City of Milwaukee

Department of Public Works

Infrastructure Services Division
Facilities Development and Management Section

MILWAUKEE SANITATION HEADQUARTERS BUILDING ADDITION AND REMODELING
2363 S. 35TH Street
Milwaukee, Wisconsin 53215

February 2013

Project Number: BU11091119

Official Notice No. 53

CITY OF MILWAUKEE, WISCONSIN

DEPARTMENT OF PUBLIC WORKS

INFRASTRUCTURE SERVICES DIVISION

FACILITIES DEVELOPMENT AND MANAGEMENT SECTION

PROJECT MANUAL

GOVERNING THE

MILWAUKEE SANITATION HEADQUARTERS

BUILDING ADDITION AND REMODELING

2363 S. 35TH Street

MILWAUKEE, WISCONSIN 53215

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CITY OF MILWAUKEE
GENERAL OFFICIAL NOTICE
TO CONTRACTORS

Separate sealed bids for each project will be received until 10:30 A.M. of the bid opening date at which time bids will be publicly opened and read for furnishing all material and doing all work for each project in accordance with the requirements of the respective Official Notice on the bid form furnished in accordance with plans, specifications, contract documents, and proposed form of contract on file in the office of the Department of Public Works, Municipal Building, 841 N. Broadway, Room 506, Milwaukee, Wisconsin, 53202.

PROSPECTIVE BIDDERS ARE TO CAREFULLY EXAMINE AND REVIEW ALL CONTRACT DOCUMENTS AND MATERIALS IN SAID OFFICE BEFORE SUBMITTING BID.

AFFIDAVITS OF NO INTEREST MUST ACCOMPANY THE BIDS, AND THE FAILURE OF PROSPECTIVE BIDDERS TO COMPLY WITH THESE REQUIREMENTS MAY DISQUALIFY THE BID.

THE CONTRACTOR/LESSEE AGREES TO COMPLY WITH ALL APPLICABLE REQUIREMENTS OF THE AMERICANS WITH DISABILITIES ACT OF 1990, 42 U.S.C. § 12101, ET. SEQ. THE TDD NUMBER FOR PUBLIC WORKS IS (414) 286-2025.

As part of the bid each bidder shall submit a list of anticipated subcontractors and the class of work to be performed by each, which list should not be added to nor altered without the written consent of the Commissioner of Public Works.

All contractor(s) and subcontractor(s) are required to furnish or have on file a certificate of insurance in accordance with the insurance provisions of the General Specifications.

All contractor(s) and subcontractor(s) are subject to the prevailing wage rates and hours of labor as prescribed by the Common Council of the City of Milwaukee consistent with provisions of Section 66.293 of the Wisconsin Statutes.

Copies of the actual work classifications and wage and fringe benefit rates enforced on this project are available in Room 506 of the Municipal Building.

Corporate surety will be required on performance and payment bonds for all projects listed in the following Official Notices. All applicable charter and Statutory provisions and ordinances, all the provisions of this official notice, invitation to bid, general and detailed specifications, special provisions, proposal, schedule of fixed prices, addendum and plans for this project and all other contract documents set forth in the invitation to bid will be incorporated and made part of the contract as if therein set forth in full.

Tie bids, when the lowest ones, will be decided by the Commissioner of Public Works.

The Commissioner of Public Works reserves the right to reject any or all bids.

Signed: GHASSAN KORBAN
Commissioner of Public Works

Countersigned: MARTIN MATSON
City Comptroller

CITY OF MILWAUKEE
SPECIFIC OFFICIAL NOTICE NO. 53

Important Notice:

The Invitation to Bid, all bid documents and the Plans & Specifications for the project listed will be available electronically to prospective bidders via http://www.mpw.net/bids/docs/53-2013. Any required addenda or responses related to the listed projects will be posted on said website. Bidders are encouraged to utilize this electronic method of obtaining bid documents as the Department of Public Works intends to solely use this method for future projects. At this time however, a limited number of hard copies of the above documents will also be available at address listed below. **IF YOU ONLY PRINT THE DOCUMENTS FROM THE WEBSITE AND WOULD LIKE YOUR COMPANY'S NAME PLACED ON THE PLAN HOLDERS' LIST, PLEASE CALL 414-286-3314.**

Sealed bids will be opened on Monday, April 08, 2013 at 10:30 A.M. for the **MILWAUKEE SANITATION HEAD QUARTERS, BUILDING ADDITION AND REMODELING**, located at 2363 South 35th Street, Milwaukee, WI 53215.

Bid Security Required: Bond, Certified Check, Cashier's Check, or Cash to accompany bid: 10% of Contractor's Base Bid

Time for Completion: 110 Working Days. All work on this project shall be completed by Monday, November 04, 2013. Contractor shall not begin work on this project prior to Monday, May 13, 2013.

Liquidated Damages, per diem: $150.00

The SBE requirement for this project is 25% of the contract base bid.

The residency requirement for this project is 40% ofall hours worked on the project.

The apprenticeship requirements for this project are:**2**

Construction Laborer, Painter, Bricklayer/Blocklayer, Carpenter, Mechanical Worker, Plumber

The contractor shall specifically note the SBE, residency, and apprenticeship forms for this project. If the forms are not filled out properly, it will be cause for rejection of the bid.

Plans and project manual will be furnished to the prospective bidders upon payment of a $10.00 non-refundable fee in room 506, Frank P. Zeidler Municipal Building, 841 North Broadway, Milwaukee, Wisconsin 53202. For general questions call 414286-3314.

A $10.00 per set additional non-refundable fee is required to obtain bid documents by mail. Plans are sent via U.S. mail unless other arrangements are made by the contractor.

Contractor must comply with all provisions of the CITY OF MILWAUKEE GENERAL OFFICIAL NOTICE TO CONTRACTORS published herein and at http://mpw.milwaukee.gov/services/bids_home

Pre-Bid Meeting: A Pre-Bid Meeting is scheduled for Monday, April 01, 2013, at 2:00 p.m. in Room 606 of the Frank P. Zeidler Municipal Building, 841 North Broadway, Milwaukee, Wisconsin. Bidder participation is urged to become familiar with all aspects of the project and bidding requirements.

Signed:

GHASSAN KORBAN
Commissioner of Public Works

PUBLISH SIX (6) TIMES INSERTION WITHOUT FAIL, Monday, March 25, 2013

SECTION 00100: INSTRUCTIONS TO BIDDERS

See also Instructions to Bidders in the "General Specifications" of the Department of Public Works, City of Milwaukee, Wisconsin, dated January 31, 1992, and all subsequent addenda.

BID FORM:

Submit lump sum prices for the work as indicated on the drawings and specified herein, complete in every respect.

Bids will not be accepted in any form except on the bid form included with this project manual.

The contractor must recognize and abide by the right of the Owner (City of Milwaukee) to accept or reject any or all bids in the best interests of the City.

ALTERNATE BIDS:

Each bidder shall examine the plans and project manual thoroughly to determine what extent the Alternates will affect the Bid.

Alternate Bid 1: Furnish and Install Metal Storage Building

Provide a lump sum price to furnish and install the Metal Storage Building as indicated on the plans and project manual.

Alternate Bid 2: Furnish and install interior partition walls in offices 2A, 2B, 2C and 2D

Provide a lump sum price to furnish and install interior partition walls in offices 2A-2D as indicated on the plans and project manual. Exterior furred walls are included in contract base bid.

INFORMATIONAL PRICES

Informational Price A-1:

Provide a lump sum price for general conditions and contractors fee including mobilization, staging, etc.

Information Price B-1:

Provide a lump sum price for new windows.

UNIT PRICES:

Each bidder shall provide on the bid proposal the following unit prices that were used in arriving at the base bid. The unit prices will be used for additions or deductions under the contract. Unit prices below are part of the base bid.

Unit Price A:

Provide a square foot price to furnish and install EPDM roofing as shown on plans and in specifications, including insulation and accessories.

Unit Price B:

Provide a cubic yard price to excavate and dispose of 71 cubic yards of brown field subsoil as described on plans and in specifications.

Unit Price C:

Provide a cubic yard price for supplying and placement of 71 cubic yards of compacted backfill as described on plans and in specifications.

Unit Price D:

Provide a cubic yard price to furnish and place 2 cubic yards of topsoil as shown and described on plans and in specifications.

Unit Price E:

Provide a cubic yard price to excavate and dispose of 19 cubic yards of bituminous concrete as shown and described on plans and in specifications.

CONTRACT AWARD:

The Commissioner of Public Works will award the contract on the basis of the Base Bid only or the Base Bid and the Alternate Bid(s) as funds permit.

CONTRACT BREAKDOWN:

Shortly after the award of the contract, each contractor shall submit a list showing the cost breakdown of the items in his contract. This list will be used as a basis for estimates of work completed for partial payment.

SITE VISIT:

All contractors shall visit the site, consult the drawings and project manual, be familiar with the work of other contractors and determine for themselves all conditions affecting the work.

Failure by a contractor to be familiar with the project shall not release him from any obligation under this contract to complete the work in strict conformity with the plans and project manual and all City, State and Federal Codes or regulations pertaining to the work.

CONSTRUCTION START AND COMPLETION DATES:

The TOTAL WORKING DAYS are stated in the Specific Official Notice. The contractor may begin procuring materials and off-site fabricating (as appropriate and approved by Architect) on the date stated on the Notice to Proceed. The Notice to Proceed will be sent to the contractor directly following the signing of the contract.

BASE BID EXCLUSIONS:

None at this time.

CONTRACT BREAKDOWN:

Shortly after the award of the contract, each contractor shall submit a list showing the cost breakdown of the items in his contract. This list will be used as a basis for estimates of work completed for partial payment.

ADDITIONAL PLANS/PROJECT MANUALS

The successful contractor will be responsible for furnishing all additional copies of plans, project manuals, addenda, etc., as may be needed by the contractor and subcontractors. The City will cooperate by making originals available to the contractor's printer of choice.

END OF SECTION

SECTION 00700: GENERAL CONDITIONS

1. SCOPE:

A. Index:

1. Scope
2. DPW General Specifications
3. Definitions
4. Control of Work and Materials
5. Samples and Tests
6. Project Coordination
7. Supervision of Work
8. Technical Specifications and Drawings
9. Safety Regulations
10. DNR Regulations
11. Code Rules

2. Department of Public Works General Specifications:

Provisions of the Department of Public Works General Specifications dated January 31, 1992, and subsequent addenda except as may be modified or expanded upon in this project manual, shall apply to all contractors and subcontractors working on the project. Copies of the General Specifications may be obtained from the Department of Public Works General Office, Room 501 Zeidler Municipal Building, 841 North Broadway, Milwaukee, Wisconsin, or from the FACILITIES DEVELOPMENT AND MANAGEMENT SECTION, Room 602, Zeidler Municipal Building.

3. Definitions:

A. Owner: City of Milwaukee.

B. Facilities Director: The Director of FACILITIES DEVELOPMENT AND MANAGEMENT SECTION.

C. Project Inspector: The authorized representative of the Commissioner assigned to make detailed inspection of any or all portions of the work and materials thereof. These inspections are not a substitute to those required by the Department of Neighborhood Services for permit and code compliance.

D. Addenda: Written or graphic instruments issued prior to the execution of the contract which modify or interpret the bidding documents, including drawings and project manual by additions, deletions, clarifications or corrections. Addenda will become part of the contract documents when the contract is executed.

E. Contract Drawings: Drawings of the work to be done as listed hereafter in Section 00850 Drawing Schedule and/or Section 00870 Plans and Details.

F. Utility: WE Energies.

G. End User: City of Milwaukee.

4. Control of Work and Materials:

A. Detail and Shop Drawings: Shop drawings and other additional drawings which may be

required for each contract of the work shall be prepared by each respective contractor unless otherwise directed by the Facilities Director. Prints shall be the same size as contract documents when practical. Prints of each drawing shall be submitted to the Facilities Director for approval before proceeding with the work. Changes ordered by the Facilities Director shall be made and revised prints submitted as above. The Facilities Director's approval of drawings shall not relieve the contractor of responsibility for errors.

B. Primary Lines and Grades: The City of Milwaukee will mark two building corners along a line and will establish a benchmark, with a relative elevation, within close proximity to the site. Once established by the City, the contractor shall preserve all points and benchmark as long as needed during construction. The contractor will bear all costs associated with re-establishing points and benchmark.

C. Construction Lines and Grades: The contractor must bear sole responsibility for the correct transfer of all construction lines and grades from the primary lines and grades points. He shall take such measurements from existing work as may be necessary to insure the proper construction of his work.

D. Material Orders and Shipping Statements: The contractor shall furnish to the Facilities Director at least two (2) copies of all material orders and shipping statements. Itemized weights of the materials and individual units of finished work shall be shown.

E. Weighing of Materials and Fabricated Units: The weighing of materials and fabricated units such as structural steel, casings, etc., when required, shall be done in the presence of the Commissioner's representative. The contractor shall be responsible for the satisfactory weighing of such materials and units.

F. Consignment and Delivery of Materials: The materials for the work shall be consigned to the contractor and he shall be responsible for the delivery of all materials required for the completion of the contract.

5. Samples and Tests:

A. Method of Sampling: Samples of the materials proposed or furnished for the work may be taken by the Commissioner at any time; at the point of manufacture, point of delivery or site of work. They will be selected, as far as practicable, in accordance with standard methods of sampling such materials as specified in the standard of the American Society for Testing Material. All sampling shall be done by authorized representatives of the Commissioner. Selections will be in an orderly and systematic manner, insuring samples representative of the lot.

B. A.S.T.M. Standards: Wherever the abbreviation A.S.T.M. is used in connection with the number of a standard specification, the specification referred to shall be the Standard of the American Society for Testing Materials, designated by that number, including all revisions in effect on the date of award of the contract. Should a revised or amended standard be issued by the American Society for Testing Materials which, in the opinion of the Commissioner, conflicts with or causes undesirable changes in the standards referred to herein, the Commissioner reserves the right, by means of addenda to the project manual, to continue under the provisions of the pertinent standard referred to herein.

C. Cost of Test Specimens and Samples: All test specimens of metals and all samples of non-metals required for tests shall be furnished by the contractor without cost to the City.

D. Costs of Tests: All tests on test specimens of metals will be made at the expense of the

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contractor and the original test on samples of non-metals will be made at the expense of the City. In all cases, the testing procedure will be in accordance with Standard A.S.T.M. tests for such materials. Subsequent tests of non-metals requested by the contractor, when such tests are permitted by A.S.T.M. Specifications and approved by the Commissioner or subsequent tests ordered by the Commissioner will be made at the expense of the contractor.

6. Project Coordination:

A. Contractors are required, so far as possible; to arrange work and to dispose of materials so as not to interfere with the work or storage of materials of other contractors or City forces engaged upon the work.

B. Contractors shall give full cooperation to other trades and furnish any information necessary to permit the work of all trades to be installed satisfactorily and with the least possible interference or delay.

C. Where the work of a contractor will be installed in close proximity to the work of other trades, or where there is evidence that the work of a contractor will interfere with the work of other trades, he shall assist in working out space conditions to make satisfactory adjustments.

D. If a contractor installs work before coordinating it with other trades or so as to cause interference with work of other trades, he shall make necessary changes in his work to correct the condition without extra charge.

E. Contractors are required to join their work to that of others in a proper manner, and in accordance with the spirit of the plans and project manual, and to perform the work in the proper sequence in relation to that of other contractors, and as may be directed by the Project Inspector.

7. Supervision of Work:

A. Contractors shall furnish the services of an experienced engineer or superintendent.

B. He shall be constantly in charge of the installation of the work together with all subcontractors, skilled workers, helpers, and labor required to unload, transfer, erect, connect up, adjust, start, operate and test each system.

C. He shall be thoroughly acquainted with and be responsible for the various subcontractors' work so that it is properly coordinated and supervised to the satisfaction of the Commissioner of Public Works or his representative.

D. Upon written notice to a contractor of the lack of such coordination and supervision, the Commissioner of Public Works may authorize such services as may be required and deduct the cost of this service at an hourly rate of $60.00 per hour per worker from the contract for the work.

