmit 0 to 100 percent valve/damper travel.
- E. Water-Flow Switches: Pressure-flow switches of bellows-actuated mercury or snap-acting type, with appropriate scale range and differential adjustment, with stainless-steel or bronze paddle. For chilled-water applications, provide vaporproof type.
- F. Pneumatic Room Thermostats: Two pipes, fully proportional with adjustable throttling range and tamperproof locking settings, direct or reverse acting as required. Factory calibrated at 2.5 psig/deg F (17.2 kPa/deg C).
 - 1. Factory Calibration: 2.5 psig/deg F (17.2 kPa/deg C).
 - 2. Range: 45 to 85 deg F (7.2 to 29.4 deg C).
 - 3. Sensitivity Adjustment Range: 1 to 4 psig/deg F (7 to 27.6 kPa/deg C).
 - 4. Dual-Temperature Thermostats: Automatic changeover from normal setting to lower unoccupied setting, with manual-reset lever to permit return to normal temperatures during unoccupied cycles, with automatic reset to normal during next cycle of operation.
 - 5. Limits: Field adjustable, to limit setting cooling set point below 75 deg F (24 deg C), and heating set point above 75 deg F (24 deg C).
- G. Room Thermostat Cover Construction: Manufacturer's standard locking covers to match existing.
- H. Immersion Thermostat: Remote-bulb or bimetal rod-and-tube type, proportioning action with adjustable throttling range and adjustable set point.
- I. Airstream Thermostats: Two-pipe, fully proportional, single-temperature type, with adjustable set point in middle of range and adjustable throttling range, plug-in test fitting or permanent pressure gage, remote bulb, bimetal rod and tube, or averaging element.
- J. Electric Low-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual-reset switch that trips if temperature sensed across any 12 inches (300 mm) of bulb length is equal to or below set point.
 - 1. Bulb Length: Minimum 20 feet (6 m).
 - 2. Quantity: One thermostat for every 20 sq. ft. (2 sq. m) of coil surface.
- K. Pneumatic Valve Operators: Rolling-diaphragm, spring-loaded, piston type with spring range as required and start-point adjustment and positioning relay. Operator shall maintain full shutoff at maximum pump differential pressure. Where actuators operate in sequence, provide pilot positioners.
 - 1. Pilot Positioners: Start point adjustable from 2 to 12 psig (14 to 83 kPa), and operating span adjustable from 5 to 13 psig (35 to 90 kPa).

2.3 AIR SUPPLY

- A. Control and Instrumentation Tubing: Type L, seamless copper tubing complying with ASTM B 88 (ASTM B 88M) or Type ACR, copper tubing complying with ASTM B 280. Provide copper tubing in non-concealed areas. (attic and equipment rooms)

1. Fittings: Cast-bronze solder fittings complying with ASME B16.18; or wrought-copper solder fittings complying with ASME B16.22, except forged-brass compression-type fittings at connections to equipment.
 2. Joining Method: Soldered or brazed.
- B. Control and Instrumentation Tubing: Virgin-polyethylene, flame-retardant, nonmetallic tubing complying with ASTM D 2737 with flame-retardant harness for multiple tubing. (use in concealed areas)
1. Fittings: Compression or push-on polyethylene fittings.
- C. Tank: ASME storage tank with drain test cock, automatic moisture removal trap, tank relief valve, and rubber-cork vibration isolation mounting pads.
- D. Duplex Air Compressor: **(resize control air compressor if not adequate for addition. Use 33-1/3 run time as guide)** Capacity to supply compressed air to temperature-control system.
1. Adjustable electric contacts pressure control, set to start and stop both compressors at different pressures.
 2. Electrical alternation set with motor starters and disconnect to operate compressors alternately or on time schedule.
- E. Compressor Type: Reciprocating.
- F. Size compressor and tank to operate compressor not more than 20 minutes during a 60-minute period.
- G. Compressor Accessories: Low-resistance intake-air filter, and belt guards.
- H. System Accessories: Air filter rated for 97 percent efficiency at rated airflow, and combination filter/pressure-reducing station or separate filter and pressure-reducing station.
- I. Refrigerated Air Dryer: Self-contained, refrigerated air dryer complete with heat exchangers, moisture separator, internal wiring and piping, and with manual bypass valve.
1. Heat Exchangers: Air-to-refrigerant coils with centrifugal-type moisture separator and automatic trap assembly.
 2. Refrigeration Unit: Hermetically sealed, operating to maintain dew point of 13 deg F (minus 11 deg C) at 20 psig (138 kPa), housed in steel cabinet with access door and panel.
 3. Accessories: Air-inlet temperature gage, air-inlet pressure gage, on-off switch, high-temperature light, power-on light, refrigerant gage on back, air-outlet temperature gage, air-outlet pressure gage, and with contacts for remote indication of power status and high-temperature alarm.
- J. Pressure Gages: Black letters on white background, 2-1/2-inch (64-mm) diameter, flush or surface mounted, with front calibration screw to match sensor, in appropriate units.
- K. Instrument Pressure Gages: Black letters on white background, 1-1/2-inch (38-mm) diameter, stem mounted, with suitable dial range.
- L. Diaphragm Control and Instrument Valves: 1/4-inch (6-mm) forged-brass body with reinforced polytetrafluoroethylene diaphragm, stainless-steel spring, and color-coded phenolic handle.
- M. Gage Cocks: Tee or level handle, bronze, rated for 125 psig (862 kPa).

- N. Relays: For summing, reversing, amplifying, highest or lowest pressure selection, with adjustable input/output ratio.
- O. Switches: With indicating plates, accessible adjustment, calibrated and marked.
- P. Pressure Regulators: Zinc or aluminum castings with elastomeric diaphragm, balanced construction to automatically prevent pressure build-up, and producing flat reduced-pressure curve.
- Q. Particle Filters: Zinc or aluminum castings with 97 percent filtration efficiency at rated airflow, quick-disconnect service devices, and aluminum or plastic bowl with metal guard and manual drain cock.
- R. Combination Filter/Regulators: Zinc or aluminum castings with elastomeric diaphragm, balanced construction to automatically prevent pressure build-up, and producing flat reduced-pressure curve; with threaded pipe connections, quick-disconnect service devices, and aluminum or plastic bowl with metal guard and manual drain cock.
- S. Airborne Oil Filter: Filtration efficiency of 99.9 percent for particles of 0.025 micrometer or larger particles of airborne lubricating oil.
- T. Pressure Relief Valves: ASME rated and labeled.
 - 1. High Pressure: Size for installed capacity.
 - 2. Low Pressure: Size for installed capacity of pressure regulators and set at 20 percent above low pressure.
- U. Pressure-Reducing Stations: Two parallel pressure regulators.

2.4 CONTROL VALVES

- A. Control Valves: Factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated.
- B. Globe Valves **NPS 2 (DN 50)** and Smaller: Bronze body, bronze trim, rising stem, renewable composition disc, and screwed ends with backseating capacity repackable under pressure.
- C. Globe Valves **NPS 2-1/2 (DN 65)** and Larger: Iron body, bronze trim, rising stem, plug-type disc, flanged ends, and renewable seat and disc.
- D. Hydronic system globe valves shall have the following characteristics:
 - 1. Rating: Class 125 for service at **125 psig (862 kPa)** and **250 deg F (121 deg C)** operating conditions.
 - 2. Internal Construction: Replaceable plugs and seats of stainless steel or brass.
 - a. Single-Seated Valves: Cage trim provides seating and guiding surfaces for plug on top and bottom of guided plugs.
 - b. Double-Seated Valves: Balanced plug; cage trim provides seating and guiding surfaces for plugs on top and bottom of guided plugs.
 - 3. Sizing: **5-psig (35-kPa)** maximum pressure drop at design flow rate.

4. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics. Operators shall close valves against pump shutoff head.
- E. Butterfly Valves: 200-psig (1380-kPa), 150-psig (1035-kPa) maximum pressure differential, ASTM A 126 cast-iron or ASTM A 536 ductile-iron body and bonnet, extended neck, stainless-steel stem, field-replaceable EPDM or Buna N sleeve and stem seals.
 1. Body Style: Lug.
 2. Disc Type: Aluminum bronze.
 3. Sizing: 1-psig (7-kPa) maximum pressure drop at design flow rate.

2.5 DAMPERS

- A. Dampers: AMCA-rated, opposed-blade design; 0.1084-inch (2.8-mm) minimum, galvanized-steel frames with holes for duct mounting; damper blades shall not be less than 0.0635-inch (1.6-mm) galvanized steel with maximum blade width of 8 inches (203 mm).
 1. Blades shall be secured to 1/2-inch- (13-mm-) diameter, zinc-plated axles using zinc-plated hardware, with nylon blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.
 2. Operating Temperature Range: From minus 40 to plus 200 deg F (minus 40 to plus 93 deg C).
 3. For low-leakage applications, use opposed-blade design with inflatable seal blade edging, or replaceable rubber seals, rated for leakage at less than 10 cfm per sq. ft. (51 L/s per sq. m) of damper area, at differential pressure of 4 inches wg (995 Pa) when damper is being held by torque of 50 in. x lbf (5.6 N x m); when tested according to AMCA 500D.

2.6 AIR SUPPLY

- A. Control and Instrumentation Tubing: Type L, seamless copper tubing complying with ASTM B 88 (ASTM B 88M) or Type ACR, copper tubing complying with ASTM B 280. Connect control air supply to existing system main in the equipment room.
 1. Fittings: Cast-bronze solder fittings complying with ASME B16.18; or wrought-copper solder fittings complying with ASME B16.22, except forged-brass compression-type fittings at connections to equipment.
 2. Joining Method: Soldered or brazed.
- B. Pressure Gages: Black letters on white background, 2-1/2-inch (64-mm) diameter, flush or surface mounted, with front calibration screw to match sensor, in appropriate units.
- C. Gage Cocks: Tee or level handle, bronze, rated for 125 psig (862 kPa).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that conditioned power supply is available to control units and operator workstation.
- B. Verify that duct-, pipe-, and equipment-mounted devices and wiring and pneumatic piping are installed before proceeding with installation.

3.2 INSTALLATION

- A. Install equipment level and plumb.
- B. Install software in control units and operator workstation. Implement all features of programs to specified requirements and as appropriate to sequence of operation.
- C. Connect and configure equipment and software to achieve sequence of operation specified.
- D. Verify location of space temperature sensors, and other exposed control sensors with plans and room details before installation. Locate all **60 inches (1524 mm)** above the floor.
 - 1. Install averaging elements in ducts and plenums in crossing or zigzag pattern.
- E. Install guards on thermostats in the following locations:
 - 1. Entrances.
 - 2. Public areas.
- F. Install automatic dampers according to Division 15 Section "Duct Accessories."
- G. Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.
- H. Install labels and nameplates to identify control components according to Division 15 Section "Mechanical Identification."
- I. Install hydronic instrument wells, valves, and other accessories according to Division 15 Section "Hydronic Piping."
- J. Install duct volume-control dampers according to Division 15 Sections specifying air ducts.