8. Technical Specifications and Drawings:

A. Governing order of Contract Documents:

1. The following provision modifies DPW General Specifications Item 2.1.3.1:

Anything mentioned in the Technical Specifications and not shown on the drawings or shown on the drawings and not mentioned in the Technical Specifications shall be as if shown on or mentioned in both. In case of difference between drawings and Technical Specifications, the Technical Specifications shall govern. In case of any discrepancy in drawings or Technical Specifications, the matter shall be immediately submitted to FACILITIES DEVELOPMENT AND MANAGEMENT SECTION for decision. Said discrepancy shall not be adjusted by the contractor.

B. All contractors shall have complete sets of plans and project manuals on the job site at all times.

9. Safety Regulations:

All work shall be done in accordance with the safety requirements referenced in the International Building Code, as adopted and amended by the State of Wisconsin and OSHA standards.

10. DNR Regulations:

All work shall be done in accordance with State of Wisconsin DNR and all Federal Environmental Regulations. Permits for work on brown field site to be obtained by the contractor, and all inspections in regards to such permits will be the responsibility of the contractor.

11. Code Rules:

The following rulings, regulations and laws in effect at the time of bid of this project shall be complied with in the completion of this project:

2009 International Building Code, as amended and adopted by the State of Wisconsin
Plumbing and Drainage Codes of the City of Milwaukee
Ordinances of the City of Milwaukee
National Board of Fire Underwriters
OSHA
NFPA
FAA
NEC
IEEE
UL
Wisconsin DNR
EPA

Rev. 1212

SECTION 00821: INSPECTION CHARGES

The contractor will be charged a fee for inspection for each and every day such inspection is required after the time allowed for completion has expired.

The amount of the fee for inspection shall be $325.00 per day.

The time allowed for completion is stated in the Specific Official Notice and shall start with the date on the Notice to Proceed which will be sent to the contractor directly following the signing of the contract. The time allowed includes the time required for fabricating and procuring material and doing the work at the building site.

PREVAILING WAGE RATE DETERMINATION
Issued by the State of Wisconsin
Department of Workforce Development
Pursuant to s. 66.0903, Wis. Stats.
Issued On: 01/10/2013
Amended On: 02/18/2013

DETERMINATION NUMBER: 201300081

EXPIRATION DATE: Prime Contracts MUST Be Awarded or Negotiated On Or Before 12/31/2013. If NOT, You MUST Reapply.

PROJECT NAME: ALL PUBLIC WORKS PROJECTS UNDER SEC 66.0903, STATS - CITY OF MILWAUKEE

PROJECT LOCATION: MILWAUKEE CITY, MILWAUKEE COUNTY, WI

CONTRACTING AGENCY: CITY OF MILWAUKEE-DEPT OF PUBLIC WORKS

CLASSIFICATION:	Contractors are responsible for correctly classifying their workers. Either call the Department of Workforce Development (DWD) with trade or classification questions or consult DWD's Dictionary of Occupational Classifications & Work Descriptions on the DWD website at: dwd.wisconsin.gov/er/prevailing_wage_rate/Dictionary/dictionary_main.htm.
OVERTIME:	Time and one-half must be paid for all hours worked: - over 10 hours per day on prevailing wage projects - over 40 hours per calendar week - Saturday and Sunday - on all of the following holidays: January 1; the last Monday in May; July 4; the 1st Monday in September; the 4th Thursday in November; December 25; - The day before if January 1, July 4 or December 25 falls on a Saturday; - The day following if January 1, July 4 or December 25 falls on a Sunday. Apply the time and one-half overtime calculation to whichever is higher between the Hourly Basic Rate listed on this project determination or the employee's regular hourly rate of pay. Add any applicable Premium or DOT Premium to the Hourly Basic Rate before calculating overtime. A DOT Premium (discussed below) may supersede this time and one-half requirement.
FUTURE INCREASE:	When a specific trade or occupation requires a future increase, you MUST add the full hourly increase to the "TOTAL" on the effective date(s) indicated for the specific trade or occupation.
PREMIUM PAY:	If indicated for a specific trade or occupation, the full amount of such pay MUST be added to the "HOURLY BASIC RATE OF PAY" indicated for such trade or occupation, whevenever such pay is applicable.
DOT PREMIUM:	This premium only applies to highway and bridge projects owned by the Wisconsin Department of Transportation and to the project type heading "Airport Pavement or State Highway Construction." DO NOT apply the premium calculation under any other project type on this determination.
APPRENTICES:	Pay apprentices a percentage of the applicable journeyperson's hourly basic rate of pay and hourly fringe benefit contributions specified in this determination. Obtain the appropriate percentage from each apprentice's contract or indenture.
SUBJOURNEY:	Subjourney wage rates may be available for some of the trades or occupations indicated below with the exception of laborers, truck drivers and heavy equipment operators. Any employer interested in using a subjourney classification on this project MUST complete Form ERD-10880 and request the applicable wage rate from the Department of Workforce Development PRIOR to using the subjourney worker on this project.

This document **MUST BE POSTED** by the **CONTRACTING AGENCY** in at least one conspicuous and easily accessible place **on the site of the project** . A local governmental unit may post this document at the place normally used to post public notices if there is no common site on the project. This document **MUST** remain posted during the entire time any worker is employed on the project and **MUST** be physically incorporated into the specifications and all contracts and subcontracts. If you have any questions, please write to the Equal Rights Division, Labor Standards Bureau, P.O. Box 8928, Madison, Wisconsin 53708 or call (608) 266-6861.

The following statutory provisions apply to local governmental unit projects of public works and are set forth below pursuant to the requirements of s. 66.0903(8), Stats.

s. 66.0903 (1) (f) & s. 103.49 (1) (c) "PREVAILING HOURS OF LABOR" for any trade or occupation in any area means 10 hours per day and 40 hours per week and may not include any hours worked on a Saturday or Sunday or on any of the following holidays:

1. January 1.
2. The last Monday in May.
3. July 4.
4. The first Monday in September.
5. The 4th Thursday in November.
6. December 25.
7. The day before if January 1, July 4 or December 25 falls on a Saturday.
8. The day following if January 1, July 4 or December 25 falls on a Sunday.

s. 66.0903 (10) RECORDS; INSPECTION; ENFORCEMENT.
(a) Each contractor, subcontractor, or contractor's or subcontractor's agent performing work on a project of public works that is subject to this section shall keep full and accurate records clearly indicating the name and trade or occupation of every person performing the work described in sub. (4) and an accurate record of the number of hours worked by each of those persons and the actual wages paid for the hours worked.

s. 66.0903 (11) LIABILITY AND PENALTIES.
(a) 1. Any contractor, subcontractor, or contractor's or subcontractor's agent who fails to pay the prevailing wage rate determined by the department under sub. (3) or who pays less than 1.5 times the hourly basic rate of pay for all hours worked in excess of the prevailing hours of labor is liable to any affected employee in the amount of his or her unpaid wages or his or her unpaid overtime compensation and in an additional amount as liquidated damages as provided under subd. 2., 3., whichever is applicable.
2. If the department determines upon inspection under sub. (10) (b) or (c) that a contractor, subcontractor, or contractor's or subcontractor's agent has failed to pay the prevailing wage rate determined by the department under sub. (3) or has paid less than 1.5 times the hourly basic rate of pay for all hours worked in excess of the prevailing hours of labor, the department shall order the contractor to pay to any affected employee the amount of his or her unpaid wages or his or her unpaid overtime compensation and an additional amount equal to 100 percent of the amount of those unpaid wages or that unpaid overtime compensation as liquidated damages within a period specified by the department in the order.
3. In addition to or in lieu of recovering the liability specified in subd. 1. as provided in subd. 2., any employee for and in behalf of that employee and other employees similarly situated may commence an action to recover that liability in any court of competent jurisdiction. If the court finds that a contractor, subcontractor, or contractor's or subcontractor's agent has failed to pay the prevailing wage rate determined by the department under sub. (3) or has paid less than 1.5 times the hourly basic rate of pay for all hours worked in excess of the prevailing hours of labor, the court shall order the contractor, subcontractor, or agent to pay to any affected employee the amount of his or her unpaid wages or his or her unpaid overtime compensation and an additional amount equal to 100 percent of the amount of those unpaid wages or that unpaid overtime compensation as liquidated damages.
5. No employee may be a party plaintiff to an action under subd. 3. unless the employee consents in writing to become a party and the consent is filed in the court in which the action is brought. Notwithstanding s. 814.04 (1), the court shall, in addition to any judgment awarded to the plaintiff, allow reasonable attorney fees and costs to be paid by the defendant.

BUILDING OR HEAVY CONSTRUCTION

Includes sheltered enclosures with walk-in access for the purpose of housing persons, employees, machinery, equipment or supplies and non-sheltered work such as canals, dams, dikes, reservoirs, storage tanks, etc. A sheltered enclosure need not be "habitable" in order to be considered a building. The installation of machinery and/or equipment, both above and below grade level, does not change a project's character as a building. On-site grading, utility work and landscaping are included within this definition. Residential buildings of four (4) stories or less, agricultural buildings, parking lots and driveways are NOT included within this definition.

SKILLED TRADES

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
101	Acoustic Ceiling Tile Installer Future Increase(s): Add $.75/hr on 6/3/2013. Add $1.25/hr on 6/2/2014.	32.93	19.81	52.74
102	Boilermaker	31.09	27.23	58.32
103	Bricklayer, Blocklayer or Stonemason Future Increase(s): Add $1.45/hr on 6/01/2013 Premium Increase(s): DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	35.80	16.87	52.67
104	Cabinet Installer Future Increase(s): Add $.75/hr on 6/3/2013. Add $1.25/hr on 6/2/2014.	32.93	19.81	52.74
105	Carpenter Future Increase(s): Add $.75/hr on 6/3/2013. Add $1.25/hr on 6/2/2014. Premium Increase(s): DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	32.93	19.81	52.74
106	Carpet Layer or Soft Floor Coverer	33.43	19.21	52.64
107	Cement Finisher	32.57	17.03	49.60
108	Drywall Taper or Finisher	29.87	18.79	48.66
109	Electrician Future Increase(s): Add $1.60/hr on 6/1/2013. Premium Increase(s): DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	32.20	21.71	53.91
110	Elevator Constructor	41.71	23.88	65.59
111	Fence Erector	28.00	4.50	32.50
112	Fire Sprinkler Fitter	37.45	19.30	56.75

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
113	Glazier	34.19	18.25	52.44
114	Heat or Frost Insulator	33.93	23.26	57.19
115	Insulator (Batt or Blown)	27.47	19.16	46.63
116	Ironworker	31.31	21.99	53.30
117	Lather	33.43	19.31	52.74
118	Line Constructor (Electrical)	37.05	16.94	53.99
119	Marble Finisher	20.00	0.00	20.00
120	Marble Mason	35.58	16.37	51.95
121	Metal Building Erector	18.50	3.20	21.70
122	Millwright	28.28	24.19	52.47
123	Overhead Door Installer	27.30	3.28	30.58
124	Painter	29.27	18.18	47.45
125	Pavement Marking Operator	30.00	0.00	30.00
126	Piledriver Future Increase(s): Add $.75/hr on 6/3/2013. Premium Increase(s): Add $.65/hr for Piledriver Loftsman; Add $.75/hr for Sheet Piling Loftsman. DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	29.06	25.46	54.52
127	Pipeline Fuser or Welder (Gas or Utility)	31.18	19.29	50.47
129	Plasterer	32.06	17.68	49.74
130	Plumber Future Increase(s): Add $1.00/hr 6/1/2013; Add $1.00/hr 6/1/2014.	36.47	19.47	55.94
132	Refrigeration Mechanic	37.76	19.99	57.75
133	Roofer or Waterproofer	29.40	15.55	44.95
134	Sheet Metal Worker Future Increase(s): Add $1.41/hour 6/1/2013; Add $1.56/hour 6/1/2014.	36.17	18.00	54.17
135	Steamfitter	37.76	19.99	57.75
137	Teledata Technician or Installer Premium Increase(s): DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	24.75	16.08	40.83

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
138	Temperature Control Installer	37.31	19.49	56.80
139	Terrazzo Finisher Future Increase(s): Add $ .80 on 6/1/2013	26.57	16.50	43.07
140	Terrazzo Mechanic	29.51	17.63	47.14
141	Tile Finisher	22.27	6.52	28.79
142	Tile Setter	29.70	16.05	45.75
143	Tuckpointer, Caulker or Cleaner	34.35	11.13	45.48
144	Underwater Diver (Except on Great Lakes)	34.16	15.31	49.47
146	Well Driller or Pump Installer Future Increase(s): Add $.20/hr on 06/01/2013.	25.32	15.45	40.77
147	Siding Installer	37.20	17.01	54.21
150	Heavy Equipment Operator - ELECTRICAL LINE CONSTRUCTION ONLY	28.24	15.10	43.34
151	Light Equipment Operator -ELECTRICAL LINE CONSTRUCTION ONLY	29.64	14.64	44.28
152	Heavy Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	25.94	13.57	39.51
153	Light Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	24.08	12.96	37.04
154	Groundman - ELECTRICAL LINE CONSTRUCTION ONLY	24.00	11.57	35.57

TRUCK DRIVERS

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
201	Single Axle or Two Axle	33.32	17.60	50.92
203	Three or More Axle	18.00	9.50	27.50
204	Articulated, Euclid, Dumptor, Off Road Material Hauler Future Increase(s): Add $0.75/hour 6/3/2013; Add $1.00/hour 6/2/2014; Add $1.50/hour 6/1/2015; Add $1.60/hour 5/30/2016.	33.52	17.60	51.12
205	Pavement Marking Vehicle	20.85	11.02	31.87
207	Truck Mechanic	18.00	9.50	27.50

LABORERS

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
301	General Laborer Premium Increase(s): Add $.11 for mortar mixer, fork lift operator, air and electric equipment and power buggy operators; Add $.22 for jackhammer operator, certified welder, gunite machineman.	28.82	16.11	44.93
302	Asbestos Abatement Worker	18.00	0.00	18.00
303	Landscaper	11.00	3.97	14.97
310	Gas or Utility Pipeline Laborer (Other Than Sewer and Water)	19.69	16.03	35.72
311	Fiber Optic Laborer (Outside, Other Than Concrete Encased)	17.24	15.03	32.27
314	Railroad Track Laborer	14.50	3.53	18.03
315	Final Construction Clean-Up Worker	28.82	15.61	44.43

HEAVY EQUIPMENT OPERATORS
SITE PREPARATION, UTILITY OR LANDSCAPING WORK ONLY

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
501	Air Track, Rotary or Percussion Drilling Machine &/or Hammers, Blaster; Asphalt Milling Machine; Boring Machine (Directional, Horizontal or Vertical); Backhoe (Track Type) Having a Mfgr's Rated Capacity of 130,000 Lbs. or Over; Backhoe (Track Type) Having a Mfgr's Rated Capacity of Under 130,000 Lbs., Backhoe (Mini, 15,000 Lbs. & Under); Bulldozer or Endloader (Over 40 hp); Compactor (Self-Propelled 85 Ft Total Drum Width & Over, or Tractor Mounted, Towed & Light Equipment); Concrete Batch Plant, Batch Hopper; Concrete Breaker (Large, Auto, Vibratory/Sonic, Manual or Remote); Crane, Shovel, Dragline, Clamshells; Forklift (Machinery Moving or Steel Erection, 25 Ft & Over); Gradall (Cruz-Aire Type); Grader or Motor Patrol; Master Mechanic; Mechanic or Welder; Robotic Tool Carrier (With or Without Attachments); Scraper (Self Propelled or Tractor Drawn) 5 cu yds or More Capacity; Tractor or Truck Mounted Hydraulic Backhoe; Tractor or Truck Mounted Hydraulic Crane (10 Tons or Under); Tractor (Scraper, Dozer, Pusher, Loader); Trencher (Wheel Type or Chain Type Having Over 8 Inch Bucket). Future Increase(s): Add $0.75/hour 6/3/2013; Add $1.00/hour 6/2/2014; Add $1.50/hour 6/1/2015; Add $1.60/hour 5/30/2016.	33.82	17.60	51.42