3.3 PNEUMATIC PIPING INSTALLATION

- A. Install piping in mechanical equipment rooms inside mechanical equipment enclosures, in pipe chases, or suspended ceilings with easy access.
 - 1. Install copper tubing with maximum unsupported length of **36 inches (914 mm)**, for tubing exposed to view.
- B. Install terminal single-line connections, less than **18 inches (450 mm)** in length, with copper or polyethylene tubing run inside flexible steel protection.
- C. In concealed locations, such as pipe chases and suspended ceilings with easy access, install copper tubing.

- D. In concrete slabs, furred walls, or ceilings with no access, install copper or polyethylene tubing in electrical metallic tubing .
- E. Purge tubing with dry, oil-free compressed air before connecting control instruments.
 - 1. Bridge cabinets and doors with flexible connections fastened along hinge side; protect against abrasion. Tie and support tubing.
- F. Number-code or color-code control air piping for future identification and service of control system, except local individual room control tubing.
- G. Pressure Gages or Test Plugs: Install on branch lines at each controller.

3.4 ELECTRICAL WIRING AND CONNECTION INSTALLATION

- A. Install raceways, boxes, and cabinets according to Division 16 Section "Raceways and Boxes."
- B. Install building wire and cable according to Division 16 Section "Conductors and Cables."
- C. Install signal and communication cable according to Division 16 Section "Control/Signal Transmission Media."
 - 1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.
 - 2. Install exposed cable in raceway.
 - 3. Install concealed cable in raceway.
 - 4. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
 - 5. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.
- D. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.
- E. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position but not to override manual or hard wired interlock controls.

3.5 CONNECTIONS

- A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
 - 1. Install piping adjacent to machine to allow service and maintenance.
- B. Ground equipment.
 - 1. 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.

3.6 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove malfunctioning units, replace with new units, and retest.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment, and retest.
 - 4. Pressure test control air piping at 30 psig (207 kPa) or 1.5 times the operating pressure for 24 hours, with maximum 5-psig (35-kPa) loss.
 - 5. Calibration test all pneumatic and electronic controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
- B. Engage a factory-authorized service representative to perform startup service.
- C. Replace damaged or malfunctioning controls and equipment.
 - 1. Start, test, and adjust control systems.
 - 2. Demonstrate compliance with requirements, including calibration and testing, and control sequences.
 - 3. Adjust, calibrate, and fine tune circuits and equipment to achieve sequence of operation specified.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain control systems and components.
 - 1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.
 - 2. Provide operator training on data display, alarm and status descriptors, requesting data, executing commands, calibrating and adjusting devices, resetting default values, and requesting logs. Include a minimum of 40 hours' dedicated instructor time on-site.
 - 3. Review data in maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."
 - 4. Schedule training with Owner, through Architect, with at least seven days' advance notice.

3.8 ON-SITE ASSISTANCE

- A. Occupancy Adjustments: Within one year of date of Substantial Completion, provide up to three Project site visits, when requested by Owner, to adjust and calibrate components and to assist Owner's personnel in making program changes and in adjusting sensors and controls to suit actual conditions.

END OF SECTION 15900

SECTION 15990 - TESTING, ADJUSTING, AND BALANCING

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 testing, adjusting, and balancing HVAC systems to produce design objectives, including the following:
 - 1. Balancing airflow and water flow within distribution systems, including submains, branches, and terminals, to indicated quantities according to specified tolerances.
 - 2. Adjusting total HVAC systems to provide indicated quantities.
 - 3. Measuring electrical performance of HVAC equipment.
 - 4. Setting quantitative performance of HVAC equipment.
 - 5. Verifying that automatic control devices are functioning properly.
 - 6. Reporting results of the activities and procedures specified in this Section.
- B. Related Sections include the following:
 - 1. Testing and adjusting requirements unique to particular systems and equipment are included in the Sections that specify those systems and equipment.
 - 2. Field quality-control testing to verify that workmanship quality for system and equipment installation is specified in system and equipment Sections.

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 design 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. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.
- E. Report Forms: Test data sheets for recording test data in logical order.

- F. 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.
- G. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.
- H. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
- I. 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.
- J. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.
- K. Test: A procedure to determine quantitative performance of a system or equipment.
- L. Testing, Adjusting, and Balancing Agent: The entity responsible for performing and reporting the testing, adjusting, and balancing procedures.
- M. AMCA: Air Movement and Control Association.
- N. CTI: Cooling Tower Institute.
- O. NEBB: National Environmental Balancing Bureau.
- P. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.

1.4 SUBMITTALS

- A. Quality-Assurance Submittals: Within 30 days from the Contractor's Notice to Proceed, submit 2 copies of evidence that the testing, adjusting, and balancing Agent and this Project's testing, adjusting, and balancing team members meet the qualifications specified in the "Quality Assurance" Article below.
- B. Certified Testing, Adjusting, and Balancing Reports: Submit 2 copies of reports prepared, as specified in this Section, on approved forms certified by the testing, adjusting, and balancing Agent.

1.5 QUALITY ASSURANCE

- A. Agent Qualifications: Engage a testing, adjusting, and balancing agent certified by NEBB.
- B. Certification of Testing, Adjusting, and Balancing Reports: Certify the testing, adjusting, and balancing field data reports. This certification includes the following:
 - 1. Review field data reports to validate accuracy of data and to prepare certified testing, adjusting, and balancing reports.

2. Certify that the testing, adjusting, and balancing team complied with the approved testing, adjusting, and balancing plan and the procedures specified and referenced in this Specification.
- C. Testing, Adjusting, and Balancing Reports: Use standard forms from NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."
- D. Instrumentation Type, Quantity, and Accuracy: As described in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," Section II, "Required Instrumentation for NEBB Certification."

1.6 PROJECT CONDITIONS

- A. Partial Owner Occupancy: The Owner may occupy completed areas of the building before Substantial Completion. Cooperate with the Owner during testing, adjusting, and balancing operations to minimize conflicts with the Owner's operations.

1.7 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 testing, adjusting, and balancing activities.
- B. Notice: Provide 7 days' advance notice for each test. Include scheduled test dates and times.
- C. Perform testing, adjusting, and balancing after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine Contract Documents to become familiar with project requirements and to discover conditions in systems' designs that may preclude proper testing, adjusting, and balancing of systems and equipment.
 1. Contract Documents are defined in the General and Supplementary Conditions of the 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 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 the 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.
- D. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Specification Sections have been performed.
- E. Examine system and equipment test reports.
- F. 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 their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.
- G. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.
- H. Examine air-handling equipment to ensure clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- I. Examine terminal units, such as variable-air-volume boxes and mixing boxes, to verify that they are accessible and their controls are connected and functioning.
- J. Examine plenum ceilings, utilized for supply air, to verify that they are airtight. Verify that pipe penetrations and other holes are sealed.
- K. Examine strainers for clean screens and proper perforations.
- L. Examine 3-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. Report deficiencies discovered before and during performance of testing, adjusting, and balancing procedures.

3.2 PREPARATION

- A. Prepare a testing, adjusting, and balancing 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. Hydronic systems are filled, clean, and free of air.
3. Automatic temperature-control systems are operational.
4. Equipment and duct access doors are securely closed.
5. Balance, smoke, and fire dampers are open.
6. Isolating and balancing valves are open and control valves are operational.
7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
8. Windows and doors can be closed so design conditions for system operations can be met.

3.3 GENERAL TESTING AND BALANCING PROCEDURES

- A. Perform testing and balancing procedures on each system according to the procedures contained in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" 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 the insulation Specifications for this Project.
- C. Mark equipment settings with paint or other suitable, permanent identification material, including damper-control positions, valve indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

3.4 FUNDAMENTAL AIR SYSTEMS' BALANCING PROCEDURES

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Determine the best locations in main and branch ducts for accurate duct airflow measurements.
- C. Check the airflow patterns from the outside-air louvers and dampers and the return- and exhaust-air dampers, through the supply-fan discharge and mixing dampers.
- D. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- E. Check dampers for proper position to achieve desired airflow path.
- F. Check for airflow blockages.
- G. Check condensate drains for proper connections and functioning.
- H. Check for proper sealing of air-handling unit components.

3.5 CONSTANT-VOLUME AIR SYSTEMS' BALANCING PROCEDURES

- A. The procedures in this Article apply to constant-volume supply-, return-, and exhaust-air systems. Additional procedures are required for variable-air-volume, multizone, dual-duct, induc-

tion-unit supply-air systems and process exhaust-air systems. These additional procedures are specified in other articles in this Section.

- B. Adjust fans to deliver total design airflows within the maximum allowable rpm listed by the 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 air-handling unit component.
 - 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. Adjust fan speed higher or lower than design with the approval of the Architect. 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 no overload will occur. Measure amperage in full cooling, full heating, and economizer modes to determine the maximum required brake horsepower.
- C. Adjust volume dampers for main duct, submain ducts, and major branch ducts to design 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 submains 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. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submains and branch ducts to design airflows within specified tolerances.
- D. Measure terminal outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or the outlet manufacturer's written instructions and calculating factors.
- E. Adjust terminal outlets and inlets for each space to design airflows within specified tolerances of design values. Make adjustments using volume dampers rather than extractors and the dampers at the air terminals.
 1. Adjust each outlet in the same room or space to within specified tolerances of design quantities without generating noise levels above the limitations prescribed by the Contract Documents.
- F. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 FUNDAMENTAL PROCEDURES FOR HYDRONIC SYSTEMS

- A. Prepare test reports with pertinent design data and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against approved pump flow rate. Correct variations that exceed plus or minus 5 percent.
- B. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:
 1. Open all manual valves for maximum flow.
 2. Check expansion tank liquid level.
 3. Check makeup-water-station pressure gage for adequate pressure for highest vent.
 4. Check flow-control valves for specified sequence of operation and set at design flow.
 5. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type, unless several terminal valves are kept open.
 6. Set system controls so automatic valves are wide open to heat exchangers.
 7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
 8. Check air vents for a forceful liquid flow exiting from vents when manually operated.

3.7 HYDRONIC SYSTEMS' BALANCING PROCEDURES

- A. Determine water flow at pumps. Use the following procedures, except for positive-displacement pumps:
 1. Verify impeller size by operating the pump with the discharge valve closed. Verify with the pump manufacturer that this will not damage pump. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on the manufacturer's pump curve at zero flow and confirm that the pump has the intended impeller size.
 2. Check system resistance. With all valves open, read pressure differential across the pump and mark the pump manufacturer's head-capacity curve. Adjust pump discharge valve until design water flow is achieved.
 3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on the pump manufacturer's performance data. Compare calculated brake

- horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
4. Report flow rates that are not within plus or minus 5 percent of design.
- B. Set calibrated balancing valves, if installed, at calculated presettings.
- C. Measure flow at all stations and adjust, where necessary, to obtain first balance.
1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.
- D. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than design flow.
- E. Adjust balancing stations to within specified tolerances of design flow rate as follows:
1. Determine the balancing station with the highest percentage over design flow.
 2. Adjust each station in turn, beginning with the station with the highest percentage over design flow and proceeding to the station with the lowest percentage over design flow.
 3. Record settings and mark balancing devices.
- F. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures, including outdoor-air temperature.
- G. Measure the differential-pressure control valve settings existing at the conclusions of balancing.

3.8 HEAT EXCHANGERS

- A. Measure water flow through all circuits.
- B. Adjust water flow to within specified tolerances.
- C. Measure inlet and outlet water temperatures.
- D. Measure inlet steam pressure. Check the setting and operation of automatic temperature-control valves, self-contained control valves, and pressure-reducing valves.
- E. Record safety valve settings.

3.9 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 if high-efficiency motor.
 5. Nameplate and measured voltage, each phase.
 6. Nameplate and measured amperage, each phase.

3.10 HEAT-TRANSFER COILS

- A. Water Coils: Measure the following data for each coil:
 - 1. Entering- and leaving-water temperatures.
 - 2. Water flow rate.
 - 3. Water pressure drop.
 - 4. Dry-bulb temperatures of entering and leaving air.
 - 5. Wet-bulb temperatures of entering and leaving air for cooling coils designed for less than 7500 cfm (3540 L/s).
 - 6. Airflow.
 - 7. Air pressure drop.

3.11 TOLERANCES

- A. Set HVAC system airflow and water flow rates within the following tolerances:
 - 1. Supply, Return, and Exhaust Fans: Plus 5 to plus 10 percent.
 - 2. Air Outlets and Inlets: 0 to minus 10 percent.
 - 3. Heating-Water Flow Rate: 0 to minus 10 percent.
 - 4. Cooling-Water Flow Rate: 0 to minus 5 percent.

3.12 REPORTING

- A. Status Reports: As Work progresses, prepare reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.13 FINAL REPORT

- A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in 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 the instruments used for procedures, along with proof of calibration.
- C. Final Report Contents: In addition to the 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 approved Shop Drawings and Product Data.

- D. General Report Data: In addition to the form titles and entries, include the following data in the final report, as applicable:
1. Title page.
 2. Name and address of testing, adjusting, and balancing Agent.
 3. Project name.
 4. Project location.
 5. Engineer's name and address.
 6. Contractor's name and address.
 7. Report date.
 8. Signature of testing, adjusting, and balancing Agent who certifies the report.
 9. Summary of contents, including the following:
 - a. Design versus final performance.
 - b. Notable characteristics of systems.
 10. Nomenclature sheets for each item of equipment.
 11. Data for terminal units, including manufacturer, type size, and fittings.
 12. Notes to explain why certain final data in the body of reports vary from design values.
 13. 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. Fan drive settings, including settings and percentage of maximum pitch diameter.
 - e. Other system operating conditions that affect performance.
- E. Air-Handling 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. Unit arrangement and class.
 - f. Discharge arrangement.
 - g. Sheave make, size in inches (mm), and bore.
 - h. Sheave dimensions, center-to-center and amount of adjustments in inches (mm).
 - i. Number of belts, make, and size.
 - j. Number of filters, type, and size.
 2. Motor Data: Include the following:
 - 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: Include design and actual values for the following:
 - 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.
- F. Apparatus-Coil Test Reports: For apparatus coils, include the following:
 1. Coil Data: Include the following:
 - 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).
 2. Test Data: Include design and actual values for the following:
 - 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. Water flow rate in gpm (L/s).
 - i. Water pressure differential in feet of head or psig (kPa).
 - j. Entering-water temperature in deg F (deg C).
 - k. Leaving-water temperature in deg F (deg C).
 - l. Inlet steam pressure in psig (kPa).
- G. Fan Test Reports: For supply, return, and exhaust fans, include the following:
 1. Fan Data: Include the following:
 - 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: Include the following:
 - 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: Include design and actual values for the following:
 - 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).
- H. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
 - 1. Report Data: Include the following:
 - a. System and air-handling unit number.
 - b. Location and zone.
 - c. Traverse air temperature in deg F (deg C).
 - d. Duct static pressure in inches wg (Pa).
 - e. Duct size in inches (mm).
 - f. Duct area in sq. ft. ((sq. m)).
 - g. Design airflow rate in cfm (L/s).
 - h. Design velocity in fpm (m/s).
 - i. Actual airflow rate in cfm (L/s).
 - j. Actual average velocity in fpm (m/s).
- I. Air-Terminal-Device Reports: For terminal units, include the following:
 - 1. Unit Data: Include the following:
 - a. System and air-handling unit identification.
 - b. Location and zone.
 - c. Test apparatus used.
 - d. Area served.
 - e. Air-terminal-device make.
 - f. Air-terminal-device type and model number.
 - g. Air-terminal-device size.
 - 2. Test Data: Include design and actual values for the following:

- a. Airflow rate in cfm (L/s).
 - b. Preliminary airflow rate as needed in cfm (L/s).
 - c. Final airflow rate in cfm (L/s).
- J. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:
- 1. Unit Data: Include the following:
 - a. System and air-handling unit identification.
 - b. Location and zone.
 - c. Room or riser served.
 - d. Coil make and size.
 - 2. Test Data: Include design and actual values for the following:
 - a. Airflow rate in cfm (L/s).
 - b. Entering-water temperature in deg F (deg C).
 - c. Leaving-water temperature in deg F (deg C).
 - d. Water pressure drop in feet of head or psig (kPa).
 - e. Entering-air temperature in deg F (deg C).
 - f. Leaving-air temperature in deg F (deg C).
 - 3. Air Data: Include design and actual values for the following:
 - a. Duct airflow rate in cfm (L/s).
 - b. Inlet-duct static pressure in inches wg (Pa).
 - c. Outlet-duct static pressure in inches wg (Pa).
 - d. Average entering-air, wet-bulb temperature in deg F (deg C).
 - e. Average leaving-air, wet-bulb temperature in deg F (deg C).
 - f. Ambient wet-bulb temperature in deg F (deg C).

END OF SECTION 15990

16000 - ELECTRICAL SPECIFICATION

Table of Contents

<u>SECTION</u>	<u>DESCRIPTION</u>
16010	GENERAL REQUIREMENTS
16110	RACEWAYS AND FITTINGS
16111	CABLE TRAY
16120	WIRES AND CABLES
16130	OUTLET AND JUNCTION BOXES
16134	PANELBOARDS
16140	WIRING DEVICES
16190	FASTENINGS AND SUPPORTS
16450	GROUNDING AND BONDING
16491	SAFETY SWITCHES
16492	MOTOR, CONTROLLERS, AND EQUIPMENT CONNECTIONS
16500	LIGHTING FIXTURES
16740	TELEPHONE, DATA, SYSTEMS



SECTION 16010 - ELECTRICAL GENERAL REQUIREMENTS

A: GENERAL

1. The 'Instructions to Bidders', 'General Conditions', and 'General Requirements' of the Architectural Specifications, govern work under this section.
2. It is understood and agreed that the electrical contractor has, by careful examination of the plans and specifications, and the site where appropriate, satisfied him as to the nature and location of the work and all conditions which must be met in order to carry out the work under this section of the contract.

3. SCOPE

a. The contract drawings are diagrammatic and are not intended to show every detail of construction, or every item of material or equipment required. The Contractor shall furnish all labor, materials and equipment and perform all operations necessary for installation of complete electrical systems as indicated on the Drawings and as specified herein. It is the intention of these specifications and drawings to provide finished work, tested, and ready for operation.

b. The scope of the work shall include but not be limited to the following:

Installation of the lighting system, power system, data and telephone conduit, and other miscellaneous systems.

4. CONTRACT DOCUMENTS:

a. Contractor shall maintain on the job site one complete set of contract documents of all trades, and shall coordinate with other trades so as to avoid conflicts.

b. Indicated locations of outlets, equipment connections, etc. are approximate and shall be verified by reference to related documents (i.e. Architectural casework drawings, equipment shop drawings, etc.)

5. RECORD DRAWINGS:

a. During construction of this project, the contractor shall maintain one complete set of electrical contract drawings, on which shall be recorded all significant changes in equipment locations, circuit assignments, etc. This set of drawings shall be used for no other purpose. Upon completion of the work, contractor shall submit these drawings to the Architect/Engineer for approval and presentation to the Owner.

b. Upon completion of the project, contractor shall prepare an operation and maintenance manual, which shall include catalog data, equipment information, wiring diagrams, warranty information, etc. for the electrical installation. Submit in five copies to the Architect/Engineer for approval and presentation to the Owner.

6. REGULATIONS AND COMPLIANCE:

a. Latest editions of National Electrical Code and any other state or local codes or ordinances govern this work. All their requirements shall be satisfied.

b. The applicable provisions of the following specifications and standards shall form a part of these specifications: National Electric Code, Underwriters' Laboratories Incorporated, National Fire Protection Association, and National Electrical Manufacturers Association.

c. This Contractor shall secure and pay for all permits, fees, inspections and licenses required. Upon completion of job he shall present to the Architect/Engineer a certificate of inspection and approval from inspection authorities.

d. Requirements of Power Utility or Telephone Company which apply to the work shall be met. Contractor shall install and connect all Utility supplied equipment such as current transformers and cabinets, meters and boxes, etc.

7. TEST, GUARANTEE, AND WARRANTIES:

a. Upon completion of work contractor shall demonstrate installation and make such tests as may be required to satisfy the Architect/Engineer and Owner that work is installed in accordance with Drawings, Specifications and instructions.

b. Contractor shall guarantee the work done in accordance with Drawings and Specifications, and to be free of imperfect materials and defective workmanship. Anything unsatisfactory shall be corrected immediately and at contractor's expense.

c. For a period of one year after acceptance contractor shall replace, without any expense to the Owner, any imperfect materials or defective workmanship.

d. The Contractor shall compile and assemble the warranties of materials and equipment etc. in a three ring binder, tabulated and indexed for easy reference with complete warranty information. Each item covered shall include the date of beginning, duration, name, addresses, telephone numbers, and procedures for obtaining warranty services.

8. TEMPORARY ELECTRICAL SERVICE

a. The electrical contractor shall be responsible for all arrangements and costs for providing at the site metering, main switches, and distribution panels etc. as required for construction purposes. The distribution and power to job trailers, etc.