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
502	Backfiller; Broom or Sweeper; Bulldozer or Endloader (Under 40 hp); Environmental Burner; Forestry Equipment, Timbco, Tree Shear, Tub Grinder, Processor; Jeep Digger; Screed (Milling Machine); Skid Rig; Straddle Carrier or Travel Lift; Stump Chipper; Trencher (Wheel Type or Chain Type Having 8 Inch Bucket & Under). Future Increase(s): Add $0.75/hour 6/3/2013; Add $1.00/hour 6/2/2014; Add $1.50/hour 6/1/2015; Add $1.60/hour 5/30/2016.	33.52	17.60	51.12
503	Air Compressor (&/or 400 CFM or Over); Augers (Vertical & Horizontal); Compactor (Self-Propelled 84 Ft Total Drum Width & Under, or Tractor Mounted, Towed & Light Equipment); Crusher, Screening or Wash Plant; Farm or Industrial Type Tractor; Forklift; Generator (&/or 150 KW or Over); Greaser; High Pressure Utility Locating Machine (Daylighting Machine); Mulcher; Oiler; Post Hole Digger or Driver; Pump (3 Inch or Over) or Well Points; Refrigeration Plant or Freeze Machine; Rock, Stone Breaker; Skid Steer Loader (With or Without Attachments); Vibratory Hammer or Extractor, Power Pack. Future Increase(s): Add $0.75/hour 6/3/2013; Add $1.00/hour 6/2/2014; Add $1.50/hour 6/1/2015; Add $1.60/hour 5/30/2016.	33.52	17.60	51.12
504	Work Performed on the Great Lakes Including Diver; Wet Tender or Hydraulic Dredge Engineer.	37.45	19.45	56.90
505	Work Performed on the Great Lakes Including Crane or Backhoe Operator; Assistant Hydraulic Dredge Engineer; Hydraulic Dredge Leverman or Diver's Tender; Mechanic or Welder; 70 Ton & Over Tug Operator. Future Increase(s): Add $2.19/hr on 01/01/2013; Add $2.00/hr on 01/01/2014. Premium Increase(s): Add $.50/hr for Friction Crane, Lattice Boom or Crane Certification (CCO).	38.80	20.17	58.97
506	Work Performed on the Great Lakes Including Deck Equipment Operator or Machineryman (Maintains Cranes Over 50 Tons or Backhoes 115,000 Lbs. or More); Tug, Launch or Loader, Dozer or Like Equipment When Operated on a Barge, Breakwater Wall, Slip, Dock or Scow, Deck Machinery. Future Increase(s): Add $2.08/hr on 01/01/2013; Add $2.00/hr on 01/01/2014.	34.50	20.04	54.54
507	Work Performed on the Great Lakes Including Deck Equipment Operator, Machineryman or Fireman (Operates 4 Units or More or Maintains Cranes 50 Tons or Under or Backhoes 115,000 Lbs. or Under); Deck Hand, Deck Engineer or Assistant Tug Operator; Off Road Trucks - Great Lakes ONLY. Future Increase(s): Add $1.88/hr on 01/01/2013; Add $2.00/hr on 01/01/2014.	28.70	19.86	48.56

HEAVY EQUIPMENT OPERATORS
EXCLUDING SITE PREPARATION, UTILITY, PAVING LANDSCAPING WORK

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
508	Boring Machine (Directional); Crane, Tower Crane, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of Over 100 Tons, Self-Erecting Tower Crane With a Lifting Capacity of Over 4,000 Lbs., Crane With Boom Dollies; Crane, Tower Crane, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 176 Ft or Over; Master Mechanic. Premium Increase(s): Crane Operators with CCO certification add $.50/hr. Cranes with boom length over 200 ft. not exceeding 300 ft. OR lifting capacity over 200 ton not exceeding 300 ton add $.50/hr. Over 300 ton OR 300 ft. add $.01/hr. per foot OR ton whichever is greater.	39.16	19.10	58.26
509	Backhoe (Track Type) Having a Mfgr's Rated Capacity of 130,000 Lbs. or Over; Boring Machine (Horizontal or Vertical); Caisson Rig; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of 100 Tons or Under, Self-Erecting Tower Crane With A Lifting Capacity Of 4,000 Lbs. & Under; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 175 Ft or Under; Pile Driver; Versi Lifts, Tri-Lifts & Gantrys (20,000 Lbs. & Over). Premium Increase(s): Crane Operators with CCO certification add $.50/hr.	38.66	19.10	57.76
510	Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of Under 130,000 Lbs., Backhoe (Mini, 15,000 Lbs. & Under); Concrete Bump Cutter, Grinder, Planing or Grooving Machine; Concrete Laser/Screed; Concrete Paver (Slipform); Concrete Pump (Over 46 Meter), Concrete Conveyor (Rotec or Bidwell Type); Concrete Slipform Placer Curb & Gutter Machine; Concrete Spreader & Distributor; Dredge (NOT Performing Work on the Great Lakes); Forklift (Machinery Moving or Steel Erection, 25 Ft & Over); Gradall (Cruz-Aire Type); Hydro-Blaster (10,000 PSI or Over); Milling Machine; Skid Rig; Traveling Crane (Bridge Type). Premium Increase(s): Crane Operators with CCO certification add $.50/hr.	38.16	19.10	57.26

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
511	Air, Track, Rotary or Percussion Drilling Machine &/or Hammers, Blaster; Bulldozer or Endloader (Over 40 hp); Compactor (Self-Propelled 85 Ft Total Drum Width & Over, or Tractor Mounted, Towed & Light Equipment); Concrete Pump (46 Meter & Under), Concrete Conveyor (Rotec or Bidwell Type); Crane (Carry Deck, Mini) or Truck Mounted Hydraulic Crane (10 Tons or Under); Environmental Burner; Gantrys (Under 20,000 Lbs.); Grader or Motor Patrol; High Pressure Utility Locating Machine (Daylighting Machine); Manhoist; Material or Stack Hoist; Mechanic or Welder; Railroad Track Rail Leveling Machine, Tie Placer, Extractor, Tamper, Stone Leveler or Rehabilitation Equipment; Roller (Over 5 Ton); Scraper (Self Propelled or Tractor Drawn) 5 cu yd or More Capacity; Screed (Milling Machine); Sideboom; Straddle Carrier or Travel Lift; Tining or Curing Machine; Tractor (Scraper, Dozer, Pusher, Loader); Tractor or Truck Mounted Hydraulic Backhoe; Tractor or Truck Mounted Hydraulic Crane (10 Tons or Under); Trencher (Wheel Type or Chain Type Having Over 8-Inch Bucket).	37.47	19.10	56.57
512	Backfiller; Broom or Sweeper; Bulldozer or Endloader (Under 40 hp); Compactor (Self-Propelled 84 Ft Total Drum Width & Under, or Tractor Mounted, Towed & Light Equipment); Concrete Batch Plant, Batch Hopper; Concrete Breaker (Large, Auto, Vibratory/Sonic, Manual or Remote); Concrete Conveyor System; Concrete Finishing Machine (Road Type); Fireman (Pile Driver & Derrick NOT Performing Work on the Great Lakes); Grout Pump; Hoist (Tugger, Automatic); Industrial Locomotives; Jeep Digger; Lift Slab Machine; Mulcher; Roller (Rubber Tire, 5 Ton or Under); Screw or Gypsum Pumps; Stabilizing or Concrete Mixer (Self-Propelled or 14S or Over); Stump Chipper; Trencher (Wheel Type or Chain Type Having 8-Inch Bucket & Under); Winches & A-Frames. Future Increase(s): Add $0.75/hour 6/3/2013; Add $1.00/hour 6/2/2014; Add $1.50/hour 6/1/2015; Add $1.60/hour 5/30/2016.	33.82	17.60	51.42
513	Air Compressor (&/or 400 CFM or Over); Air, Electric or Hydraulic Jacking System; Augers (Vertical & Horizontal); Boatmen (NOT Performing Work on the Great Lakes); Boiler (Temporary Heat); Crusher, Screening or Wash Plant; Elevator; Farm or Industrial Type Tractor; Fireman (Asphalt Plant NOT Performing Work on the Great Lakes); Forklift; Generator (&/or 150 KW or Over); Greaser; Heaters (Mechanical); Loading Machine (Conveyor); Oiler; Post Hole Digger or Driver; Prestress Machine; Pump (3 Inch or Over) or Well Points; Refrigeration Plant or Freeze Machine; Robotic Tool Carrier (With or Without Attachments); Rock, Stone Breaker; Skid Steer Loader (With or Without Attachments); Vibratory Hammer or Extractor, Power Pack.	30.44	19.10	49.54
514	Gas or Utility Pipeline, Except Sewer & Water (Primary Equipment). Future Increase(s): Add $2/hr on 1/1/2013.	34.89	20.59	55.48
515	Gas or Utility Pipeline, Except Sewer & Water (Secondary Equipment). Future Increase(s): Add $1.60/hr on 06/01/2013; Add $1.60/hr on 06/01/2014; Add $1.65/hr on 06/01/2015	32.26	17.95	50.21
516	Fiber Optic Cable Equipment	20.00	7.88	27.88

SEWER, WATER OR TUNNEL CONSTRUCTION

Includes those projects that primarily involve public sewer or water distribution, transmission or collection systems and related tunnel work (excluding buildings).

SKILLED TRADES

Fringe Benefits Must Be Paid On All Hours Worked

CODE	TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
103	Bricklayer, Blocklayer or Stonemason Future Increase(s): Add $1.45/hr on 6/01/2013 Premium Increase(s): DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	35.80	16.87	52.67
105	Carpenter Future Increase(s): Add $.75/hr on 6/3/2013. Add $1.25/hr on 6/2/2014. Premium Increase(s): DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	32.93	19.81	52.74
107	Cement Finisher	30.68	16.75	47.43
109	Electrician Future Increase(s): Add $1.60/hr on 6/1/2013. Premium Increase(s): DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	32.20	21.71	53.91
111	Fence Erector	28.00	4.50	32.50
116	Ironworker	30.90	19.11	50.01
118	Line Constructor (Electrical)	37.05	16.94	53.99
125	Pavement Marking Operator	28.10	15.00	43.10
126	Piledriver	29.56	24.96	54.52
130	Plumber	36.97	17.66	54.63
135	Steamfitter	38.26	19.49	57.75
137	Teledata Technician or Installer	24.65	15.67	40.32
143	Tuckpointer, Caulker or Cleaner	34.35	11.13	45.48
144	Underwater Diver (Except on Great Lakes)	37.45	19.45	56.90
146	Well Driller or Pump Installer	21.00	2.23	23.23

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
150	Heavy Equipment Operator - ELECTRICAL LINE CONSTRUCTION ONLY	28.24	15.10	43.34
151	Light Equipment Operator -ELECTRICAL LINE CONSTRUCTION ONLY	29.64	14.64	44.28
152	Heavy Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	25.94	13.57	39.51
153	Light Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	24.08	12.96	37.04
154	Groundman - ELECTRICAL LINE CONSTRUCTION ONLY	21.75	11.90	33.65

TRUCK DRIVERS

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
201	Single Axle or Two Axle	25.87	13.00	38.87
203	Three or More Axle	18.00	0.00	18.00
204	Articulated, Euclid, Dumptor, Off Road Material Hauler	31.89	17.98	49.87
205	Pavement Marking Vehicle	20.85	11.02	31.87
207	Truck Mechanic	17.00	0.00	17.00

LABORERS

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
301	General Laborer Premium Increase(s): Add $1.92 for bottomman; Add $2.03 for concrete manhole builder, bracer, jointman, or pipelayer; Add $4.83 for blaster. Add $2.00 for all tunnel work under 15 lbs. compressed air; Add $2.00 for 0-30 lbs. compressed air; Add $3.00 for over 30 lbs. compressed air.	28.95	16.11	45.06
303	Landscaper	26.92	12.51	39.43
304	Flagperson or Traffic Control Person	23.55	13.45	37.00
311	Fiber Optic Laborer (Outside, Other Than Concrete Encased)	17.24	15.03	32.27
314	Railroad Track Laborer	14.50	3.53	18.03

HEAVY EQUIPMENT OPERATORS
SEWER, WATER OR TUNNEL WORK

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
521	Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of 130,000 Lbs. or Over; Caisson Rig; Crane, Tower Crane, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 176 Ft or Over; Crane, Tower Crane, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of Over 100 Tons, Self-Erecting Tower Crane With a Lifting Capacity Of Over 4,000 Lbs., Crane With Boom Dollies; Master Mechanic; Pile Driver. Future Increase(s): Add $1/hr on 6/2/2013. Premium Increase(s): Add $.50/hr for >200 Ton / Add $1/hr at 300 Ton / Add $1.50 at 400 Ton / Add $2/hr at 500 Ton & Over.	35.12	18.46	53.58
522	Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of Under 130,000 Lbs., Backhoe (Mini, 15,000 Lbs. & Under); Boring Machine (Directional); Concrete Bump Cutter, Grinder, Planing or Grooving Machine; Concrete Laser/Screed; Concrete Paver (Slipform); Concrete Pump (Over 46 Meter), Concrete Conveyor (Rotec or Bidwell Type); Concrete Spreader & Distributor; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 175 Ft or Under; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of 100 Tons or Under, Self-Erecting Tower Crane With a Lifting Capacity of 4,000 Lbs. & Under; Dredge (NOT Performing Work on the Great Lakes); Milling Machine; Skid Rig; Telehandler; Traveling Crane (Bridge Type). Premium Increase(s): Add $.25/hr for operating tower crane.	35.36	19.15	54.51
523	Air Track, Rotary or Percussion Drilling Machine &/or Hammers, Blaster; Boring Machine (Horizontal or Vertical); Bulldozer or Endloader (Over 40 hp); Crane (Carry Deck, Mini) or Truck Mounted Hydraulic Crane (10 Tons or Under); Concrete Pump (46 Meter & Under), Concrete Conveyor (Rotec or Bidwell Type); Concrete Slipform Placer Curb & Gutter Machine; Gradall (Cruz-Aire Type); Grader or Motor Patrol; Hydro-Blaster (10,000 PSI or Over); Manhoist; Material or Stack Hoist; Mechanic or Welder; Roller (Over 5 Ton); Scraper (Self Propelled or Tractor Drawn) 5 cu yd or More Capacity; Screed (Milling Machine); Sideboom; Straddle Carrier or Travel Lift; Tractor (Scraper, Dozer, Pusher, Loader); Tractor or Truck Mounted Hydraulic Backhoe; Tractor or Truck Mounted Hydraulic Crane (10 Tons or Under); Trencher (Wheel Type or Chain Type Having Over 8-Inch Bucket). Premium Increase(s): Add $.25/hr for operating tower crane.	34.41	19.15	53.56

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
524	Backfiller; Broom or Sweeper; Bulldozer or Endloader (Under 40 hp); Compactor (Self-Propelled 85 Ft Total Drum Width & Over, or Tractor Mounted, Towed & Light Equipment); Concrete Batch Plant, Batch Hopper; Concrete Breaker (Large, Auto, Vibratory/Sonic, Manual or Remote); Concrete Conveyor System; Concrete Finishing Machine (Road Type); Environmental Burner; Fireman (Pile Driver & Derrick NOT Performing Work on the Great Lakes); Forestry Equipment, Timbco, Tree Shear, Tub Grinder, Processor; Hoist (Tugger, Automatic); Grout Pump; Jeep Digger; Lift Slab Machine; Mulcher; Power Subgrader; Pump (3 Inch or Over) or Well Points; Robotic Tool Carrier (With or Without Attachments); Roller (Rubber Tire, 5 Ton or Under); Screw or Gypsum Pumps; Stabilizing or Concrete Mixer (Self-Propelled or 14S or Over); Stump Chipper; Tining or Curing Machine; Trencher (Wheel Type or Chain Type Having 8-Inch Bucket & Under); Winches & A-Frames.	31.89	18.11	50.00
525	Air Compressor (&/or 400 CFM or Over); Air, Electric or Hydraulic Jacking System; Augers (Vertical & Horizontal); Compactor (Self-Propelled 84 Ft Total Drum Width & Under, or Tractor Mounted, Towed & Light Equipment); Crusher, Screening or Wash Plant; Farm or Industrial Type Tractor; Fireman (Asphalt Plant NOT Performing Work on the Great Lakes); Generator (&/or 150 KW or Over); Heaters (Mechanical); High Pressure Utility Locating Machine (Daylighting Machine); Loading Machine (Conveyor); Post Hole Digger or Driver; Refrigeration Plant or Freeze Machine; Rock, Stone Breaker; Skid Steer Loader (With or Without Attachments); Vibratory Hammer or Extractor, Power Pack. Premium Increase(s): Add $.25/hr for operating tower crane.	31.96	19.15	51.11
526	Boiler (Temporary Heat); Forklift; Greaser; Oiler.	30.44	19.10	49.54
527	Work Performed on the Great Lakes Including Diver; Wet Tender or Hydraulic Dredge Engineer.	37.45	19.45	56.90
528	Work Performed on the Great Lakes Including 70 Ton & Over Tug Operator; Assistant Hydraulic Dredge Engineer; Crane or Backhoe Operator; Hydraulic Dredge Leverman or Diver's Tender; Mechanic or Welder.	37.45	19.45	56.90
529	Work Performed on the Great Lakes Including Deck Equipment Operator or Machineryman (Maintains Cranes Over 50 Tons or Backhoes 115,000 Lbs. or More); Tug, Launch or Loader, Dozer or Like Equipment When Operated on a Barge, Breakwater Wall, Slip, Dock or Scow, Deck Machinery.	27.75	19.15	46.90
530	Work Performed on the Great Lakes Including Deck Equipment Operator; Machineryman or Fireman (Operates 4 Units or More or Maintains Cranes 50 Tons or Under or Backhoes 115,000 Lbs. or Under), Deck Hand, Deck Engineer or Assistant Tug Operator; Off Road Trucks - Great Lakes ONLY.	27.75	19.15	46.90

AIRPORT PAVEMENT OR STATE HIGHWAY CONSTRUCTION

Includes all airport projects (excluding buildings) and all projects awarded by the Wisconsin Department of Transportation (excluding buildings).

SKILLED TRADES

Fringe Benefits Must Be Paid On All Hours Worked

CODE	TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
103	Bricklayer, Blocklayer or Stonemason	35.58	19.20	54.78
105	Carpenter Future Increase(s): Add $.75/hr on 6/3/2013. Add $1.25/hr on 6/2/2014. Premium Increase(s): DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	32.93	19.81	52.74
107	Cement Finisher Future Increase(s): Add $1.87 on 6/1/13; Add $1.87 on 6/1/14; Add $1.87 on 6/1/15; Add $1.75 on 6/1/16. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.40/hr when the Wisconsin Department of Transportation or responsible governing agency requires that work be performed at night under artificial illumination with traffic control and the work is completed after sunset and before sunrise.	30.69	17.53	48.22
109	Electrician	31.54	21.14	52.68
111	Fence Erector	28.00	4.50	32.50
116	Ironworker	31.31	21.99	53.30
118	Line Constructor (Electrical)	31.29	15.34	46.63
124	Painter	29.22	16.69	45.91
125	Pavement Marking Operator	29.22	16.69	45.91
126	Piledriver	29.56	23.86	53.42
133	Roofer or Waterproofer	29.40	15.05	44.45
137	Teledata Technician or Installer	24.65	15.67	40.32
143	Tuckpointer, Caulker or Cleaner	34.35	11.13	45.48
144	Underwater Diver (Except on Great Lakes)	37.45	19.45	56.90
150	Heavy Equipment Operator - ELECTRICAL LINE CONSTRUCTION ONLY	29.64	17.06	46.70

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
151	Light Equipment Operator -ELECTRICAL LINE CONSTRUCTION ONLY Premium Increase(s): DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	30.60	14.64	45.24
152	Heavy Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	25.94	13.57	39.51
153	Light Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	24.08	12.96	37.04
154	Groundman - ELECTRICAL LINE CONSTRUCTION ONLY	21.75	11.90	33.65

TRUCK DRIVERS

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
201	Single Axle or Two Axle	33.22	18.90	52.12
203	Three or More Axle Future Increase(s): Add $1.85/hr on 6/1/2013. Premium Increase(s): DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	23.31	17.13	40.44
204	Articulated, Euclid, Dumptor, Off Road Material Hauler Future Increase(s): Add $2/hr on 6/1/13; Add $1.75/hr on 6/1/14. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.25/hr night work premium. See DOT's website for details about the applicability of this night work premium at: http://roadwaystandards.dot.wi.gov/hcci/labor-wages-eeo/index.shtm.	27.77	19.90	47.67
205	Pavement Marking Vehicle	23.84	14.90	38.74
206	Shadow or Pilot Vehicle	33.22	18.90	52.12
207	Truck Mechanic	22.50	16.19	38.69

LABORERS

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
301	General Laborer Future Increase(s): Add $1.70/hr on 6/1/2013; Add $1.60/hr on 6/1/2014. Premium Increase(s): Add $.15/hr for air tool operator, joint sawer and filler (pavement), vibrator or tamper operator (mechanical hand operated), chain saw operator and demolition burning torch laborer; Add $.35/hr for bituminous worker (raker and luteman), formsetter (curb, sidewalk and pavement) and strike off man; Add $.50/hr for line and grade specialist; Add $.65/hr for blaster and powderman; Add $2.01/hr for topman; Add $2.46/hr for bottomman; Add $3.23/hr for pipelayer. / DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.25/hr for work on projects involving temporary traffic control setup, for lane and shoulder closures, when work under artificial illumination conditions is necessary as required by the project provisions (including prep time prior to and/or cleanup after such time period).	25.39	18.40	43.79
302	Asbestos Abatement Worker	18.00	0.00	18.00
303	Landscaper Future Increase(s): Add $1.70/hr on 6/1/13; Add $1.60/hr on 6/1/14. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.25/hr for work on projects involving temporary traffic control setup, for lane and shoulder closures, when work under artificial illumination conditions is necessary as required by the project provisions (including prep time prior to and/or cleanup after such time period).	25.39	18.40	43.79
304	Flagperson or Traffic Control Person Future Increase(s): Add $1.70/hr on 6/1/2013; Add $1.60/hr on 6/1/2014. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.25/hr when the Wisconsin Department of Transportation or responsible governing agency requires that work be performed at night under artificial illumination with traffic control and the work is completed after sunset and before sunrise.	21.88	18.40	40.28

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
311	Fiber Optic Laborer (Outside, Other Than Concrete Encased)	17.24	15.03	32.27
314	Railroad Track Laborer	14.50	3.53	18.03

HEAVY EQUIPMENT OPERATORS
AIRPORT PAVEMENT OR STATE HIGHWAY CONSTRUCTION

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
531	Crane, Tower Crane, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 176 Ft or Over; Crane, Tower Crane, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of Over 100 Tons, Self-Erecting Tower Crane With a Lifting Capacity Of Over 4,000 Lbs., Crane With Boom Dollies; Traveling Crane (Bridge Type). Future Increase(s): Add $2/hr on 6/1/13; Add $1.75/hr on 6/1/14. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.25/hr night work premium. See DOT's website for details about the applicability of this night work premium at: http://roadwaystandards.dot.wi.gov/hcci/labor-wages-eeo/index.shtm.	35.22	19.90	55.12
532	Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of 130,000 Lbs. or Over; Caisson Rig; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 175 Ft or Under; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of 100 Tons or Under, Self-Erecting Tower Crane With A Lifting Capacity Of 4,000 Lbs., & Under; Dredge (NOT Performing Work on the Great Lakes); Licensed Boat Pilot (NOT Performing Work on the Great Lakes); Pile Driver. Future Increase(s): Add $2/hr on 6/1/13; Add $1.75/hr on 6/1/14. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.25/hr night work premium. See DOT's website for details about the applicability of this night work premium at: http://roadwaystandards.dot.wi.gov/hcci/labor-wages-eeo/index.shtm.	34.72	19.90	54.62

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
533	Air Track, Rotary or Percussion Drilling Machine &/or Hammers, Blaster; Asphalt Heater, Planer & Scarifier; Asphalt Milling Machine; Asphalt Screed; Automatic Subgrader (Concrete); Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of Under 130,000 Lbs., Backhoe (Mini, 15,000 Lbs. & Under); Bituminous (Asphalt) Plant & Paver, Screed; Boatmen (NOT Performing Work on the Great Lakes); Boring Machine (Directional, Horizontal or Vertical); Bridge (Bidwell) Paver; Bulldozer or Endloader; Concrete Batch Plant, Batch Hopper; Concrete Breaker (Large, Auto, Vibratory/Sonic, Manual or Remote); Concrete Bump Cutter, Grinder, Planing or Grooving Machine; Concrete Conveyor System; Concrete Laser/Screed; Concrete Paver (Slipform); Concrete Pump, Concrete Conveyor (Rotec or Bidwell Type); Concrete Slipform Placer Curb & Gutter Machine; Concrete Spreader & Distributor; Crane (Carry Deck, Mini) or Truck Mounted Hydraulic Crane (10 Tons or Under); Crane With a Lifting Capacity of 25 Tons or Under; Forestry Equipment, Timbco, Tree Shear, Tub Grinder, Processor; Gradall (Cruz-Aire Type); Grader or Motor Patrol; Grout Pump; Hydro-Blaster (10,000 PSI or Over); Loading Machine (Conveyor); Material or Stack Hoist; Mechanic or Welder; Milling Machine; Post Hole Digger or Driver; Roller (Over 5 Ton); Scraper (Self Propelled or Tractor Drawn) 5 cu yds or More Capacity; Shoulder Widener; Sideboom; Skid Rig; Stabilizing or Concrete Mixer (Self-Propelled or 14S or Over); Straddle Carrier or Travel Lift; Tractor (Scraper, Dozer, Pusher, Loader); Tractor or Truck Mounted Hydraulic Backhoe; Trencher (Wheel Type or Chain Type); Tube Finisher; Tugger (NOT Performing Work on the Great Lakes); Winches & A-Frames. Future Increase(s): Add $2/hr on 6/1/13; Add $1.75/hr on 6/1/14. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.25/hr night work premium. See DOT's website for details about the applicability of this night work premium at: http://roadwaystandards.dot.wi.gov/hcci/labor-wages-eeo/index.shtm.	34.22	19.90	54.12
534	Belting, Burlap, Texturing Machine; Broom or Sweeper; Compactor (Self-Propelled or Tractor Mounted, Towed & Light Equipment); Concrete Finishing Machine (Road Type); Environmental Burner; Farm or Industrial Type Tractor; Fireman (Asphalt Plant, Pile Driver & Derrick NOT Performing Work on the Great Lakes); Forklift; Greaser; Hoist (Tugger, Automatic); Jeep Digger; Joint Sawer (Multiple Blade); Launch (NOT Performing Work on the Great Lakes); Lift Slab Machine; Mechanical Float; Mulcher; Power Subgrader; Robotic Tool Carrier (With or Without Attachments); Roller (Rubber Tire, 5 Ton or Under); Self Propelled Chip Spreader; Shouldering Machine; Skid Steer Loader (With or Without Attachments); Telehandler; Tining or Curing Machine. Future Increase(s): Add $2/hr on 6/1/13; Add $1.75/hr on 6/1/14. Premium Increase(s):	33.96	19.90	53.86

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
	DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.25/hr night work premium. See DOT's website for details about the applicability of this night work premium at: http://roadwaystandards.dot.wi.gov/hcci/labor-wages-eeo/index.shtm.			
535	Air Compressor (&/or 400 CFM or Over); Air, Electric or Hydraulic Jacking System; Augers (Vertical & Horizontal); Automatic Belt Conveyor & Surge Bin; Boiler (Temporary Heat); Concrete Proportioning Plant; Crusher, Screening or Wash Plant; Generator (&/or 150 KW or Over); Heaters (Mechanical); High Pressure Utility Locating Machine (Daylighting Machine); Mudjack; Oiler; Prestress Machine; Pug Mill; Pump (3 Inch or Over) or Well Points; Rock, Stone Breaker; Screed (Milling Machine); Stump Chipper; Tank Car Heaters; Vibratory Hammer or Extractor, Power Pack. Future Increase(s): Add $2/hr on 6/1/13; Add $1.75/hr on 6/1/14. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.25/hr night work premium. See DOT's website for details about the applicability of this night work premium at: http://roadwaystandards.dot.wi.gov/hcci/labor-wages-eeo/index.shtm.	33.67	19.90	53.57
536	Fiber Optic Cable Equipment.	20.00	7.88	27.88
537	Work Performed on the Great Lakes Including Diver; Wet Tender or Hydraulic Dredge Engineer.	37.45	19.45	56.90
538	Work Performed on the Great Lakes Including 70 Ton & Over Tug Operator; Assistant Hydraulic Dredge Engineer; Crane or Backhoe Operator; Hydraulic Dredge Leverman or Diver's Tender; Mechanic or Welder.	37.45	19.45	56.90
539	Work Performed on the Great Lakes Including Deck Equipment Operator or Machineryman (Maintains Cranes Over 50 Tons or Backhoes 115,000 Lbs. or More); Tug, Launch or Loader, Dozer or Like Equipment When Operated on a Barge, Breakwater Wall, Slip, Dock or Scow, Deck Machinery.	27.75	19.15	46.90
540	Work Performed on the Great Lakes Including Deck Equipment Operator, Machineryman or Fireman (Operates 4 Units or More or Maintains Cranes 50 Tons or Under or Backhoes 115,000 Lbs. or Under); Deck Hand, Deck Engineer or Assistant Tug Operator; Off Road Trucks-Great Lakes ONLY.	27.75	19.15	46.90

LOCAL STREET OR MISCELLANEOUS PAVING CONSTRUCTION

Includes roads, streets, alleys, trails, bridges, paths, racetracks, parking lots and driveways (except residential or agricultural), public sidewalks or other similar projects (excluding projects awarded by the Wisconsin Department of Transportation).