B: MATERIALS

1 GENERAL:

a. All materials shall be new, with required Underwriter's Laboratories label, and manufacturer's label or nameplate giving complete electrical data.

b. Where a manufacturer's catalog number is used, all parts shall be furnished to make it complete and for the construction intended.

2 SUBMITTALS, ETC.:

a. Within twenty days after award of contract, contractor shall submit to Architect/Engineer a complete list of triplicate of the materials be proposes to use.

b. Materials shall be make and number given in these Specifications or shown on Drawings, or approved equal. If contractor wishes to furnish another make or number he shall furnish complete, detailed data and obtain approval of it in writing from the Architect/Engineer.

c. Submit cuts of fixture, shop drawings on panels, and any other descriptive materials requested, in six copies. The cut sheets shall reference the specification number on the cover.

d. Materials should be inspected upon their arrival at the Site to be sure they are correct. Completely adequate housing shall be provided on the Site for orderly and careful storage of all materials and equipment.

C EXECUTION

1 EXCAVATION:

a. Required excavation for installation of all electrical work shall be provided by the Electrical Contractor.

2 CUTTING, PATCHING, ETC.:

a. Contractor shall place his own sleeves and advise other trades of required chases and openings so they can be properly built in. Where any raceways, supports etc. installed under this Contract pierce the roof, suitable pitch pockets shall provided and coordinated with the roofing contractor as necessary to be acceptable to the Architect. Provide suitable fittings where any raceways or equipment cross expansion joints.

b. Permitted cutting or patching necessary shall be done by contractor. Structural members shall not be cut except by written permission of Architect/Engineer.

3 CLEANING, ETC.

a. Contractor shall properly protect his work against damage by weather or other trades. All work shall be left well cleaned, and damaged finishes shall be restored to original condition.

b. Contractor shall keep premises free of debris resulting from this work.

4 PAINTING, FINISHING:

a. Suitable finishes shall be provided on all items of electrical equipment, conduit, etc. which

are exposed. This shall consist of either an acceptable finish as manufactured and supplied to the job or application of suitable finishes after installation.

b. Where installed in finished areas, exposed equipment, raceways, etc. (e.g. panel covers, wire mold, etc.) shall be supplied with prime coat, and shall be professionally painted or enameled as directed to match or blend with adjacent surfaces.

c. In unfinished areas, such as equipment rooms, etc. exposed equipment shall be furnished with suitable factory applied finishes. (e.g. standard gray enamel finishes for panel boards, etc.).

d. Equipment furnished in finishes such as stainless steel, brushed aluminum, etc. shall not be painted.

e. All finishing shall be as directed by and shall be satisfactory to the Architect/Engineer.

5 EQUIPMENT LABELS, ETC.:

a. Suitable labels shall be provided for the identification of major items of electrical equipment including switchboards, panel boards, motor starters, safety switches, enclosed circuit breaker, etc.

b. Labels shall be of plastic laminate, not less than 1/16" thick, with white letters on black field.

c. Engraving shall be of professional quality, with block style letters, minimum 1/4" high.

d. Nameplates shall be attached with sheet metal screws or with epoxy glue.

END OF SECTION 16010

SECTION 16110 – RACEWAYS AND FITTINGS

A: GENERAL

1. SCOPE:

- a. Provide a complete system of raceways for the installation of wiring as indicated on the drawings, as herein specified, and as required by applicable codes.
- b. All wiring shall be installed in raceways unless specifically noted otherwise.
- c. Conduit shall not be less than 3/4".

B: PRODUCTS

1. MANUFACTURERS:

- a. Metal raceway system components shall be as manufactured by G.E., Kaiser, Republic, T & B, or other approved manufacturers.
- b. Non-metallic raceway system components shall be as manufactured by Carlon, Queen City Plastics, or other approved manufacturers.

2. APPLICATIONS:

- a. Raceways shall be of metal except as specifically noted, or where non-metallic raceway is permitted by these specifications.
- b. Use heavy wall rigid metal conduit (RMC) for any metal conduit run underground or in poured concrete.
- c. Use heavy wall metal conduit (RMC) or intermediate metal conduit (IMC) for any conduit exposed below a height of 60" and for any metal raceway larger than 2" diameter.
- d. Electric metallic tubing (EMT) for most other general applications.
- e. Flexible conduit for appropriate applications. Galvanized type for dry locations. Liquid-tight type for wet locations, or as noted. Flexible conduit shall be minimum 1/2" diameter. Liquid-tight flexible metal conduit shall be used for final connection to all motors, transformers, and other rotating or vibrating equipment. Flexible metal conduit shall be used for final connection to fluorescent lighting fixtures mounted in or on suspended ceilings, and similar applications.
- f. Non-metallic raceway shall be minimum schedule 40 PVC. In general non-metallic raceway will be permitted for use underground or in poured concrete (including panel feeders, etc.). Non-metallic raceways will not be permitted for any exposed work or for raceways in ceiling spaces, etc.
- g. No raceway may be exposed in any finished space unless specifically so approved.

h. Raceways exposed in finished spaces shall be of an appropriate type "wire mold" type surface raceway or approval equal.

3. COUPLINGS, CONNECTIONS, ETC.:

a. EMT couplings and connectors shall be compression gland type of steel. Connectors shall be insulated throat type.

b. Flexible conduit connectors shall be T & B "Tite-Bite" type or approved equal, with insulated throats and "anti-short" bushings.

c. "Split" or "Erickson" couplings shall be manufactured by O.Z. or approved equal.

C: EXECUTION

1. INSTALLATION:

a. Heavy wall and intermediate metal conduit to be made up with full threads, to which a conductive pipe compound (T & B Kopr-Shield or equal) has been applied, and butted in couplings.

b. Underground runs shall have minimum of 24" cover, filled and tamped in 6" layers.

c. Support conduits with approved straps or hangers within one foot of each termination and 5'0" o.c. (maximum) in runs.

d. All raceways shall be concealed unless specifically shown or approved otherwise.

e. Make all cuts square. Remove any burrs by reaming.

f. EMT shall be attached to boxes or enclosures with approved couplings only.

g. RMC or IMC shall be attached to boxes or enclosures with double locknuts (one inside and one outside) and insulating bushing.

h. All junction boxes, cabinets, switches, light fixtures, and other electrical equipment shall be solidly mounted prior to the installation of conduit, and shall not depend upon the conduit for support. Conduit systems shall be installed complete between pull points before pulling wire.

i. Install expansion fittings in raceway every 200 feet of linear run or wherever structural expansion joints are crossed.

2. SLEEVES AND PENETRATIONS

a. Electrical Contractor shall provide sleeves and openings for raceways penetrating exterior wall, interior walls and partitions, floors and roofs. Provisions for all such penetrations shall be as approved by the Architect/Engineer.

b. For any raceways passing through an exterior wall, above or below grade, provide appropriate sleeve and water proofing. Fill space between conduit and sleeve with appropriate

compound (e.g. lead and oakum) and then apply caulking compound - Thiocaulk or approved equal - flush with finished surfaces.

c. For raceways penetrating interior walls or partitions (except as in item d below) provide steel pipe or galvanized sheet metal sleeves.

d. For raceways penetrating floor slabs, smoke partitions, and other fire-rated walls, provide steel pipe sleeves and seal with high-temperature non-shrink grout or other material as approved by the Architect/Engineer.

e. Conduits penetrating roof surfaces for purpose of connecting to mechanical equipment (e.g. rooftop HVAC units, exhaust fans, etc.) shall utilize openings, curbs, etc, provided for the equipment where possible.

f. For raceway penetrations through roof (except as described in item e above) contractor shall provide appropriate prefabricated roof curb assembly - "Pipe Portal System" as manufactured by Roof Products & Systems Corp., Addison, Illinois or equal method as approved by Architect/Engineer and roofing subcontractor.

END OF SECTION 16110

SECTION 16111 - CABLE TRAYS

PART 1 - GENERAL

RELATED DOCUMENTS:

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

SUMMARY:

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

Division 16 Section "Supporting Devices" for cable tray supports not specified in this Section.

SUBMITTALS:

General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.

Product data for each component. Show tray types, dimensions, and finishes.

Shop drawings detailing fabrication and installation of cable tray, including plans, elevations, sections, details of components, and attachments to other construction elements. Designate components and accessories, including clamps, brackets, hanger rods, splice plates connectors, expansion joint assemblies, straight lengths, and fittings.

Coordination drawings, including floor plans and sections drawn to accurate scale. Show accurately scaled cable tray layout and relationships between components and adjacent structural and mechanical elements.

Qualification data for firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, names of Architects and Owners, and other information specified.

Factory certified test reports of specified products, conforming to NEMA VE 1.

Field test reports indicating and interpreting test results relative to compliance with performance requirements specified in "Field Quality Control" Article of this Section.

Maintenance data for cable tray, for inclusion in "Operating and Maintenance Manual" specified in Division 1. Include detailed manufacturer's instructions on tightening connections.

QUALITY ASSURANCE:

Manufacturer Qualifications: Select a firm experienced in manufacturing cable trays similar to those indicated for this Project and which has a record of successful in-service performance.

Comply with NFPA 70, "National Electrical Code" for components and installation.

Listing and Labeling: Provide products specified in this Section that are listed and labeled.

The Terms "Listed and Labeled": As defined in the "National Electrical Code", Article 100.

Single-Source Responsibility: All cable tray components shall be the product of a single manufacturer.

SEQUENCING AND SCHEDULING:

Coordination: Coordinate layout and installation of cable tray with other installations.

Revise locations and elevations from those indicated as required to suit field conditions and as approved by the Architect.

PART 2 - PRODUCTS

MANUFACTURERS:

Available Manufacturers: Subject to compliance with requirements, manufacturers offering cable trays that may be incorporated in the Work include, but are not limited to, the following:

Manufacturers: Subject to compliance with requirements, provide cable trays manufactured by one of the following:

B-Line Systems, Inc.

GS Metals Corp.

MP Husky Corp.

Mono-Systems, Inc.

MATERIALS AND FINISHES:

Conform to NEMA VE 1.

Cable Trays, Fittings, and Accessories: Steel, hot-dipped galvanized after fabrication conforming to ASTM A 123, Class B2.

Fabricate cable tray products with rounded edges and smooth surfaces.

Solid-Bottom-Type Trays: Class 20C unless indicated.

Width: 6 inches (152 mm).

Inside Depth: 4 inches (102 mm).

Minimum Fitting Radius: 24 inches (610 mm).

CABLE TRAY ACCESSORIES:

Fittings: Tees, crosses, risers, elbows, and other fittings as indicated, manufactured with the same materials and finishes as the cable trays.

Covers: Louvered type, of same materials and finishes as cable trays.