SKILLED TRADES

Fringe Benefits Must Be Paid On All Hours Worked

CODE	TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
103	Bricklayer, Blocklayer or Stonemason	33.00	15.00	48.00
105	Carpenter	30.16	15.31	45.47
107	Cement Finisher	28.73	17.03	45.76
109	Electrician Future Increase(s): Add $1.60/hr on 6/1/2013. Premium Increase(s): DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	32.20	21.71	53.91
111	Fence Erector	28.00	4.50	32.50
116	Ironworker	31.31	21.99	53.30
118	Line Constructor (Electrical)	37.05	16.94	53.99
124	Painter	29.27	18.18	47.45
125	Pavement Marking Operator	28.10	15.00	43.10
126	Piledriver	29.56	24.96	54.52
133	Roofer or Waterproofer	29.40	15.05	44.45
137	Teledata Technician or Installer	24.65	15.67	40.32
143	Tuckpointer, Caulker or Cleaner	34.35	11.13	45.48
144	Underwater Diver (Except on Great Lakes)	37.45	19.45	56.90
150	Heavy Equipment Operator - ELECTRICAL LINE CONSTRUCTION ONLY	29.64	14.55	44.19
151	Light Equipment Operator -ELECTRICAL LINE CONSTRUCTION ONLY Premium Increase(s): DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	30.60	14.64	45.24
152	Heavy Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	25.94	13.57	39.51
153	Light Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	24.08	12.96	37.04
154	Groundman - ELECTRICAL LINE CONSTRUCTION ONLY	21.75	11.90	33.65

TRUCK DRIVERS

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
201	Single Axle or Two Axle	25.87	13.00	38.87
203	Three or More Axle	17.00	0.00	17.00
204	Articulated, Euclid, Dumptor, Off Road Material Hauler Future Increase(s): Add $1/hr on 6/2/2013.	32.39	18.46	50.85
205	Pavement Marking Vehicle	20.85	11.02	31.87
206	Shadow or Pilot Vehicle	25.87	13.00	38.87
207	Truck Mechanic	17.00	0.00	17.00

LABORERS

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
301	General Laborer	22.31	18.64	40.95
303	Landscaper Future Increase(s): Add $1.70/hr on 6/1/13; Add $1.60/hr on 6/1/14. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.25/hr for work on projects involving temporary traffic control setup, for lane and shoulder closures, when work under artificial illumination conditions is necessary as required by the project provisions (including prep time prior to and/or cleanup after such time period).	28.07	13.90	41.97
304	Flagperson or Traffic Control Person Future Increase(s): Add $1.70/hr on 6/1/2013; Add $1.60/hr on 6/1/2014. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.25/hr when the Wisconsin Department of Transportation or responsible governing agency requires that work be performed at night under artificial illumination with traffic control and the work is completed after sunset and before sunrise.	24.70	13.90	38.60
311	Fiber Optic Laborer (Outside, Other Than Concrete Encased)	17.24	15.03	32.27
314	Railroad Track Laborer	14.50	3.53	18.03

HEAVY EQUIPMENT OPERATORS
CONCRETE PAVEMENT OR BRIDGE WORK

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
541	Crane, Tower Crane, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of Over 100 Tons, Self-Erecting Tower Crane With a Lifting Capacity Of Over 4,000 Lbs., Crane With Boom Dollies; Crane, Tower Crane, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 176 Ft or Over; Master Mechanic. Future Increase(s): Add $2/hr on 6/1/13; Add $1.75/hr on 6/1/14. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.25/hr night work premium. See DOT's website for details about the applicability of this night work premium at: http://roadwaystandards.dot.wi.gov/hcci/labor-wages-eeo/index.shtm.	35.22	19.90	55.12
542	Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of 130,000 Lbs. or Over; Caisson Rig; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of 100 Tons or Under, Self-Erecting Tower Crane With a Lifting Capacity of 4,000 Lbs. & Under; Crane, Tower Crane Portable Tower, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 175 Ft or Under; Dredge (NOT Performing Work on the Great Lakes); Licensed Boat Pilot (NOT Performing Work on the Great Lakes); Pile Driver. Future Increase(s): Add $2/hr on 6/1/13; Add $1.75/hr on 6/1/14. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.25/hr night work premium. See DOT's website for details about the applicability of this night work premium at: http://roadwaystandards.dot.wi.gov/hcci/labor-wages-eeo/index.shtm.	34.72	19.90	54.62

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
543	Air Track, Rotary or Percussion Drilling Machine &/or Hammers, Blaster; Automatic Subgrader (Concrete); Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of Under 130,000 Lbs., Backhoe (Mini, 15,000 Lbs. & Under); Boring Machine (Directional, Horizontal or Vertical); Bridge (Bidwell) Paver; Bulldozer or Endloader; Concrete Batch Plant, Batch Hopper; Concrete Breaker (Large, Auto, Vibratory/Sonic, Manual or Remote); Concrete Bump Cutter, Grinder, Planing or Grooving Machine; Concrete Conveyor System; Concrete Laser/Screed; Concrete Paver (Slipform); Concrete Pump, Concrete Conveyor (Rotec or Bidwell Type); Concrete Slipform Placer Curb & Gutter Machine; Concrete Spreader & Distributor; Crane (Carry Deck, Mini) or Truck Mounted Hydraulic Crane (10 Tons or Under); Crane With a Lifting Capacity of 25 Tons or Under; Forestry Equipment, Timbco, Tree Shear, Tub Grinder, Processor; Gradall (Cruz-Aire Type); Grader or Motor Patrol; Grout Pump; Hydro-Blaster (10,000 PSI or Over); Loading Machine (Conveyor); Manhoist; Material or Stack Hoist; Mechanic or Welder; Milling Machine; Post Hole Digger or Driver; Scraper (Self Propelled or Tractor Drawn) 5 cu yds or More Capacity; Shoulder Widener; Sideboom; Skid Rig; Stabilizing or Concrete Mixer (Self-Propelled or 14S or Over); Straddle Carrier or Travel Lift; Tractor (Scraper, Dozer, Pusher, Loader); Tractor or Truck Mounted Hydraulic Backhoe; Trencher (Wheel Type or Chain Type); Tube Finisher; Tugger (NOT Performing Work on the Great Lakes); Winches & A-Frames. Future Increase(s): Add $2/hr on 6/1/13; Add $1.75/hr on 6/1/14. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.25/hr night work premium. See DOT's website for details about the applicability of this night work premium at: http://roadwaystandards.dot.wi.gov/hcci/labor-wages-eeo/index.shtm.	34.22	19.90	54.12
544	Backfiller; Belting, Burlap, Texturing Machine; Broom or Sweeper; Compactor (Self-Propelled or Tractor Mounted, Towed & Light Equipment); Concrete Finishing Machine (Road Type); Environmental Burner; Farm or Industrial Type Tractor; Fireman (Pile Driver & Derrick NOT Performing Work on the Great Lakes); Forklift; Greaser; Jeep Digger; Joint Sawer (Multiple Blade); Launch (NOT Performing Work on the Great Lakes); Lift Slab Machine; Mechanical Float; Mulcher; Power Subgrader; Robotic Tool Carrier (With or Without Attachments); Self Propelled Chip Spreader; Shouldering Machine; Skid Steer Loader (With or Without Attachments); Telehandler; Tining or Curing Machine. Future Increase(s): Add $2/hr on 6/1/13; Add $1.75/hr on 6/1/14. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.25/hr night work premium. See DOT's website for details about the applicability of this night work premium at: http://roadwaystandards.dot.wi.gov/hcci/labor-wages-eeo/index.shtm.	33.96	19.90	53.86

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
545	Air Compressor (&/or 400 CFM or Over); Air, Electric or Hydraulic Jacking System; Automatic Belt Conveyor & Surge Bin; Boiler (Temporary Heat); Concrete Proportioning Plant; Crusher, Screening or Wash Plant; Generator (&/or 150 KW or Over); Heaters (Mechanical); High Pressure Utility Locating Machine (Daylighting Machine); Mudjack; Oiler; Prestress Machine; Pug Mill; Pump (3 Inch or Over) or Well Points; Rock, Stone Breaker; Screed (Milling Machine); Stump Chipper; Tank Car Heaters; Vibratory Hammer or Extractor, Power Pack.	33.02	17.60	50.62
546	Fiber Optic Cable Equipment.	20.00	7.88	27.88
547	Work Performed on the Great Lakes Including Diver; Wet Tender or Hydraulic Dredge Engineer.	37.45	19.45	56.90
548	Work Performed on the Great Lakes Including 70 Ton & Over Tug Operator; Assistant Hydraulic Dredge Engineer; Crane or Backhoe Operator; Hydraulic Dredge Leverman or Diver's Tender; Mechanic or Welder.	37.45	19.45	56.90
549	Work Performed on the Great Lakes Including Deck Equipment Operator or Machineryman (Maintains Cranes Over 50 Tons or Backhoes 115,000 Lbs. or more); Tug, Launch or Loader, Dozer or Like Equipment When Operated on a Barge, Breakwater Wall, Slip, Dock or Scow, Deck Machinery.	27.75	19.15	46.90
550	Work Performed on the Great Lakes Including Deck Equipment Operator; Machineryman or Fireman (Operates 4 Units or More or Maintains Cranes 50 Tons or Under or Backhoes 115,000 Lbs. or Under); Deck Hand, Deck Engineer or Assistant Tug Operator; Off Road Trucks - Great Lakes ONLY.	27.75	19.15	46.90

HEAVY EQUIPMENT OPERATORS
ASPHALT PAVEMENT OR OTHER WORK

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
551	Crane, Tower Crane, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of Over 100 Tons, Self Erecting Tower Crane With a Lifting Capacity of Over 4,000 Lbs., Crane With Boom Dollies; Crane, Tower Crane, Pedestal Tower or Derrick, With Boom, Leads and/or Jib Lengths Measuring 176 Ft or Over; Master Mechanic.	39.16	19.10	58.26
552	Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of 130,000 Lbs. or Over; Caisson Rig; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of 100 Tons or Under, Self-Erecting Tower Crane With a Lifting Capacity Of 4,000 Lbs. & Under; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 175 Ft or Under; Dredge (NOT Performing Work on the Great Lakes); Licensed Boat Pilot (NOT Performing Work on the Great Lakes); Pile Driver. Future Increase(s): Add $1/hr on 6/2/2013.	32.92	18.46	51.38

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
553	Air, Track, Rotary or Percussion Drilling Machine &/or Hammers, Blaster; Asphalt Heater, Planer & Scarifier; Asphalt Milling Machine; Asphalt Screed; Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of Under 130,000 Lbs., Backhoe (Mini, 15,000 Lbs. & Under); Bituminous (Asphalt) Plant & Paver, Screed; Boring Machine (Directional, Horizontal or Vertical); Bulldozer or Endloader; Concrete Breaker (Large, Auto, Vibratory/Sonic, Manual or Remote); Concrete Conveyor System; Concrete Laser/Screed; Concrete Slipform Placer Curb & Gutter Machine; Crane (Carry Deck, Mini) or Truck Mounted Hydraulic Crane (10 Tons or Under); Crane With a Lifting Capacity of 25 Tons or Under; Forestry Equipment, Timbco, Tree Shear, Tub Grinder, Processor; Gradall (Cruz-Aire Type); Grader or Motor Patrol; Hydro-Blaster (10,000 PSI or Over); Loading Machine (Conveyor); Manhoist; Material or Stack Hoist; Mechanic or Welder; Milling Machine; Post Hole Digger or Driver; Railroad Track Rail Leveling Machine, Tie Placer, Extractor, Tamper, Stone Leveler or Rehabilitation Equipment; Roller (Over 5 Ton); Scraper (Self Propelled or Tractor Drawn) 5 cu yds or More Capacity; Shoulder Widener; Sideboom; Skid Rig; Stabilizing or Concrete Mixer (Self-Propelled or 14S or Over); Tractor (Scraper, Dozer, Pusher, Loader); Tractor or Truck Mounted Hydraulic Backhoe; Trencher (Wheel Type or Chain Type); Tube Finisher; Tugger (NOT Performing Work on the Great Lakes); Winches & A-Frames.	32.67	18.44	51.11
554	Backfiller; Broom or Sweeper; Compactor (Self-Propelled or Tractor Mounted, Towed & Light Equipment); Concrete Finishing Machine (Road Type); Environmental Burner; Farm or Industrial Type Tractor; Fireman (Asphalt Plant, Pile Driver & Derrick NOT Performing Work on the Great Lakes); Forklift; Greaser; Hoist (Tugger, Automatic); Jeep Digger; Joint Sawer (Multiple Blade); Launch (NOT Performing Work on the Great Lakes); Lift Slab Machine; Mechanical Float; Mulcher; Power Subgrader; Robotic Tool Carrier (With or Without Attachments); Roller (Rubber Tire, 5 Ton or Under); Self-Propelled Chip Spreader; Shouldering Machine; Skid Steer Loader (With or Without Attachments); Telehandler. Future Increase(s): Add $2/hr on 6/1/13; Add $1.75/hr on 6/1/14.	33.67	19.55	53.22
555	Air Compressor (&/or 400 CFM or Over); Air, Electric or Hydraulic Jacking System; Augers (Vertical & Horizontal); Automatic Belt Conveyor & Surge Bin; Boiler (Temporary Heat); Crusher, Screening or Wash Plant; Generator (&/or 150 KW or Over); Heaters (Mechanical); High Pressure Utility Locating Machine (Daylighting Machine); Mudjack; Oiler; Prestress Machine; Pug Mill; Pump (3 Inch or Over) or Well Points; Rock, Stone Breaker; Screed (Milling Machine); Stump Chipper; Tank Car Heaters; Vibratory Hammer or Extractor, Power Pack. Future Increase(s): Add $2/hr on 6/1/13; Add $1.75/hr on 6/1/14.	33.67	19.55	53.22
556	Fiber Optic Cable Equipment.	20.00	7.88	27.88

RESIDENTIAL OR AGRICULTURAL CONSTRUCTION

Includes single family houses or apartment buildings of no more than four (4) stories in height and all buildings, structures or facilities that are primarily used for agricultural or farming purposes, excluding commercial buildings. For classification purposes, the exterior height of a residential building, in terms of stories, is the primary consideration. All incidental items such as site work, driveways, parking lots, private sidewalks, private septic systems or sewer and water laterals connected to a public system and swimming pools are included within this definition. Residential buildings of five (5) stories and above are NOT included within this definition.

SKILLED TRADES

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
101	Acoustic Ceiling Tile Installer	19.50	10.98	30.48
102	Boilermaker	31.09	27.23	58.32
103	Bricklayer, Blocklayer or Stonemason	25.00	12.36	37.36
104	Cabinet Installer	26.00	2.61	28.61
105	Carpenter	33.43	7.16	40.59
106	Carpet Layer or Soft Floor Coverer	32.93	21.85	54.78
107	Cement Finisher	23.32	6.27	29.59
108	Drywall Taper or Finisher	29.87	18.79	48.66
109	Electrician	24.50	8.96	33.46
110	Elevator Constructor	41.71	23.88	65.59
111	Fence Erector	13.00	1.07	14.07
112	Fire Sprinkler Fitter	37.45	19.30	56.75
113	Glazier	22.00	2.09	24.09
114	Heat or Frost Insulator	35.00	0.00	35.00
115	Insulator (Batt or Blown)	12.82	0.00	12.82
116	Ironworker	30.90	19.11	50.01
117	Lather	33.43	7.16	40.59
119	Marble Finisher	16.50	2.38	18.88
120	Marble Mason	25.00	12.36	37.36
121	Metal Building Erector	17.00	2.62	19.62
123	Overhead Door Installer	25.00	19.00	44.00
124	Painter	23.50	3.73	27.23
125	Pavement Marking Operator	28.10	15.00	43.10

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
129	Plasterer	20.00	0.00	20.00
130	Plumber	36.97	18.42	55.39
132	Refrigeration Mechanic	24.75	10.42	35.17
133	Roofer or Waterproofer	29.40	15.55	44.95
134	Sheet Metal Worker	28.15	15.14	43.29
135	Steamfitter	38.26	19.49	57.75
137	Teledata Technician or Installer	18.85	5.00	23.85
138	Temperature Control Installer	22.00	1.10	23.10
139	Terrazzo Finisher	26.57	16.00	42.57
140	Terrazzo Mechanic	30.01	17.13	47.14
141	Tile Finisher	20.60	3.53	24.13
142	Tile Setter	20.43	8.03	28.46
143	Tuckpointer, Caulker or Cleaner	32.50	2.84	35.34
146	Well Driller or Pump Installer	27.60	0.00	27.60
147	Siding Installer	16.00	0.62	16.62

TRUCK DRIVERS

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
201	Single Axle or Two Axle	16.25	4.60	20.85
203	Three or More Axle	17.10	1.78	18.88
205	Pavement Marking Vehicle	20.85	11.02	31.87
207	Truck Mechanic	19.00	1.85	20.85

LABORERS

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
301	General Laborer	18.00	6.16	24.16
302	Asbestos Abatement Worker	18.00	0.00	18.00
303	Landscaper	11.00	0.00	11.00

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
311	Fiber Optic Laborer (Outside, Other Than Concrete Encased)	17.24	15.03	32.27
315	Final Construction Clean-Up Worker	15.00	0.00	15.00

HEAVY EQUIPMENT OPERATORS RESIDENTIAL OR AGRICULTURAL CONSTRUCTION

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
557	Asphalt Heater, Planer & Scarifier; Asphalt Milling Machine; Asphalt Screed; Backhoe (Track Type); Backhoe (Mini, 15,000 Lbs. & Under); Bituminous (Asphalt) Plant & Paver, Screed; Boring Machine (Directional, Horizontal or Vertical); Bulldozer or Endloader; Concrete Breaker (Large, Auto, Vibratory/Sonic, Manual or Remote); Concrete Bump Cutter, Grinder, Planing or Grooving Machine; Concrete Conveyor System; Concrete Laser/Screed; Concrete Paver (Slipform); Concrete Pump, Concrete Conveyor (Rotec or Bidwell Type); Concrete Slipform Placer Curb & Gutter Machine; Concrete Spreader & Distributor; Crane (Carry Deck, Mini) or Truck Mounted Hydraulic Crane (10 Tons or Under); Crane With a Lifting Capacity of 25 Tons or Under; Crane, Shovel, Dragline, Clamshells; Forestry Equipment, Timbco, Tree Shear, Tub Grinder, Processor; Grader or Motor Patrol; Grout Pump; Hydro-Blaster (10,000 PSI or Over); Loading Machine (Conveyor); Manhoist; Material or Stack Hoist; Mechanic or Welder; Milling Machine; Roller (Over 5 Ton); Scraper (Self Propelled or Tractor Drawn) 5 cu yds or More Capacity; Shoulder Widener; Skid Rig; Stabilizing or Concrete Mixer (Self-Propelled or 14S or Over); Tractor (Scraper, Dozer, Pusher, Loader); Tractor or Truck Mounted Hydraulic Backhoe; Tractor or Truck Mounted Hydraulic Crane (10 Tons or Under); Trencher (Wheel Type or Chain Type); Winches & A-Frames.	23.35	5.58	28.93
558	Air Compressor (&/or 400 CFM or Over); Air, Electric or Hydraulic Jacking System; Backfiller; Belting, Burlap, Texturing Machine; Boiler (Temporary Heat); Broom or Sweeper; Compactor (Self-Propelled or Tractor Mounted, Towed & Light Equipment); Concrete Finishing Machine (Road Type); Farm or Industrial Type Tractor; Forklift; Generator (&/or 150 KW or Over); Heaters (Mechanical); High Pressure Utility Locating Machine (Daylighting Machine); Jeep Digger; Lift Slab Machine; Mulcher; Oiler; Post Hole Digger or Driver; Power Subgrader; Pump (3 Inch or Over) or Well Points; Robotic Tool Carrier (With or Without Attachments); Rock, Stone Breaker; Roller (Rubber Tire, 5 Tons or Under); Screed (Milling Machine); Self Propelled Chip Spreader; Shouldering Machine; Skid Steer Loader (With or Without Attachments); Stump Chipper; Telehandler; Vibratory Hammer or Extractor, Power Pack.	21.10	0.87	21.97

********** END OF RATES **********

SECTION 00850: DRAWING SCHEDULE

The following listed drawings accompany and form a part of the project contract documents along with this project manual and generally illustrate the nature of the work.