Cable tray supports and connectors, including bonding jumpers, as recommended by cable tray manufacturer.

SOURCE QUALITY CONTROL:

Perform design and production tests according to NEMA VE 1.

PART 3 - EXECUTION

EXAMINATION:

Examine surfaces to receive cable tray for compliance with installation tolerances and other required conditions. Do not proceed with installation until unsatisfactory conditions have been corrected.

WIRING METHODS:

Use cable tray of indicated types and sizes, complete with manufacturer's recommended covers, barrier strips, dropouts, fittings, conduit adapters, hold-down devices, grommets, and blind ends.

INSTALLATION:

Install cable tray level and plumb according to manufacturer's written instructions, rough-in drawings, the original design, and referenced standards.

Remove burrs and sharp edges of cable trays.

Fasten cable tray supports securely to the building structure as specified in Division 16 Section "Supporting Devices" unless otherwise indicated.

Locate and install supports according to recommendations of NEMA VE 1.

Design supports, including fastenings to the structure, to carry the greater of the calculated load multiplied by a safety factor of 4, or the calculated load plus 200 lbs (90 kg).

Install expansion connectors in cable tray runs that exceed 90 feet (27 m). Space connectors and set gaps according to NEMA VE 1.

Make changes in direction and elevation using standard fittings.

Make cable tray connections using standard fittings.

Locate cable tray above piping except as required for tray accessibility and as otherwise indicated.

Working Space: Install cable trays with sufficient space to permit access for installing cables.

Install covers after installation of cable is completed.

GROUNDING:

Connect cable trays to ground as instructed by manufacturer. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals according to tightening torques specified in UL Standard 486A.

WARNING SIGNS:

After installation of cable trays is completed, install warning signs in visible locations on or near cable trays.

FIELD QUALITY CONTROL:

Grounding: Test cable trays to ensure electrical continuity of bonding and grounding connections.

Anchorage: Test pull-out resistance of one of each type, size, and anchorage material for toggle bolts and powder-driven threaded studs.

Furnish equipment, including jacks, jigs, fixtures, and calibrated indicating scales required for reliable testing. Obtain Architect's approval before transmitting loads to the structure. Test to 90 percent of rated proof load for fastener.

Correct malfunctioning units at site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.

CLEANING:

Upon completion of installation of system, including fittings, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes, including chips, scratches, and abrasions.

PROTECTION:

Provide final protection and maintain conditions in a manner acceptable to manufacturer and Installer to ensure that the cable tray is without damage or deterioration at Substantial Completion.

Repair damage to galvanized finishes with zinc-rich paint recommended by the tray manufacturer.

Repair damage to PVC or paint finishes with matching touch-up coating recommended by the tray manufacturer.

END OF SECTION 16111

SECTION 16120 – WIRES AND CABLES

A GENERAL

1. SCOPE:

a. Furnish and install a complete system of wiring and cable as shown, specified, and required.

B: PRODUCTS

1. MATERIALS:

a. Conductors shall be as manufactured by Phelps Dodge, Anaconda, Triangle, Southwire, or approved equal.

b. Normal trade standard "Building Wire" of copper, Aluminum conductors may be used only where specifically indicated on the Drawings. Burndy "Hy-Plug" adapters shall be used on aluminum wire terminations in panels, switchboards, equipment, etc. unless noted otherwise.

c. Conductors #10 AWG smaller shall be solid. #8 AWC and larger shall be stranded.

d. Each conductor shall bear easily readable markings along entire length, indicating size and insulation type.

e. Insulation on conductors #8 AWG and smaller shall be suitable colored in manufacturer.

f. All wires to be furnished shall be copper of the size and ampacity indicated on the drawings and shall be type THHN or THWH.

h. Conductors in any location subject to abnormal temperature shall be furnished with an insulation type suitable for temperature encountered.

i. Where no indication is made of wire size, the conductor shall be of N.E.C. size to match its overcurrent protective device, but in no case smaller than #12 AWG.

j. Control and signal conductors shall be type and size indicated in those sections of the specifications.

C: EXECUTION

1. INSTALLATION:

a. Joints in conductors # 10 AWG and smaller shall be made with approved twist-on type connectors as manufactured by T & B, Ideal, or approved equal.

b. Joints in conductors #8 AWG and larger shall be made with mechanical pressure type connectors or lugs.

c. Circuit joints may not be made up on terminal screws of wiring devices. Make circuit joints as above, and connect single leads to device terminals.

d. Conductors shall be labeled within all junction boxes, etc, using plastic "punch" tape, identifying the conductors according to circuit numbers.

e. Where connected under screw or bolt heads, stranded wire shall be fitted with a lug of proper size. Make solid conductor loops clockwise so as to be forced closed as screw is tightened. Only one solid wire loop may be held unit a single screw.

f. Make all connections tight.

g. Wires within panelboards, terminal cabinets, and similar equipment shall be neatly squared and "bunched" together and held so with plastic ties at several places.

h. Where paralleling of conductors is shown for feeders or service entrance, it is absolutely required they be exactly the same length between points of bonding together.

2. COLOR CODING:

a. All wiring shall be color coded.

b. On 120/208V, 3 phase, 4 wire or 120/240V, 1 phase, 3 wire power systems, conductors shall be color coded black (Phase A), red (Phase B), blue (Phase C), and white (Neutral). On 277/480V, 3 phase, 4 wire systems, conductors shall be color coded brown (Phase A), orange (Phase B), yellow (Phase C), and gray (Neutral).

c. Ground conductors on all systems shall be green.

d. Conductors #8 AWG and larger may be identified with two or more bands of proper color plastic tape applied near each termination. Painting of wire will not be acceptable.

e. Unless noted otherwise, or another arrangement is approved by the Engineer, busses in panels and switch gear shall be considered "A", "B", and "C" from left to right, top to bottom or front to back when facing equipment.

f. Control and signal wiring shall not use the above named colors except green for grounding. Any other colors or striping may be used but the coding shall provide same color or striping between any two terminals being jointed.

g. "Travelers" in switching circuits shall be of same color as phase conductors serving the circuit.

3. WIRING METHOD FOR BRANCH CIRCUITS:

a. Unless shown differently, single-phase circuiting shall be limited to one neutral per raceway (a maximum of three different phase wires but with a single neutral in any case). Three-phase circuits shall be limited to one circuit per raceway (three different phase wires and a neutral if needed).

b. In "3 wire" and "4 wire" branch circuits a neutral shall not serve more than one circuit tied

to the same phase. The neutral carrying all or any part of the current of any specific load or run shall be contained in the same raceway or enclosure with the phase wire or wires also carrying that current.

c. Circuits shall be connected to panels as shown in the panel schedules.

d. Under the above requirements and with required color coding system no feeder or branch circuit raceway will contain more than one wire of the same color, except for switch legs and control circuits.

e. Conductors feeding lighting outlets may be combined in the same raceway with conduit feeding convenience receptacles; but lighting outlets and convenience receptacles shall not be put on the same circuit unless specifically indicated.

f. Branch circuit conductors shall be no smaller than No. 12 AWG, except that conductors for branch circuits whose length from panel to center of loads exceeds 300 feet shall be no smaller than No. 10 AWG to the first outlet.

g. Where splices are required, wire connectors of insulating material or properly taped solderless pressure connectors, shall be utilized for all splices in wiring.

h. Compression type connectors size # 1/0 AWG and above shall be crimped with a hydraulic tool with the die size as recommended by the connector manufacturer.

END OF SECTION 16120

SECTION 16130 – OUTLET AND JUNCTION BOXES

A: GENERAL

1. SCOPE:

a. Provide and install outlet boxes, junction boxes, floor boxes, etc as required for installation of electrical work, as shown, specified and required.

B: PRODUCTS

1. MATERIALS:

a. Unless specifically noted or approved otherwise, boxes shall be of metal (steel or aluminum) as manufactured by Steel City, T & B, Raco, Appleton, or approved equal.

b. Size all boxes in accordance with applicable NEC articles (e.g. 362, 370, 373, 375, etc.).

c. Device boxes shall be section type or 4" square, equipped with plaster rings as required to mount devices.

C: EXECUTION

1. INSTALLATION:

a. Set all boxes with edges flush with finished surface.

b. Immediately after installation cover raceways and boxes to prevent entrance of foreign matter, paint, etc.

c. Contractor shall coordinate with other trades, and shall study the Architectural Plan Drawings, casework drawings, etc. to determine proper placement and mounting heights of all devices.

d. Where not shown or required otherwise, the following "standard" mounting heights and positions shall apply:

1. Switch boxes 50" from finished floor to center. Boxes beside doors shall be mounted so edge of trim plate is 2" from edge of door trim on strike side.

2. Telephone boxes 18" from finished floor to center and vertical. Boxes for wall phones shall be 54" from finished floor and vertical.

3. Bracket light boxes 6'8" finished floor to center

4. Clock outlet boxes 7'6" from finished floor to center.
 5. Panel board enclosures 6'4" (plus or minus 4" in concrete block construction) from finished floor to top of can.
 6. Fire alarm pull stations 46" from finished floor to center.
 7. Fire alarm signal devices 80" to bottom.
 8. Receptacle boxes 18" from finished floor to center, mounted vertically.
- e. Where receptacles, telephone outlets, etc. occur over counter tops, etc. install box so that device is centered 4" above counter or backsplash, or higher if required to coincide with clockwork coursing. Carefully coordinate so that trim plates are completely clear of backsplashes, etc.

END OF SECTION 16130

SECTION 16134 – PANEL BOARDS

A: GENERAL

1. SCOPE:

a. Furnish and install power distribution panel boards as scheduled on the drawings and as herein specified.

b. Types, sizes, capacities, and characteristics shall be as shown on riser diagram or in schedules on the drawings.

B: MATERIALS

1. MANUFACTURERS:

a. Panel boards shall be as manufactured by Square D, General Electric or approved equal.

b. Panel board types indicated on the drawings are those of Square D, and the standard construction features of those types shall be considered as minimum requirements, with additional requirements as specified herein.

2. CONSTRUCTION FEATURES:

General: Except as otherwise indicated, provide panel boards, enclosures and ancillary components, of types, sizes, and rating indicated, which comply with manufacturer's standard materials; with the design and construction in accordance with published product information; equip with proper number of unit panel board devices as required for complete installation. Where types, sizes, or ratings are not indicated, comply with NEC, UL, NEMA, and established industry standards for those applications indicated.

a. Housing shall be constructed of galvanized sheet steel and shall be securely fabricated with screws, bolts, rivets, or by welding. Housings for panel boards shall be a minimum 20" wide and 5-3/4" deep, unless noted otherwise. Top or bottom gutter space shall be increased 6" where feeder loops through panel. End plates shall be supplied without knockouts.

b. Door flush with face and closed against a full inside trim stop. Hinges shall be inside type.

c. A flush latch and tumbler type lock, so panel door may be held closed without being locked. All such locks on same job shall be keyed alike. Furnish two keys with each lock, or a total of 10 keys for the job.

d. Minimum interrupting capacity rating of any panel board assembly shall be 10000A. Furnish panel boards with higher rating where so noted or where evidently intended by specification of circuit breaker frame types, etc.

e. Where drawing schedules indicate spaces for addition of future circuit breakers, furnish all necessary bussing, brackets, hardware, etc.

Service-Entrance Panel boards: Provide factory-assembled, dead-front safety constructed,

service-entrance circuit-breaker type panelboards in sizes and ratings indicated. Equip with panel board unit devices, of types, ratings and characteristics indicated. Construct with rectangular shaped bus bars of solid copper, with conductivity not less than 98-percent, which are securely mounted and braced, and with solderless lugs bolted to main bus bars, suitable for service with 120/208 volts, 3-phase, 4-wire, system. Provide branch circuits with molded-case type three-pole circuit-breakers, with toggle handles that indicate when tripped. Select enclosures which are fabricated by same manufacturer as panel boards, and which mate and match properly with panel boards. Provide panel boards with UL markings which indicate "suitable for use as service-entrance equipment".

Power Distribution Panel boards: Provide dead-front safety type power distribution panel boards as indicated, with panel board switching and protective devices in quantities, ratings, types, and with arrangement shown; with anti-turn solderless pressure type main lug connectors approved for use with copper conductors. Select unit with feeders connecting at top of panel. Equip with copper bus bars with not less than 98-percent conductivity, and with full-sized neutral bus; provide suitable lugs on neutral bus for outgoing feeders requiring neutral connections. Provide molded-case main and branch circuit-breaker types for each circuit, with toggle handles that indicate when tripped. Where multiple-pole breakers are indicated, provide with common trip so overload on one pole will trip all poles simultaneously. Provide panel boards with bare uninsulated grounding bars suitable for bolting to enclosures. Select enclosures fabricated by same manufacturer as panel boards, which mate and match properly with panel boards.

Lighting and Appliance Panel boards: Provide dead-front safety type lighting and appliance panel boards as indicated with switching and protective devices in quantities, ratings, types and arrangements shown; with anti-burn solderless pressure type lug connectors approved for use with copper conductors; construct unit for connecting feeders at top of panel. Equip with copper bus bars, full-sized neutral bar, with bolt-in type heavy-duty, quick-make, quick-break, single-pole circuit-breakers, with toggle handles that indicate when tripped. Provide suitable lugs on neutral bus for each outgoing feeder required; and provide bare uninsulated grounding bars suitable for bolting to enclosures. Select enclosures fabricated by same manufacturer as panel boards, with mate and match properly with panel boards.

Panel board Enclosures: Provide galvanized sheet steel cabinet type enclosures, in sizes and NEMA types as indicated, code-gage, minimum 16-gage thickness. Construct with multiple knockouts and wiring gutters. Provide fronts with adjustable trim clamps, and doors with flush locks and keys, all panel board enclosures keyed alike, with concealed piano door hinges and door swings as indicated. Equip with interior circuit-directory frame, and card with clear plastic covering. Provide baked gray enamel finish over a rust inhibitor coating. Design enclosures for recessed mounting. Provide enclosures which are fabricated by same manufacturer as panel boards, which mate and match properly with panel boards to be enclosed.

Molded-Case Circuit Breakers: Provide factory-assembled, molded-case circuit breakers of frame sizes, characteristics, and ratings including RMS symmetrical interrupting ratings indicated. Select breakers with permanent thermal and instantaneous magnetic trip, and with fault-current limiting protection, ampere ratings as indicated. Construct with over center, trip-free, toggle-type operating mechanisms with quick-make, quick-break action and positive handle trip indication. Construct breakers for mounting and operating in any physical position, and operating in an ambient temperature of 40 degrees C. Provide breakers with mechanical screw type removable connector lugs, AL/CU rated.

Accessories: Provide panel board accessories and devices including, but not necessarily limited

to, cartridge and plug time- delay type fuses, ground-fault protection units, etc., as recommended by panel board manufacturer for ratings and applications indicated.

C: EXECUTION

1. INSTALLATION:

- a. Front edges of all flush mounted panel housings shall be exactly flush with finished wall.
- b. All equipment, either surface or flush mounted, shall be perfectly plumb and level.
- c. All openings in boxes, cabinets, or gutters shall be cut if sawed with tools made for that purpose. Burning of openings is absolutely unacceptable.
- d. All unused openings shall be closed.
- e. Only one solid wire is allowable under a screw. Provide an approved lug for connecting stranded wire or more than one solid conductor.
- f. Interior trim shall fit nearly between interior assemble and cover leaving no gaps between the two.
- g. Before the completed installation is energized, the panel boards, and their components, shall be thoroughly inspected and tested as necessary to ensure that the following requirements are met:

1. Tightness of all connections.
2. Continuity of all wiring.
3. Correct phasing of all wiring.
4. Presence of all required neutral and ground connections.
5. Absence of any unintentional grounds.
6. Removal of all shipping braces, blocks, tapes, etc.
7. Removal of all tools, foreign materials and construction debris.
8. Removal of all obstructions from ventilating louvers and air passages.
9. Installation of all required barriers.
- h. Breakers in distribution or branch circuit panel boards shall be physically arranged in locations shown in panel schedules on the drawings. They shall be connected to the phases as shown.

2. LABELING:

- a. For branch circuit power panel boards, directory cards shall be neatly typed to indicate load

served by each breaker or fuse. Directory cards shall indicate circuits in a manner analogous to the physical circuit breaker arrangement (e.g. odd numbered circuits in one column, even-numbered circuits in another). Mount cards behind heavy plastic shields in metal frames.

b. Next to each breaker within main or distribution panel boards, attach a label indicating load served. Wording shall be as shown on its diagram or schedule on the drawings.

c. Centered above the breaker in each panel board attaches a label indicating panel designation - for example "PANEL A", or "PANEL MDP".

END OF SECTION 16134

SECTION 16140 – WIRING DEVICES

A: GENERAL

1. SCOPE:

a. Contractor shall furnish and completely install lighting switches convenience outlets, special purpose receptacles, etc. along with appropriate outlet boxes, trim plates.

b. All wiring devices shall be SPECIFICATION GRADE and comply with the applicable requirements of the NEC, NEMA, IEEE, and be UL listed and labeled.

B: PRODUCTS

1. MANUFACTURERS:

a. All wiring devices of any one general type (e.g. all duplex receptacles, all wall switches etc.) shall be of the same manufacturer and shall match throughout.

b. Wiring devices and trim plates shall be as manufactured by Hubbell, Leviton, P & S, Arrow, or approved equal.

2. WIRING DEVICES:

a. GENERAL

1. Devices shall be equal to those specified on the drawing schedules or herein.

2. Devices approved shall be in color as selected by the owner.

b. RECEPTACLES

1. Duplex receptacles for general use shall be 2 pole, 3 wire, grounding type with green hexagonal ground screw, ground terminals and poles internally connected to mounting yoke, 20 amperes, 125 volts; designed for side and back wiring with spring loaded, screw activated pressure plate, and NEMA configuration 5-20R.

2. Single receptacles for clocks shall be 2 pole, 3 wire, grounding, 15 ampere, 125 volts, side wiring with NEMA configuration 5-15R, with recess for male plug which permits clock to be flush mounted with wall and cover outlet. Provide with stainless steel plate with metal hook for supporting clock.

3. Special purpose receptacles are specified on the drawings.

4. Ground fault circuit interrupter receptacles (GFCI) shall be capable of being installed in a 2 3/4" deep outlet box without adapter, grounding type, UL rated, rated 20 amperes, 120 volts, 60 Hz; with solid-state ground fault sensing and signaling, with NEMA 5-20R configuration and 5 milliamps ground fault trip.

c. SWITCHES

1. Single pole switches for general use shall be 20 amperes, 120-277 volts AC, with mounting yoke insulated from mechanism, equip with plaster ears, switch handle, and side-wired screw terminals.

2. Three way switches for general use shall be 20 amperes, 120-277 volts, with mounting yoke insulated from mechanism, equip with plaster ears, and lock type switch handles, side-wired screw terminals, with break off tab features, which allows wiring with separate or common feed.

3. Special purpose switches are specified on the drawings.

3. TRIM PLATES:

a. All trim plates shall be of same style, matching throughout project.

b. Unless noted otherwise, trim plates shall be of #302 stainless steel.

c. Wall plates for single and combination wiring devices shall be 0.04" thick satin finished stainless steel, of size, types and with cutouts as indicated. Screws for securing plates to devices shall be of metal with heads to match finish of plates.

C: EXECUTION

1. INSTALLATION

a. Devices shall be mounted tightly to boxes, and be adjusted plum and level.

b. Where two or more devices are indicated for gang installation they shall be trimmed with gang type plates.

c. Grounding type receptacles (except for devices indicated as "isolated ground type") shall be bonded to box in which mounted, using a green insulated copper "jumper", sized per NEC but not smaller than #12 AWG.

END OF SECTION 16140

SECTION 16190 – FASTENINGS AND SUPPORTS

A: GENERAL

1. SCOPE:

a. Full and proper support shall be provided for all items of electrical equipment, raceway, etc. The type of supports, anchors, sleeves, and seals specified in this section shall include Riser clamps, C-clamps, I-beam clamps, Round steel rods, Lead expansion anchors, Toggle bolts, and Wall and floor seals.

B: PRODUCTS

1. MATERIALS:

- a. Materials used shall be good quality, made of steel or of other non-corroding material.
- b. Inserts in masonry shall be lead, plastic, or fiber type, installed in drilled holes. Lead only shall be used for exterior locations or for interior locations subject to moisture.

2. MANUFACTURED SUPPORTING DEVICES:

a. General: Provide supporting devices which comply with manufacturer's standard materials, design and construction in accordance with published product information, and as required for complete installation; and as herein specified. Where more than one type of supporting device meets indicated requirements, selection is installer's option.

b. Supports: Provide supporting devices of types, sizes and materials indicated; and having the following construction features:

1. Clevis Hangers: For supporting 2" rigid metal conduit; galvanized steel; with 1/2" diameter hole for round steel rod; approximately 54 pounds per 100 units.

2. Riser Clamps: For supporting 5" rigid metal conduit; black steel; with 2 bolt and nuts, and 4" ears; approximately 510 pounds per 100 units.

3. Reducing Couplings: Steel rod reducing coupling, 1/2" x 5/8"; black steel; approximately 16 pounds per 100 units.

4. C-Clamps: Black malleable iron; 1/2" rod size; approximately 70 pounds per 100 units.

5. I-Beam Clamps: Black steel, 1-1/4" x 3/16" stock; 3/8" cross bolt; flange width 2"; approximately 52 pounds per 100 units.