INDEX OF DRAWINGS:

ARCHITECTURAL
A0.00 Title Sheet & Code Information
C0.01 Site Survey
A0.01 General Information Sheet
A0.02 Partition Types
A0.10 Site Plan
A1.00 Phasing and Demolition Plans
A2.00 New Work Plans – Office Building
A2.01 Plans and Exterior Elevations – Storage Building
A3.00 Reflected Ceiling Plan – Office Building
A4.00 Exterior Elevations, Sections & Details
A4.01 Window Types and Details & Roof Details
A7.00 Interior Elevations – Office Building
A8.00 Schedules

STRUCTURAL
S1.01 Demo Plans and New Foundation & Roof Plans
S1.02 New Wall and Slab Plans, Foundation, Section
S1.03 General Notes & Details

MECHANICAL
M0.01 Mechanical Symbols, Abbreviations and Schedules
M2.01 First Floor Mechanical (South) Demolition and New Work
M2.02 Roof Mechanical (South) Demolition and New work
M2.03 First Floor and Roof (North) Mechanical New Work
TC2.01 Temperature Controls Diagram

ELECTRICAL
E0.01 Electrical Symbols and Abbreviations
E1.01 Site Plan Power New Work
E2.01 First Floor Electrical (South) Demolition & New Work
E2.02 First Floor Electrical (North) Demolition & New Work
E2.03 First Floor Power (South) Demolition & New Work
E2.04 First Floor Power (North) Demolition & New Work
E2.05 Roof Power (South) Demolition & New Work
E3.01 Electrical Schedules
E3.02 Electrical Panel Schedules
E4.01 Electrical Work One-Line Schematic Diagrams

PLUMBING
P0.01 Plumbing Symbols, Abbreviations and Schedules
P2.01 Under Floor Plumbing Demolition & New Work
P2.02 First Floor Plumbing Demolition & New Work
P3.01 Plumbing Isometrics

SECTION 01010: SUMMARY OF WORK:

1. SCOPE:

A. Index:
1. Scope
2. Project Description
3. Work by Others
4. Scheduling of Work

2. PROJECT DESCRIPTION:

A. In general, the project includes demolition and removal of sections of existing garage walls, paving, concrete walk, mechanical systems, plumbing, electrical, data, flooring, etc.; removal and replacement of existing windows and installation of new windows; construction of new foundation, walls, roof, interior partition walls, doors, suspended acoustical ceiling; furnishing and installing new mechanical, plumbing, electrical, data service; patching existing walls and floor, flooring, painting. ALTERNATE BID 1 includes furnishing and construction of a metal storage building. ALTERNATE BID 2 includes furnishing and installing interior partition walls in offices A, B, C and D.

B. The City will occupy the site during construction. The contractor is required to coordinate all construction with the City or agent to minimize impact to City operations and to ensure the safety of City employees and property. Coordination shall include the placement of field offices, public protection barriers, construction site fencing, scaffolding, interruption of utility service, demolition of existing garage section, construction of new addition, delivery and storage of materials, and all temporary moves of staff. City of Milwaukee will arrange for temporary electrical, data, phone relocations for interim relocations of staff needed for completion of this project. City of Milwaukee will arrange for staff furnishings to be relocated to interim space.

C. The site is located on a brown field. All soil removed from the site must be brought to a Wisconsin DNR certified landfill site. Contractor to provide manifest tickets regarding hazardous waste landfilled to the City.

D. Building materials to be recycled as follows: All aluminum and other metals, 50 percent of all concrete building materials. Recycle tickets to be presented to the City.

E. EPA regulated materials (refrigerants, etc.) must be recycled in accordance with federal and state regulations.

F. It is understood that the submittal of a proposal shall include furnishing all labor, materials, equipment, and incidentals necessary for completion of the work required, including that which may not be directly shown on the drawings or in the specifications, but are necessary for proper operation and approval.

G. Examine Documents and Visit Site:

1. Before submitting a bid proposal, bidders should carefully examine the drawings and specifications; visit the site of work; fully inform themselves as to all existing conditions and limitations including those of labor; and shall include in the bid proposal a sum sufficient to cover the cost of all items contemplated by the construction documents.

2. Each sub-bidder further represents that he has inspected the site of the proposed work to ascertain any obstacles that might be encountered and other matters and conditions relevant to this work.

3. The nature of the work required demands thorough review of all drawings and the project manual, and diligent and careful site inspection by all prospective sub-bidders as a means of determining the extent of work and conditions under which the work is to be performed.

4. Additional charges will not be as considered for work which, prior to bidding, could reasonably be inferred as appropriate by examination of the drawings and specifications, visiting the site, and closely reviewing the work as indicated above. No representations as to subsurface conditions are made.

H. The following outline is intended to serve as a general guide only and not as a complete listing of work, operations, or materials. Consult the Table of Contents for complete listing of items included.

1. PHASE ONE:

   a. Removal of pavement on brown field site, and construction of new storage Building (Alternate Bid 1). Dispose of any hazardous material in compliance with State and Federal Regulations. City of Milwaukee will remove and install electrical services.
   b. Relocation of equipment in existing garage by City of Milwaukee to new storage building or in event storage building will not be built, to another area on site.
   c. City staff's furnishings and equipment located in the existing open office area that will be part of construction in Phase Two will be moved into the existing Conference Room by City of Milwaukee.
   d. City of Milwaukee to provide temporary power, phone and data for staff to continue to be able to work in the existing conference area. Contractor to coordinate with the City for the installation of this temporary work.
   e. Contractor to build temporary partition as located on sheet A1.00.

2. PHASE TWO:

   a. Phase Two construction is to include all work located to the north of the partition wall as shown on sheet A1.00.
      1) All work related to the new addition, including the foundation system, exterior walls, roof deck, and thermal and weather barrier systems
      2) Demolition and removal of all finish materials not to be reused.
      3) All interior construction.
      4) All mechanical electrical and plumbing systems in total as required to provide a working system capable to serve the spaces to the north of temporary partition.
   b. Contractors will have minimal access to the portion of the building south of the temporary partition during Phase Two.
   c. Work on Phase Two is to be substantially complete prior to beginning of work on Phase Three.
   d. City of Milwaukee will relocate staff, equipment and furnishings into the new Assembly Room.
   e. City of Milwaukee will provide temporary phone and data for staff in the new Assembly room. Contractor to coordinate with City for the installation of this temporary work.

3. PHASE THREE:
   a. Phase Three construction is to include all work located to the south of the partition wall as shown on Sheet A1.00.

b. Once the work south of the temporary partition is approximately 90% complete, and upon approval from the City, the contractor is to remove the temporary partition wall to allow work adjacent and continuous on both sides of the partition wall to be completed.

c. Relocation of staff, furnishings and equipment to permanent locations by City.

3. WORK BY OTHERS:

A. Building electrical, data or telephone work by City of Milwaukee.

B. Furnishings by City of Milwaukee, except as noted on plans and in specifications.

4. SCHEDULING OF WORK:

A. A preconstruction conference will be held prior to the start of work.

B. All work unless otherwise specifically approved or noted, is to be done during normal working hours.

C. Contractor must notify the City 48 hours in advance before starting work.

D. The contractor shall sign in and identify all personnel working at the site on a daily basis with the supervisor in charge at the site. All personnel leaving the site will sign out prior to departure.

E. Shut downs of existing equipment and connections to existing equipment must be arranged in advance with the Project Inspector from Facilities Development and Management. Power outages must be scheduled for Saturdays.

F. Dispose of all removed materials in legal manner.

G. The contractor shall provide a construction schedule which includes all phases of construction. The contractor shall provide that complete schedule at the Pre-Construction Meeting arranged by the City.

H. Project Total working days includes submittals and submittal approval, acquisition and preparation of materials, and work off-site.

END OF SECTION

SECTION 01210: PROJECT MEETINGS

1. SCOPE:

A. Index:
1. Scope
2. Pre-Construction Meeting
3. Progress Meetings

2. PRE-CONSTRUCTION MEETING:

A. Soon after the award of the contract and prior to the start of construction, the contractor shall attend a pre-construction conference with representatives of the City.

B. The contractor shall have at the meeting responsible representatives from subcontractors who are to perform major work on the project.

C. The purpose of the meeting is to discuss in detail the plans and specifications. The discussion shall include:

1. Schedule
2. Equipment/Delivery Dates
3. Material Storage
4. Inspection Requirements
5. Protection Procedures for the structure, adjacent facilities, environment, and personnel.
6. Hours of Work

D. The contractor shall submit the construction schedule to the architect/engineer at this meeting and a listing of subcontractors and their work. The contractor shall describe, in detail, when each portion of the work is expected to be accomplished. The subcontractors shall participate in the discussion. The architect/engineer will serve to interpret the contract documents should such questions arise.

E. Any other questions that the contractor or his subcontractors have about the work or its scheduling shall be raised at these meetings.

F. Requirements for contract administration and construction operations will be defined for participants.

G. The architect/engineer will determine time, date, and place of the meeting.

3. PROGRESS MEETINGS:

A. Bi-weekly meetings will be held for the purpose of coordinating and expediting the work.

B. Attendance at project meetings by the contractor is mandatory. These meetings shall also be attended by representatives of each subcontractor who is either working at the site or is affected by work being done at the site. The contractor shall submit an updated construction schedule at these meetings and a short narrative should be written, describing the cause of any delays and intended action to remedy these delays.

C. Contractors shall give a verbal report of progress on the project, discuss the work schedule for the coming period, and present all conflicts, discrepancies or other difficulties for resolution.

END OF SECTION

SECTION 01300: SUBMITTALS/PERMITS

1. SCOPE:

A. Index:

1. Scope
2. Submittals
3. Permits
4. Inspection

2. SUBMITTALS:

A. Comply with the requirements of the General Conditions and as follows:

1. Forward Submittals not more than 20 calendar days after the Notice to Proceed date. No work, as indicated on any shop drawing, samples, hardware list, etc., shall be started until the submittals have been reviewed and work authorized.

2. All submittals must be thoroughly reviewed by the prime contractor for conformance to contract documents, prior to submission to the City, or its agents, for review. Shop drawings and catalog information shall be stamped "Reviewed By" and signed by the contractor's reviewer. The prime contractor shall review all subcontractor submittals prior to submittal to the City for compliance with contract documents and to coordinate all work.

3. Include with each submittal a transmittal letter signed and dated by the prime contractor containing the following:

a. Name of Contractor
b. Name of Project
c. List of Submittals
d. Name of Manufacturer or Supplier
e. Additional information as required for the items being provided.

B. Shop Drawings, Catalog Information, Calculations, and Samples:

1. Shop Drawings: Submit four blue/black line prints for review. The City will notify the contractor in writing and return one copy marked "REVIEWED - NO EXCEPTIONS TAKEN" with minor or no notations. The City will also notify the contractor in writing and return one copy, along with comments, when the drawings are marked either "REJECTED" or "REVISE AND RESUBMIT". For those shop drawings, the contractor will be responsible for resubmitting a new print.

2. Catalog Information and Calculations: Submit four copies for City's record and additional numbers of copies required for the contractor's purpose. The City will notify the contractor in writing and return the contractor's copies, with or without notation, marked either "REVIEWED - NO EXCEPTIONS TAKEN", "REVISE AND RESUBMIT", OR "REJECTED". Catalog information or calculations marked "REVISE AND RESUBMIT" or "REJECTED" must be resubmitted in the same quantities as originally required.

3. Samples: Submit two samples of requested materials for the City's records and additional samples, if desired, to be returned to the contractor. The City will notify the contractor in writing, whether the samples are approved or rejected. If they are rejected, new samples must be resubmitted as originally required.

4. Corrections or comments made on the submittals during the review do not relieve the contractor from compliance with requirements of the contract documents. The check is only for review of general conformance with the design concept of the project and general compliance with the information given in the contract documents. Contractors are responsible for conforming and correlating all quantities and dimensions; selecting fabrication processes and techniques of construction; coordinating their work with that of all other trades; and performing their work in a safe manner.

C. "Or Equal": Whenever the words "or equal" or similar term is used, it shall mean as determined by the Commissioner of Public Works or agent. All drawings, data and bulletins necessary to make an "or equal" determination shall be submitted to the Facilities Manager of FACILITIES DEVELOPMENT AND MANAGEMENT SECTION. Such review shall apply to design only and shall in no way relieve the contractor from the responsibilities as outlined in Item 2B above. Evaluation of "or equal" products will be made at the time of shop drawing submission. Any change required in design and coordination between all contractors, subcontractors, or trades due to the use of "or equal" materials shall become the contractor's responsibility. Any costs for detailed engineering reviews and/or any costs to incorporate "or equal" products will be borne by the contractor.

3. PERMITS:

A. The City of Milwaukee will obtain the general construction and occupancy permits.

B. Contractors shall obtain, from the City of Milwaukee Department of City Development and/or other government or private agencies, all special permits as may be necessary in their work.

C. Contractors shall obtain all permits to occupy or work in the public way as may be necessary for their work.

D. Contractors shall notify the City and/or appropriate utilities when making utility connections as part of the project.

4. INSPECTION:

REV 1/10

A. FACILITIES DEVELOPMENT AND MANAGEMENT SECTION will provide daily inspection to verify compliance with contract documents, identify contractors and crews on the job, verify compliance with contract conditions (MWSBE, residency, wage requirements), and record job progress and conditions.

REV 1/04

B. Contractors shall arrange with the Department of Neighborhood Services/Construction Trades Division and permit issuing agencies for all code compliance inspections as required by all permits including, but not limited to, the general building and all special permits issued by that agency.

D. Contractors shall arrange with the appropriate City agency for compliance inspections, as required, for all permits including, but not limited to, curb and pavement cuts and patches, and public way occupancy and utility connections.

REV 7/99

SECTION 01500: JOB SITE UTILITIES, FACILITIES, AND SECURITY

1. SCOPE:

A. Index:

1. Scope
2. Building Security
3 Temporary or Trial Usage
4. Occupancy During Construction
5. Temporary Hoists, Lifts
6. Scaffolding
7. Electrical Power
8. Water
9. Temporary Toilet Facilities
10. Site Security
11. Parking

1. Scope:

The following building security policy and procedure statement has been provided in this project manual for bid consideration and shall be distributed at the Pre-Construction Meeting. All City agents/officials responsible for engaging contractors, all contractors, and all subcontractors shall be held responsible for following the procedures.