6. One-Hole Conduit Straps: For supporting 3/4" rigid metal conduit; galvanized steel; approximately 7 pounds per 100 units.

7. Two-Hole Conduit Straps: For supporting 3/4" rigid metal conduit, galvanized steel, 3/4" strap width; and 2-1/8" between center of screw holes.

8. Hexagon Nuts: For 1/2" rod size; galvanized steel; approximately 4 pounds per 100 units.

9. Round Steel Rod: Black steel; 1/2" diameter; approximately 67 pounds per 100 feet.

10. Offset Conduit Clamps: For supporting 2" rigid metal conduit; black steel; approximately 200 pounds per 100 units.

c. Anchors: Provide anchors of types, sizes and materials indicated, with the following construction features:

1. Lead Expansion Anchors: 1/2"; approximately 38 pounds per 100 units.

2. Toggle Bolts: Springhead; 3/16" x 4"; approximately 5 pounds per 100 units.

3. Manufacturers: Subject to compliance with requirements, provide anchors of one of the following: Ackerman Johnson Fastening Systems Inc., Elcen Metal Products Co., Ideal Industries, Inc., Joslyn Mfg and Supply Co., McGraw Edison Co., Rawlplug Co. Inc., Star Expansion Co., and U.S. Expansion Bolt Co.

d. Sleeves and Seals: Provide sleeves and seals, of types, sizes and materials indicated, with the following construction features:

1. Wall and Floor Seals: Provide factory-assembled watertight wall and floor seals, of types and sizes indicated; suitable for sealing around conduit, pipe, or tubing passing through concrete floors and walls. Construct seals with steel sleeves, malleable iron body, neoprene sealing grommets and rings, metal pressure rings, pressure clamps, and cap screws.

e. Conduit Cable Supports: Provide cable supports with insulating wedging plug for non-armored type electrical cables in risers; construct for 2" rigid metal conduit; 3-wires, type wire as indicated; construct body of malleable-iron casting with not-dip galvanized finish.

f. U-Channel Strut Systems: Provide U-channel strut system for supporting electrical equipment, 12 gage hot-dip galvanized steel, of types and sizes indicated; construct with 9/16" diameter holes, 8" o.c. on top surface, with standard green finish, and with the following fittings which mate and match with U-channel: Fixture hangers, Channel hangers, End caps, Beam clamps, Wiring studs, Thinwall conduit clamps, Rigid conduit clamps, Conduit hangers, and U-bolts.

1. Manufacturers: Subject to compliance with requirements, provide channel systems of one of the following: Kindart, B-Line Systems, Inc., Power-Strut Div; Van Heffel Tube Corp., Unistrut Div; GTE Products Corp., or Globe Strut.

h. FABRICATED SUPPORTING DEVICES:

1. Pipe Sleeves: Provide pipe sleeves of one of the following:

a. Sheet Metal: Fabricate from galvanized sheet metal; round tube closed with snap lock joint, welded spiral seams, or welded longitudinal joint. Fabricate sleeves from the following gage metal: 3" and smaller, 20-gage; 4" to 6", 16 gage; over 6", 14 gage.

- b. Steel Pipe: Fabricate from Schedule 40 galvanized steel pipes; remove burrs.

2. Sleeve Seals: Provide modular mechanical type seals, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve, connected with bolts and pressure plates which cause rubber sealing elements to expand when tightened, providing watertight seals and electrical insulation.

C. EXECUTION

1. INSTALLATION:

a. All equipment and flat raceways attached to outside walls or interior walls subject to permanent moisture shall be shimmed out with non-corroding material so as to provide 1/4" air space between wall and equipment or raceway.

b. All materials, whether exposed or concealed, shall be firmly and adequately held in place. Fastening and support shall afford safety factor of three or higher.

c. All fixtures, raceways, equipment shall be supported from the structure. Nothing may be supported on suspended ceilings unless definitely noted so on the drawings or specifically permitted by the Architect/Engineer.

d. Fixtures shall be supported with (minimum) 10 gauge steel wire, or with threaded steel rods, adjusted as necessary to level fixture. For fluorescent fixtures 18" wide or less, use minimum of two supports; for wider units, use four supports.

e. Where installed recessed in grid type ceilings, attach each fluorescent fixture to grid with minimum of two "earthquake clips" or other approved method.

END OF SECTION 16190

SECTION 16450 – GROUNDING AND BONDING

A: GENERAL

1. SCOPE:

a. Grounding and bonding of the electrical system shall be provided in accordance with requirements of the National Electrical Code, and the requirements of these specifications and the drawings.

b. Contractor shall note that not all required grounding conductors are specifically noted on the drawings or in the schedules or specifications.

B: PRODUCTS

1. GROUNDING CLAMPS, BUSHINGS, ETC:

a. Materials shall be as manufactured by T & B or approved equal.

b. Clamps for attachment of grounding conductors to water, pipes, etc. shall be of bronze or brass, with conduit hub with insulated bonding bushings and compression type lugs.

2. GROUNDING CONDUCTORS:

a. Grounding conductors shall be sized in accordance with the requirements of the NEC, or as noted on the drawings or specified herein.

b. Grounding conductors shall be of copper. Insulation as required by NEC or as noted or specified. Otherwise, bare conductors will be acceptable.

3. MADE ELECTRODES:

a. Where indicated or required provide "made" grounding electrodes in accordance with NEC Article 250 III.

b. Driven grounding electrodes shall consist of copper clad steel rods not less than 8 feet in length and 5/8 inches in diameter.

4. VOLTAGE SURGE PROTECTORS:

a. Voltage surge protectors shall be installed at service entrance in accordance with NEC Articles 250 and 280.

b. Unless noted otherwise, surge protectors shall be solid state (MOV) type. Square D Type J9200-Series or approved equal. Furnish unit(s) as required for service voltage and configuration.

C: EXECUTION

1. GENERAL INSTALLATION:

- a. All systems and equipment shall be grounded in accordance with NEC Article 250.
- b. All grounding conductors shall be contained within raceway, unless specifically noted otherwise.

2. SERVICE GROUNDING:

- a. Where available on the premises, bond together the following:
 - Metal water pipe.
 - Building metal frame.
- b. Where required by NEC Article 250, or where shown on drawings, provide "made" grounding electrodes to supplement the above. Bond together all available and made electrodes.
- c. Service ground clamp shall be attached to cold water main at an accessible point and before its size is reduced. Clamp shall be accessible after construction is complete. Grounding conductor shall be without splice into the service enclosures where it shall be connected to main service neutral (or service ground buss, if provided).

3. EQUIPMENT GROUNDING, ETC.:

- a. Ground all fixed and portable appliances and equipment connected under this contract with a green grounding conductor. This wire shall be carried inside the raceway and flex from equipment to nearest grounding portion of raceway system. Connect at both ends with suitable lugs.
- b. Each grounding type receptacle shall have a green wire jumper from its grounding terminal to box in which mounted. Attach jumper to box, not plaster ring, with a bolt or Steel City "G" grounding clip or approved equal. Jumper shall be sized by NEC with #12 AWG minimum.
- c. Any feeder raceway anywhere in the system which enters a box or cabinet through part of a concentric knockout shall be fitted with a bonding bushing and jumper. The jumper shall be sized by NEC Table 250-66 and be lugged to the box.
- d. Each circuit serving convenience outlets shall include a separate green insulated copper grounding conductor not smaller than #12 AWG.

4. VOLTAGE SURGE PROTECTORS:

- a. Install voltage surge protector(s) within service entrance equipment enclosure. Locate for proper accessibility.
- b. Use shortest practical lengths of leads for connection to service conductors and service grounding conductor.

5. TRANSFORMER SECONDARY GROUNDING:

- a. Equipment on the secondary side of transformers shall be considered "service" and be bonded and separately grounded directly to the main service ground bus or electrode. Grounding

conductor may be run in feeder raceways back to main service enclosure.

b. In addition, transformer secondary shall be provided with a local grounding electrode, consisting of a clamp on a local 3/4" (minimum) copper cold water pipe or a grounded member. Grounding conductor shall be sized as shown on Plans.

END OF SECTION 16450

SECTION 16491 – SAFETY SWITCHES

A: GENERAL

1. SCOPE:

- a. Contractor shall furnish and install switches as indicated on the drawings and as specified.

B: PRODUCTS

1. MANUFACTURERS:

- a. Switches shall be as manufactured by Square D, General Electric or approved equal.
- b. Fuses shall be by Buss, Shawmut, or approved equal.

2. RATINGS, CHARACTERISTICS, ETC:

- a. Switches shall be of fusible type as indicated or as evidently intended.
- b. All switches shall be of heavy-duty type.
- c. Switches shall be equipped with cover-interlock. Also provide interlock-defeat mechanism to permit opening of switch while energized.
- d. Voltage rating, ampere rating, and motor horsepower rating shall be as indicated and as required for application.
- e. Where Class R fuses are specified or required, equip switch with rejection feature to prevent installation of other fuse types.

3. FUSES:

- a. All fusible type switches shall be equipped with fuses.
- b. Upon completion of project, furnish to the owner one complete set of replacement fuses, including one full set of each type and rating used on the project.
- c. Unless noted or specified otherwise, all fuses shall be Class RK5 time delay. Where fuses are located on the load side of dry-type transformers, fuses may be standard "one-time" type, unless noted otherwise.

C: EXECUTION (NOT USED)

END OF SECTION 16491

SECTION 16492 – MOTORS, CONTROLLERS AND EQUIPMENT CONNECTIONS

A: GENERAL

1. SCOPE:

a. It is generally intended that electrical contractor shall make provisions for power connections to all items of equipment installed on the project requiring electric power. Specific requirements for such connections are generally noted or indicated on the drawings.

B: PRODUCTS

- a. Controllers shall be as manufactured by Square D, General Electric or approved equal.
- b. Fuses shall be by Buss, Shawmut, or approved equal.

C: EXECUTION

1. MOTORS:

a. Disconnects.

1. Every motor connected under this contract shall be provided with a disconnect switch if so required by the NEC. Unless noted otherwise, disconnects shall be furnished by this contractor.

b. Controllers.

1. Motors controllers shall be furnished as noted on the plan drawings. Contractor shall provide controllers with appropriate overload relays, etc. to suit the load served. Coordinate prior to any installation.

2. Unless motor controller is specifically noted to be furnished by this contractor, controller will be furnished by others and turned over to this contractor for installation.

c. Connections.

1. Motor connection, where appropriate, shall be made using liquid tight flexible conduit for vibration isolation. Include grounding conductor.