2. BUILDING SECURITY:

A. General:

The Downtown Complex is open to the public from 8:00 AM until 4:45 PM, Monday through Friday, excluding holidays. Since most contracted work takes place outside normal business hours, it is essential that contractors and their City agents understand and abide by security policy.

Outlying buildings are not generally open to the public. Contracted work in these buildings can take place at any time. It is essential that contractors and their City agents understand and abide by security policy.

B. Police Access (General):

1. Access to Milwaukee Police Department facilities requires the contractor to meet the access procedures described below.

2. The Police Department requires that all contractors, vendors, visitors or other who intend to do business at any Police Department site must have a background check performed by the Milwaukee Police Department **PRIOR** to any access.

3. All contractors' staff requiring access to the site, including any subcontractors, suppliers or vendors, will be required to submit their full name (including full middle name) and birth date to allow the Department to perform the necessary background check. The contractor shall provide a staff list two weeks before work begins. At this time, the contractor shall provide a brief outline of the work, project schedule, and company contact information (company name, contact name and title, phone number and address).

4. To add staff during the course of the project, provide the same information as above and allow 48 hours for a response.

5. The Contractor will be notified if the worker does not pass the backgroundcheck.

6. Sign in and sign out will be required at all Milwaukee Police Department facilities.

C. City Agents/Officials

1. Any City agents/officials who commission outside contractors to work in any of the facilities managed by FACILITIES DEVELOPMENT AND MANAGEMENT SECTION shall provide the following information no less than twenty-four (24) hours in advance of the work:

   a. The names of any contract or subcontract employees who will be present in the facilities (for the purpose of designing badges appropriate to their work area):
   Green – Zeidler Municipal Building, 841 North Broadway
   Red – City Hall, 200 East Wells Street
   Yellow – 809 North Broadway
   Gold – Any outlying buildings

   These names must be listed on a sign-in sheet available in the Zeidler Municipal Building, Room 602 (FACILITIES DEVELOPMENT AND MANAGEMENT SECTION support staff – Extension 8222). City agents/officials shall be responsible to ensure the sheet and badges are transported to the appropriate location where the work is to be completed (in the Downtown Complex it would go to the City Hall Information Center, for outlying buildings to the person responsible for controlling access in the facility) the day before work is to begin.

   b. A list of keys and/or access cards required for access only to the areas necessary for work involved in the project. The keys and card will be received from the Security Manager or his designee and signed out to the City agents/officials responsible for the contracted work. The City employee will take the keys and/or access cards to the City Hall Information Center or the person responsible for controlling access in the outlying building where they shall be logged under the name of the contractor's company. When a project is complete, the City agents/officialsmust retrieve the keys/cards and return them to FACILITIES DEVELOPMENT AND MANAGEMENT SECTION support staff in Room 602 of the Zeidler Municipal Building.

c. The City agents/officialsare responsible for communicatingthe security policy and procedures to contractors. The City agents/officialsshall act as liaison for all communication between FACILITIES DEVELOPMENT AND MANAGEMENT SECTION and the contractor.

D. Contractors:

1. Contractors shall abide by City security policy and procedures at all times during the scope of their participation in a project. Failure to comply will result in the contracted employee being escorted from the premises and the resulting lost time and expense shall be deducted from the contractor's invoice or penalties of $50.00 per occurrence as determined by the contracting City agent/official.

a. All access should be provided in advance through the City agent/official. Contractors shall enter and exit only through those doors designated by City agents/officials (the Market Street entrance to City Hall and the doors established by the person responsible for access at outlying buildings). All other exterior doors are locked and alarmed and are not to be used as delivery points unless the City agent/officialhas been provided 24 hour notification to provide additional security coverage at that point while the delivery is in progress.

b. All of the contractor's employees and all of the employees of any of his subcontractors shall wear at all times while on the site, in a clearly visible location, an identificationcard. The identificationcard is to have a minimum 1" x 1" color photo of the head and shoulders. The photo is to have been taken no more than one year previously. The card is to be laminated with clear plastic and is to contain the company name, employee's name, and the employee's signature, and is to be furnished by the contractor or respective subcontractor.

c. Effective October 1, 2004 – City of Milwaukee Policy Change

The following policy has been established to maintain control of City Property and to ensure the physical protection of the City Hall Complex.

Anyone signing out access cards and/or keys from the Information Center will be following the steps below.

1) Sign in on the sheet assigned to the project you are working on and pull that sheet and provide it to the Operator noting that you will need to sign out City property to access the building.

2) Provide the Operator your driver's license as collateral for the return of City property.

3) Sign out the property in the sign out book as per current policy.

4) The Operator will file your driver's license until such time as you sign in and return the City property at which time your license will be returned.

5) Sign out at the end of your workday on the sign out sheet.

6) Under NO circumstances will keys or cards be disbursed without the user signing for the property and providing the City Hall Operator their driver's license as collateral.

7) In the event that keys or cards are not returned daily the contractor in question will have a deduct (security violation) **$50.00 penalty** for each occurrence, as per the contract. Individuals who loose or fail to return keys will be responsible for the cost of rekeying to the City.

8) Contractors shall not ask custodians or mechanics to unlock doors. All access should be provided in advance through the City agent/official. In the rare case where access is not provided, the City Hall Operator may be contacted to assist in providing access. The contractor shall cooperate with security personnel at all times. The contractor should be prepared to allow searches of equipment when leaving, and should remain only in the areas designated on the signin sheets.

e. If the contractor requires use of the loading dock in Upper Parking, 24 hou advance notice shall be given to the City agent/official to make arrangements to provide additional security coverage while the delivery is in progress. The contractor or subcontractor shall meet the delivery driver and take delivery at that point. At no time shall a driver be allowed in the facilities without following the access procedure stated above.

f. If after normal business hours work is required in the outlying buildings, all subcontractors and trades will arrange appropriate security measures and lock-up procedures with the contractor in writing. Any work completed at night shall be left "open" for City inspection of the work. The contractor shall notify the City agent/official 24 hours in advance of after-hours work in writing, indicating the type of work to be done and the security measures to be taken by the contractor.

g. The contractor shall provide plywood door and window closures during construction to secure the structure from weather and damage from vandalism. The contractor is responsible to maintain the security of the space where they are working during construction.

h. If proper notification is not provided to the contractor, the subcontractor or trades shall be liable for any subsequent damage/vandalism/inspection cost, etc., due to lack of security/inspection coordination.

i. Use of City materials is strictly prohibited unless pre-arranged through the City employee contact.

j. At no time shall any interior doors that control access or exterior doors be propped open.

3. TEMPORARY OR TRIAL USAGE:

The owner shall have the right to make temporary or trial usage of any mechanical device, machinery, apparatus, equipment, work, material or construction supplied under contract before final completion or acceptance of the work, and the same shall not be construed as evidence of acceptance of the work by the owner.

4. OCCUPANCY DURING CONSTRUCTION:

The owner will occupy the premises while work is in progress. Contractor is to coordinate his work as to not interfere with the owner's operation or compromise building security.

5. TEMPORARY HOISTS, LIFTS

Contractors and subcontractors requiring hoists or lifts shall provide their own and remove upon completion of work.

6. SCAFFOLDING, SWING STAGES, AND LIFTS:

General Contractor shall provide protective sidewalk scaffolding and any additional measures as required to protect the public and allow safe use of this entrance into the facility during the entire construction period.

All scaffolding, swing stages and lifts as required to perform work defined in this contract document shall be provided and maintained by the General Contractor and shall be removed when no longer needed. The General Contractor is solely responsible for the design, safety and security of any scaffolding erected under this contract for this project. All scaffolding, swing stages and lifts shall be available with operators for access to the project for the Project Engineer, City Liaison and City Inspectors.

Exterior scaffolding access (up & down) shall be provided. Access through to the facility will be strictly limited. Adequate security must be provided by the General Contractor to limit the opportunity of unauthorized access of scaffolding.

Submittals for the scaffolding and egress protection shall be provided and reviewed before proceeding with erection. Scaffolding and egress protection submittals shall be stamped by a professional engineer. The scaffolding engineer shall design any foundations or anchoring points as required. The scaffolding system shall be properly grounded.

All anchors and other attachments into building shall be limited. All anchors and attachment shall be clearly indicated on submittals. All costs for scaffolding including installation of anchoring, foundation, erection and patching of all anchor and attachment points at the conclusion of the project shall be

included in the base bid. At the completion of the project, the Contractor is to patch all anchor and attachment points. Patching of all anchor or attachment points shall match existing façade materials. On site patching sample shall be provided and approved before proceeding with all patch work. Any damage to sidewalks, pavement or landscaped areas shall be restored to existing pre-construction conditions after the removal of the scaffolding, lifts, or other equipment placed on it by the Contractor.

Contractor is to verify that the parking and grass areas that surround the building are structurally suitable for placement of scaffolding, lifts or other equipment or materials prior to placement thereof. Verify by investigation and record plans the location of pervious pavement, water wells, or other underground structures not capable of supporting scaffolding, lifts, equipment or materials, and avoid placement of equipment and/or materials over these areas.

7. ELECTRICAL POWER:

Contractor may use existing outlets for power. Contractor to verify power available at site. Contractor is to supply his own lines. OSHA regulations require that employers use either ground fault circuit interrupters or an assured equipment grounding conductor program in addition to any other regulations for equipment grounding conductors. The cost of the current used will be paid for by the City.

8. WATER:

Hose bibs are available as shown on the drawings. Contractoris to verify that location of existing hose bib is suitable for his work, or provide his own source of water. Contractoris to supply his own hoses. Contractor's hose shall be leak free and contractor is to regulate the flow to limit it to project related use. The cost of water at the building shall be paid for by the City.

9. TEMPORARY TOILET FACILITIES:

The contractor is responsible for providingtheir own exterior toilet facilities during construction.

10. SITE SECURITY:

Contractor shall secure all doors and gates prior to leaving site.

11. PARKING:

Parking is available off site, on the streets adjacent to the project.

SECTION 01505: CONSTRUCTION WASTE MANAGEMENT

PART 1 - GENERAL

1.1 SCOPE:

A. This section specifies requirements for salvaging, recycling and disposing of construction waste for purposes of protecting the environment and reducing project cost.

Requirements include the following:

1. Developing a Construction Waste Management Plan including waste management goals and provisions for waste reduction and recycling.
2. Implementing, monitoring and documenting the waste management plan.
3. Incorporating special programs. If soil contaminants are found on site, Contractor will be responsible for complying with all applicable Federal and State regulations regarding providing monitoring of existing conditions, and disposal of contaminants.
4. Evaluating construction waste management.

1.2 RELATED DOCUMENTS AND SECTIONS:

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

B. Related documents include the following

1. Section 01010 "Summary of Work"
2. Section 01300 "Submittal & Permits"
3. Section 01500 "Utilities, Facilities, and Security" for environmental-protection measures during construction.

1.3 PRECONSTRUCTION MEETING:

A. After award of Contract and prior to the commencement of the Work, sched ule and conduct a meeting with the Owner and Architect to discuss the proposed Construction Waste Management Plan and to develop a mutual understanding regarding details of environmental protection.

1.4 CONSTRUCTION WASTE MANAGEMENT PLAN:

A. Construction Waste Management Plan

1. The purpose of the Construction Waste Management Plan is to identify construction waste reduction goals, identify targeted materials, and explain specific waste reduction actions to be taken, by whom, and when.
2. The Contractor shall develop a Construction Waste Management Plan for this Project within 15 working days after Contract award or prior to any waste removal. The Owner and the Architect will furnish the Contractor with information that will assist in the development of the Construction Waste Management Plan. Submit the Construction Waste Management Plan (include document/report form) to the Architect for approval prior to implementing the Plan.

B. The Plan, which should be entered into and generated by WasteCapTRACE, shall include the following:

1. **A list of the waste materials expected to be generated from the Project debris.**
2. **A list of each material proposed to be salvaged, reused, recycled and discarded. Identify applicable markets for reuse and recycling. At a minimum, all materials required by state law to be recycled shall be recycled (e.g., cardboard, cans, bottles, office paper, fluorescent tubes, refrigerants, mercury, etc.) and scrap metal shall be recycled.**
3. **Separation and materials handling procedures: Description of how waste materials identified above will be separated, cleaned (if necessary) and protected from contamination.**
4. **Educational and Motivational Procedures: Meetings to be held and other proposed methods for educating construction personnel regarding waste reduction and recycling. Construction waste management requirements should be discussed at least monthly at project site meetings.**
5. **Waste Auditing Procedures: Methods of monitoring and enforcing the Plan.**
6. **Documentation Procedures: Methods of documenting materials leaving the Project site as waste, for the reuse or recycling to allow Summary of Waste Progress Reports to be submitted with Applications for Payment.**
7. **The Lead contractor shall distribute copies of the Construction Waste Management Plan to DPW's Project manager.**

C. Progress Documentation: Document solid waste disposal and diversion. Include the date of removal, type of waste removed, quantity by weight and volume, final destination and use (recycled, reused or landfilled), and net cost or income.

1. Document on the Form acceptable to the Owner and Architect.
2. With each Application for Payment, submit updated documentation identifying solid waste disposal and diversion.
3. With each Application for Payment, submit manifests, weight tickets, receipts and invoices identifying the Project and construction waste material.

D. Record Submittals: Submit the following:

1. Summary of solid waste disposal and diversion. Submit on form acceptable to the Owner and Architect.
2. End-of-Project recycling rates and landfill rates demonstrating the percentage of construction waste that was recycled or reused.

1.5 WASTE MANAGEMENT GOALS:

A. Develop Construction Waste Management Plan that results in end-of-Project rates for the reuse/recycling of **50%** percent by weight or volume of total waste generated by the Project. Record the total construction waste reduction goal on the Construction Waste Management Plan Form.

B. Reduce: The Project shall generate the least amount of waste and methods shall be used that minimize waste due to error, poor planning, breakage, mishandling, contamination, or similar factors. Promote the resourceful use of materials to the greatest extent possible.

C. Recycle: As many of the waste materials not able to be eliminated in the first place or salvaged for reuse shall be recycled. Waste disposal in landfills shall be minimized to greatest extent possible.

1.6 MATERIALS HANDLING AND SORTING:

A. Handling:

1. Materials that are contaminated prior to placing in collection containers shall be properly cleaned. Deliver materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to recycling processes.
2. Cover materials with tarps and keep truckloads level so as to prevent spillage.
3. Arrange for collection by or delivery to the appropriate recycling or reuse facility.
4. Hazardous Waste and Hazardous Materials: Handle in accordance with applicable regulations. If encountered, such waste and materials shall be abated under separate contract.

B. The following sorting methods are acceptable:

1. Sorting recyclable materials at the Project site and transporting them to recycling markets directly from the Project site.
2. Employing haulers who make use of a materials-recovery facility or a transfer station where recyclable materials are sorted from the waste and recycled before disposing of the remainder. If using a hauler or recycling facility to sort out recyclables, verify that the hauler sorts out all construction waste loads and is not limited to those that are not acceptable at the landfill. Also, verify that the hauler or recycling facility recycles at least three types of materials.

1.7 WASTE MANAGEMENT PLAN IMPLEMENTATION:

A. The Contractor shall designate a party (or parties) who shall be responsible for instructing construction personnel and overseeing and documenting results of the Construction Waste Management Plan.

B. Distribution: The Contractor shall distribute copies of the Construction Waste Management Plan to the Project Foreman, each Subcontractor, the Owner, and the Architect

C. Instruction: The Contractor shall provide on-site instruction regarding appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all construction personnel at the appropriate phases of the Project.

D. Separation Facilities: The Contractor shall lay out and identify a specific area on the Project site to facilitate separation of materials for recycling, salvage, reuse, and return. Recycling and waste bin areas shall be kept neat and clean, and clearly marked to avoid contamination of materials. Materials for recycling include concrete, non-fibrous wallboard, paper, clean corrugated cardboard (no pizza boxes), non-treated wood, metals (steel, aluminum and copper), and glass bottles (no windows). Provide separate containers, preferably near the job trailer, with smaller containers located at convenient places throughout the job site. Empty smaller containers into larger containers every night or when full. Cover outdoor containers to keep out rain, snow, and wind-driven debris. Lock containers whenever site is not in use to prevent illegal dumping.