2. Unless noted otherwise, this contractor shall wire through the motor via disconnect switches and/or controllers, and make power connections to motor as required.

3. Unless noted otherwise, all control wiring will be by others.

2. MISCELLANEOUS EQUIPMENT:

a. Equipment connections are generally indicated on the drawings by special symbols, which are defined in schedules or notes.

b. Where manufacturer's catalog numbers, models, etc. are indicated, the item of equipment shall be furnished and installed under this contract, unless specifically noted otherwise.

END OF SECTION 16492

SECTION 16500 – LIGHTING FIXTURES

A: GENERAL

1. SCOPE:

- a. Contractor shall furnish and completely install lighting fixtures as indicated on the drawings and as herein specified.
- b. All fixtures shall be equipped with lamps.
- c. A lighting fixture shall be provided for every lighting outlet indicated. Any omission shall be brought to the attention of the Architect/Engineer before submitting proposal: otherwise a unit selected by the Architect/Engineer shall be furnished and installed at no additional charge.

B: PRODUCTS

1. FIXTURES:

- a. Fixture types and manufacturers shall be as indicated on the drawings.
- b. Catalog numbers shown on the drawings are for general identification of fixtures only. All related parts, such as plaster rings, junction boxes, louvers, shields, mounting stems, canopies, connectors, straps, nipples, etc., required to fit them properly to the construction, shall be furnished and installed.
- c. Unless noted otherwise, all fluorescent fixtures shall be provided with high power factor, UL approved, ETL approved, and CBM made Class "P" ballast's individually fused. Where available for lamp type specified, ballast's serving fluorescent lamps shall be of the electronic type equal to GE "Maxi-Miser II" or approved equal by Advance or Sylvania.
- d. Recessed incandescent fixtures shall be thermally protected in compliance with NEC Section 410-65.

2. LAMPS:

- a. Lamps shall be as manufactured by Sylvania, General Electric, Westinghouse, or approved equal.
- b. Nominal 4' foot fluorescent lamps shall be 32 watt T-8 type, compatible with ballasts furnished. All fluorescent lamps shall be of electronic type where available for lamp specified.
- c. All HID lamps shall be phosphor coated, unless specified otherwise.

LED INTERIOR LIGHTING

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. Interior solid-state luminaires that use LED technology.
2. Lighting fixture supports.

B. Related Requirements:

1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.

1.3 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. LED: Light-emitting diode.
- F. Lumen: Measured output of lamp and luminaire, or both.
- G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Arrange in order of luminaire designation.
2. Include data on features, accessories, and finishes.
3. Include physical description and dimensions of luminaires.
4. Include emergency lighting units, including batteries and chargers.
5. Include life, output (lumens, CCT, and CRI), and energy efficiency data.
6. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing and Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps and accessories identical to those indicated for the lighting fixture as applied in this Project.
 - a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For luminaires, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

B. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Product Certificates: For each type of luminaire.

D. Product Test Reports: For each luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency.

E. Sample warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: Ten for every 100 of each type and rating installed. Furnish at least one of each type.

2. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.

3. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.8 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.

B. Provide luminaires from a single manufacturer for each luminaire type.

C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.10 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

B. Warranty Period: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined according to ASCE/SEI 7
- B. Seismic Performance: Luminaires and lamps shall be labeled vibration and shock resistant.

1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified and the luminaire will be fully operational during and after the seismic event."

2.2 LUMINAIRE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.
- C. Recessed Fixtures: Comply with NEMA LE 4.
- D. Bulb shape complying with ANSI C79.1.
- E. Lamp base complying with ANSI C81.61 or IEC 60061-1.
- F. Rated lamp life of 70,000 hours at 80%.
- G. Lamps dimmable from 100 percent to 0 percent of maximum light output.
- H. Internal driver.
- I. Nominal Operating Voltage: As indicated on Plans.

1. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

J. Housings:

1. Extruded-aluminum housing and heat sink.
2. powder-coat finish.

2.3 DOWNLIGHT

- A. See Plans for manufacturers.
- B. Minimum 1,000 lumens. Minimum allowable efficacy of 80 lumens per watt.
- C. Universal mounting bracket.
- D. Integral junction box with conduit fittings.

2.4 LINEAR INDUSTRIAL

- A. See Plans for manufacturers.
- B. Minimum 5,000 lumens. Minimum allowable efficacy of 110 lumens per watt.
- C. Housing and heat sink rated to the following:
 1. NEMA 4X.
 2. IP 54.
 3. IP 66
 4. Marine and wet locations.
 5. CSA C22.2 No 137.

2.5 RECESSED LINEAR

- A. See Plans for manufacturers.
- B. Minimum 2,000 lumens. Minimum allowable efficacy of 110 lumens per watt.
- C. Integral junction box with conduit fittings.

2.6 STRIP LIGHT

- A. See Plans for manufacturers.
- B. Minimum 750 lumens. Minimum allowable efficacy of 110 lumens per watt.
- C. Integral junction box with conduit fittings.

2.7 SURFACE MOUNT, LINEAR

- A. See Plans for manufacturers.
- B. Minimum 750 lumens. Minimum allowable efficacy of 110 lumens per watt.
- C. Integral junction box with conduit fittings.

2.8 SURFACE MOUNT, NONLINEAR

- A. See Plans for manufacturers.
- B. Minimum 750 lumens. Minimum allowable efficacy of 110 lumens per watt.
- C. Integral junction box with conduit fittings.

2.9 SUSPENDED, LINEAR

- A. See Plans for manufacturers.
- B. Minimum 2,000 lumens. Minimum allowable efficacy of 110 lumens per watt.

2.10 SUSPENDED, NONLINEAR

- A. See Plans for manufacturers.
- B. Minimum 2,000 lumens. Minimum allowable efficacy of 110 lumens per watt.
- C. Integral junction box with conduit fittings.

2.11 MATERIALS

- A. Metal Parts:
 - 1. Free of burrs and sharp corners and edges.
 - 2. Sheet metal components shall be steel unless otherwise indicated.
 - 3. Form and support to prevent warping and sagging.
- B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- C. Diffusers and Globes:
 - 1. prismatic acrylic
 - 2. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - 3. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.
- D. Housings:
 - 1. Extruded-aluminum housing and heat sink.
 - 2. Powder-coat finish.

- E. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

- 1. Label shall include the following lamp characteristics:
 - a. "USE ONLY" and include specific lamp type.
 - b. Lamp diameter, shape, size, wattage, and coating.
 - c. CCT and CRI for all luminaires.

2.12 METAL FINISHES

- A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.13 LUMINAIRE FIXTURE SUPPORT COMPONENTS

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.
- C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gage.
- D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.
- E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before fixture installation. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPORARY LIGHTING

- A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

3.3 INSTALLATION

- A. Comply with NECA 1.

- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Install lamps in each luminaire.
- D. Supports:
 - 1. Sized and rated for luminaire weight.
 - 2. Able to maintain luminaire position after cleaning and relamping.
 - 3. Provide support for luminaire without causing deflection of ceiling or wall.
 - 4. Luminaire mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and vertical force of 400 percent of luminaire weight.
- E. Flush-Mounted Luminaire Support:
 - 1. Secured to outlet box.
 - 2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
 - 3. Trim ring flush with finished surface.
- F. Wall-Mounted Luminaire Support:
 - 1. Attached to structural members in walls.
 - 2. Do not attach luminaires directly to gypsum board.
- G. Ceiling-Mounted Luminaire Support:
 - 1. Ceiling mount with two 5/32-inch-diameter aircraft cable supports adjustable to 120 inches in length.
 - 2. Ceiling mount with pendant mount with 5/32-inch-diameter aircraft cable supports adjustable to 120 inches in length.
 - 3. Ceiling mount with hook mount.
- H. Suspended Luminaire Support:
 - 1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
 - 2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
 - 3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and wire support for suspension for each unit length of luminaire chassis, including one at each end.
 - 4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.
- I. Ceiling-Grid-Mounted Luminaires:
 - 1. Secure to any required outlet box.

2. Secure luminaire to the luminaire opening using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
 3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.
- J. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

3.4 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
 2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.
- C. Prepare test and inspection reports.

3.6 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.
1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
 2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
 3. Adjust the aim of luminaires in the presence of the Architect.

C: EXECUTION

1. COORDINATION:

- a. Contractor shall verify ceiling or wall type in or on which each fixture is to be mounted,

and shall furnish unit with appropriate trim type, mounting hardware, etc. to fit the construction.

b. Contractor shall furnish fixtures with appropriate trim type, feed-through junction boxes, etc. as required to maintain proper access to system wiring.

2. INSTALLATION:

a. Where fixtures are connected to the rigid raceway system by flexible conduit, then a green grounding conductor shall be run within the flexible conduit. This grounding jumper shall be connected to the fixture and to the raceway system using screws, bolts, or clips, equal to Steel city "G" clip.

b. Conductors in fixture taps shall be #12 AWG minimum.

c. Support fixtures from structure, See Section 16190.

d. Mount fixtures plumb and square. Keep rows in perfect line.

e. At time of project completion, fixtures and lamps shall be clean, with visible labels removed.

END OF SECTION 16500

SECTION 16740 – TELEPHONE, DATA SYSTEMS

A: GENERAL

1. SCOPE:

a. Contractor shall furnish and install stub-ups with bushings, wiring as indicated on plans, outlet devices for telephone, & data, wall outlet boxes, equipment boards, cabinets, etc., as indicated on the drawings and as herein specified.

b. Contractor shall furnish and install stub-ups with bushings, outlet devices for telephone, & data with blank covers, as indicated on the drawings and as herein specified.

B: PRODUCTS

1. MATERIALS:

a. Raceways, boxes, etc. shall be in compliance with the relevant sections of these specifications.

b. Wall outlet shall consist of a standard 4" x 2 1/2" outlet box, with single device ring. Trim plate shall be standard "telephone" type, to match wiring device trim plates.

c. Special outlets, floor outlets, etc. shall be as noted on the drawings.

d. Equipment cabinets shall be Square D, or approved equal. Cabinets shall have hinged doors with flush lock and latch. Furnish with plywood backing. Sizes and mounting types (i.e. flush on surface) as noted on the drawings.

e. Telephone equipment boards shall be of size noted or shown on the drawings, and shall be constructed of 3/4" plywood, with finish grade on front. Paint board with gray fire-retardant paint.

C: EXECUTION

1. COORDINATION:

a. Contractor shall fully coordinate with the telephone utility, and shall install service entrance raceway, etc. in accordance with their requirements.

2. INSTALLATION:

a. Install pull boxes as necessary to limit runs to two (2) 90 degree bends (or equivalent) and to 100 feet in length.

b. Install raceways, boxes, etc. in accordance with relevant sections of these specifications.

END OF SECTION 16740