E. Hazardous Waste: Hazardous waste shall be separated, stored, and disposed of according to applicable regulations.

F. Application for Payments: With each Application for Payment, the Contractor shall submit a Summary of Waste generated by the Project. **This reporting shall take place using WasteCapTRACE, an online documentation system. There is a fee, to be included in the bid, of two cents per square foot of gross construction for use of WasteCapTRACE.** Failure to submit this information shall render the Application for Payment void, thereby delaying the Progress Payment.

G. The Summary of Waste shall contain the following information:

1. The amount (in tons and/or cubic yards) of material landfilled from the Project, the identity of the landfill, and the related disposal cost. Include corresponding manifests, weight tickets, receipts, and invoices.
2. For each material recycled from the Project, the amount (in tons and/or cubic yards), the date removed from the Project site, the receiving party, the transportation cost, the amount of any money paid or received for the recycled or salvaged material, and the net total cost or savings of recycling. Include corresponding manifests, weight tickets, receipts, and invoices.
3. **Final Payment: Prior to application for Final Payment, the Lead Contractor shall submit a Final Summary of Waste: reuse and recycling results for all prime and subcontractors, including the quantity of each material recycled, reused, or salvaged, the receiving party and the applicable diversion rates. The final report will be generated by WasteCapTRACE based on information entered throughout the project by the Lead Contractor.**

H. Implementing the Plan: The Contractor shall designate a party (or parties) responsible for implementing the Construction Waste Management Plan. This party (or parties) shall explain to Contractor's and Subcontractor's construction personnel, the Plan's goals and methods for achieving those goals.

1.8 SPECIAL PROGRAMS:

A. The Contractor shall be responsible for final implementation of programs involving tax credits, rebates, or similar incentives related to recycling, if applicable to the Project. Revenues or other savings obtained for recycling or returns shall accrue to the Contractor.

B. The Contractor shall be responsible for obtaining information packets related to the special programs prior to commencing Work.

C. The Contractor shall document work methods, recycled materials, etc., as required for the tax credits, rebates, or other savings described above.

END OF SECTION

SECTION 01600: MATERIALS AND EQUIPMENT

1. SCOPE:

A. Index:

1. Scope
2. Materials
3. Equipment
4. Hazardous Material Requirements
5. Material Storage
6. Protection
7. Revisions

2. MATERIALS:

A. Furnish materials of the type, qualities, and characteristics specified. The specification of a trade name and catalog number is intended to establish quality, type, character, and operating characteristics of the material required. Materials by other manufacturers of equal specifications will be accepted, excepting as may be specifically stated otherwise.

B. Materials shall be delivered adequately protected, in merchantable condition, and in original unbroken packages if normally packaged. They shall be stored and handled so as to protect and maintain their merchantable condition.

C. The Commissioner of Public Works or his representative shall have the right to reject material not in compliance with the project manual, as well as damaged material, and the contractor shall remove such material from the construction site when and as directed.

3. EQUIPMENT:

A. Internal combustion engine and compressor shall be equipped with mufflers to reduce noise to a minimum and shall not be operated in enclosed areas without adequate ventilation.

B. All materials and work procedures used shall be in accordance with all air pollution control regulations in effect at the work site.

4. HAZARDOUS MATERIAL REQUIREMENTS:

A. The requirements set forth in the OSHA Hazard Communication Standard, 29CFR19101.1200, U.S. Environmental Protection Agency (EPA), and Wisconsin Department of Natural Resources in the Wisconsin Administrative Code NR600, shall be met by each on-site contractor.

1. Material Safety Data Sheets (M.S.D.S.):

a. All contractors, which may/may not include the City of Milwaukee, shall provide the M.S.D.S. for all hazardous chemicals to which any person may be exposed at the work site.

b. A master list will be kept in the office of the Project Supervisor/Construction Manager and updated as materials are delivered.

2. Container Labeling:

Each container of hazardous material at the work site shall be clearly labeled with:

a.) Identity of the hazardous chemical(s).

b.) Appropriate hazard warning(s).

c.) Name and address of the manufacturer.

B. The City of Milwaukee reserves the right to stop the work of a contractor if compliance with OSHA regulations is inadequate. Work will not proceed until all applicable safety and health procedures are implemented by the contractor.

5. MATERIAL STORAGE:

A. The storage areas shall be kept in good order and free of all rubbish and debris.

B. Coordinate the delivery and storage of all materials and equipment with the FACILITIES DEVELOPMENT AND MANAGEMENT SECTION Project Inspector.

C. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.

D. Store and protect products in accordance with manufacturer's instructions.

E. Store with seals and labels intact and legible.

F. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.

G. For exterior storage of fabricated products, place on sloped supports above ground.

H. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

I. Prevent contact with material that may cause corrosion, discoloration, or staining.

J. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

K. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

6. PROTECTION:

A. The premises and the work shall be adequately protected from damage from the commencement of work to the date of final acceptance.

B. All construction work and traffic shall remain within the construction area.

C. All damage shall be corrected or repaired by the contractor or contractors causing same at his or their own expense.

D. All open pipes, pipe threads, fittings, and insulation must be protected during construction.

7. REVISIONS:

The right is reserved to make modifications to a reasonable extent as building conditions may require, or as may be required to conform to code rulings, or manufacturer's standards without extra cost to the City.

END OF SECTION

SECTION 01700: CLEANING AND PROJECT CLOSE-OUT

1. SCOPE:

   A. Index:

      1. Scope
      2. General
      3. Safety Cleaning
      4. Progress Cleaning
      5. Disposal
      6. Final Cleaning
      7. Charges
      8. Record Drawings
      9. Operating Instructions & Maintenance Manuals
      10. Guarantees

2. GENERAL:

   Article 2.5.4 of the General Requirements of City of Milwaukee Department of Public Works shall be supplemented as specified hereinafter.

3. SAFETY CLEANING:

   Safety cleaning: Each contractor is responsible for safety cleaning, which includes but is not limited to the following:

   A. Keep work areas, driveways, parking areas, ramps, stairs, free of debris and scrap.

   B. Form and scrap lumber shall have nails withdrawn or bent over and lumber shall be stacked or removed.

   C. Remove spills of oil, grease, or other liquids immediately.

   D. Hazardous material shall be handled in accordance with Section 01600. Each container of hazardous material at the work site shall be clearly labeled with:

      a. Identity of the hazardous chemical(s)
      b. Appropriate hazard warning(s).

4. PROGRESS CLEANING:

   A. Prime Contractor and subcontractor shall remove his rubbish and debris from building site promptly upon its accumulation, and prior to the contractor's regular Friday general clean up. Contractor shall perform broom cleaning of all appropriate surfaces each Friday afternoon.

   B. Combustible waste shall be stored in fire resistive containers and disposed of regularly.

   C. Oily, flammable or hazardous wastes such as caustics, acids, harmful dusts, etc., shall be stored in appropriate covered containers.

   D. All solvents and cleaners used on this project must be rated as containing low or no volatile organic compounds (VOC's).

5. DISPOSAL:

A. No burning of rubbish or debris will be allowed at site. No rubbish shall be thrown through opening or from heights without proper protection. Where dust will be generated or flying debris is likely to occur, provide dust tight chutes or other means to control dust.

B. Containers: Contractor shall provide mobile industrial type waste containers in the number and size required, placed at adequate locations to handle debris or provide other methods of disposing of debris.

C. Oil, flammable or hazardous wastes such as, but not limited to, caustics, acids, harmful dusts, etc., shall be placed in properly marked containers as necessary and disposed of at a site designed for such wastes.

6. FINAL CLEANING:

A. Immediately prior to substantial completion.

B. Contractors shall expedite or perform thorough cleaning, sweeping, washing and polishing of work to remove from work and equipment provided under his contract, all foreign matter, spots and soil, so as to put all such work and equipment, including finishes, in a complete and finished condition ready for acceptance and use intended.

C. The contractor is responsible for final sweeping and dusting not covered by other subcontractors. This general cleaning shall include all areas and floors of the building, including the site outside the building.

D. All solvents and cleaners used on this project must be rated as containing low or no volatile organic compounds (VOC's).

7. CHARGES:

A. If prime contractor does not remove rubbish or clean building as specified above, the owner reserves right to have work done by others at contractor's expense.

B. Employees or contracted services of the owner who are required to clean up any rubbish or to sweep any floors because prime contractor failed to do so will record all hours involved to complete such work. The cost incurred by the owner for this special cleaning and sweep-up work shall be charged against the contract price of the contractor as determined by owner.

8. RECORD DRAWINGS:

A. After the completion of work and prior to final payment, the mechanical and electrical contractors shall provide FACILITIES DEVELOPMENT AND MANAGEMENT SECTION with three (3) marked up sets of prints showing all changes or variations from contract drawings, and not specified on change order drawings theretofore issued. Contractors providing buried or concealed piping, conduit, or similar items shall locate such items by dimensions and elevations.

B. Other contractors shall provide one (1) marked up set of prints showing all changes or variations from contract drawings.

C. Drawings shall show complete layout of revised piping, equipment, etc., as actually installed.

9. OPERATING INSTRUCTIONS AND MAINTENANCE MANUALS:

A. The contractor shall, upon completion of all work, furnish the necessary skilled labor to instruct City personnel in the operation, adjustment, and maintenance of all equipment furnished.

B. At termination of work, the contractor shall submit maintenance and operating manuals presenting full details of care and maintenance and operation of mechanical and electrical equipment of every nature. See specific requirements in relevant sections as applicable.

C. The manual shall include manufacturer's instructions for maintenance and operation and shall be completely indexed, including the spare parts list. See specific requirements in relevant sections.

D. Submit three (3) final copies in hard bound cover to FACILITIES DEVELOPMENT AND MANAGEMENT SECTION.

E. The contractor shall allow for 3- 1 hour training sessions for City maintenance personnel on all equipment and controls installed under this contract.

10. GUARANTEES:

A. Each contractor shall guarantee to replace or repair promptly at his own expense, as directed by the Commissioner of Public Works or his agent, all workmanship or materials in which defects may develop within one (1) year from the date of final acceptance of his work. This guarantee includes all damage done to the City due to faulty equipment, poor installation or poor construction.

B. Guarantee periods other than the one year time period are indicated in specific specification sections.

TECHNICAL SPECS

SECTION 02140
DEWATERING

PART 1 GENERAL

A. Applicable provisions of Division 01 shall govern all work of this section.

1.2 SUMMARY

A. Include all materials, labor, services and incidentals necessary for the completion of this section of the work.

B. Dewatering consists of performing all work necessary to remove surface water and/or control the groundwater levels and hydrostatic pressures in order to permit all excavation and construction under this contract to be performed. The control of all ice and snow shall be considered as part of the work under this section.

C. Dewatering work shall include all mobilization, supply, installation, operation, maintenance, supervision, dismantling and removal from the site of the dewatering equipment.

D. The Contractor must familiarize himself with the potential for excessive rainfall, the site conditions, the ground conditions and the groundwater conditions. Copies of the logs of the borings and information on the groundwater conditions are among the data available. This available data is furnished for the convenience of the Contractor in interpreting underground conditions.

PART 2 PRODUCTS

2.1 Not Used.

PART 3 EXECUTION

3.1 The control of all surface and subsurface water, ice and snow are part of the dewatering requirements. Maintain adequate control so that the stability of excavated and construction slopes is not adversely affected by water, that erosion is controlled and that flooding of excavations or damage to structures does not occur. Drain surface water away from the excavation.

A. Dispose of all water removed from the excavation in a manner that will not endanger public health, property or portions of the work under construction or completed. Dispose of water in a manner that will cause no inconvenience whatsoever to others engaged in work at the site.

B. The bottom of the excavation shall be in a suitable condition to the extent required to maintain the subgrade in a stable condition.

C. All pumping equipment shall discharge into a silt box of adequate design to remove the suspended solids prior to discharge of the water into storm sewers.

END OF SECTION

SECTION 02230
SITE CLEARING

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. Protecting existing trees and vegetation to remain.
   2. Removing trees and other vegetation.
   3. Clearing and grubbing.
   4. Topsoil stripping.
   5. Removing above-grade site improvements.
   6. Disconnecting, capping or sealing, and removing site utilities.

B. Related Sections include the following:
   1. Division 1 Section "Job Site Utilities, Facilities, and Security" for temporary utilities, temporary construction and support facilities, temporary security and protection facilities, and environmental protection measures during site operations.
   2. Division 2 Section "Earthwork" for soil materials, excavating, backfilling, and site grading.

1.3 DEFINITIONS

A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches (50 mm) in diameter; and free of weeds, roots, and other deleterious materials.

1.4 MATERIALS OWNERSHIP

A. Except for materials indicated to be stockpiled or to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from the site in a manner in conformance with DNR regulations.

1.5 SUBMITTALS

A. Record drawings according to Division 1 Section "Contract Closeout."
   1. Identify and accurately locate capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 QUALITY ASSURANCE

A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

1.7 PROJECT CONDITIONS

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

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

C. Notify utility locator service for area where Project is located before site clearing.

PART 2 PRODUCTS

2.1 SOIL MATERIALS

A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 2 Section "Earthwork."
   1. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

PART 3 EXECUTION

3.1 PREPARATION

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

B. Provide erosion-control measures to prevent soil erosion and discharge of

soil-bearing water runoff or airborne dust to adjacent properties and walkways.

C. Locate and clearly flag trees and vegetation to remain or to be relocated.

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

3.2 TREE PROTECTION

A. Erect and maintain a temporary chain link fence around drip line of individual trees or around perimeter drip line of groups of trees to remain. Remove fence when construction is complete.
   1. Do not store construction materials, debris, or excavated material within drip line of remaining trees.
   2. Do not permit vehicles, equipment, or foot traffic within drip line of remaining trees.

B. Do not excavate within drip line of trees, unless otherwise indicated.

C. Where excavation for new construction is required within drip line of trees, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.
   1. Cover exposed roots with burlap and water regularly.
   2. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.
   3. Coat cut faces of roots more than 1-1/2 inches (38 mm) in diameter with an emulsified asphalt or other approved coating formulated for use on damaged plant tissues.
   4. Cover exposed roots with wet burlap to prevent roots from drying out. Backfill with soil as soon as possible.

3.3 UTILITIES

A. Owner will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing when requested by Contractor.
   1. Verify that utilities have been disconnected and capped before proceeding with site clearing.
   2. It shall be the Contractor's responsibility to perform this task in coordination with the Owner.

B. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.
   1. Owner will arrange to shut off indicated utilities when requested by Contractor.
   2. It shall be the Contractor's responsibility to perform this task in coordination with the Owner.

C. 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.

D. Excavate for and remove underground utilities indicated to be removed.

E. Removal of underground utilities is included in Division 15 mechanical or Division 16 electrical Sections.

3.4 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction. Removal includes digging out stumps and obstructions and grubbing roots.
   1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
   2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
   3. Completely remove stumps, roots, obstructions, and debris extending to a depth of 18 inches (450 mm) below exposed subgrade.
   4. Use only hand methods for grubbing within drip line of remaining trees.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated.
   1. Place fill material in horizontal layers not exceeding 8-inch (200-mm) loose depth, and compact each layer to a density equal to adjacent original ground.

3.5 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Strip surface soil of unsuitable topsoil, including trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.
   1. Limit height of topsoil stockpiles to 72 inches (1800 mm).
   2. Do not stockpile topsoil within drip line of remaining trees.
   3. Dispose of excess topsoil as specified for waste material disposal.
   4. Stockpile surplus topsoil and allow for respreading deeper topsoil.

3.6 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
   1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.

3.7 DISPOSAL

A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials, including trash and debris, and legally dispose of them off Owner's property. Excavated soil to be used later as backfill may be temporarily stored in a staging area to be located by the City of Milwaukee. Unused excavated soil must be removed from the temporary storage area at the completion of the project.

END OF SECTION

SECTION 02270
EROSION CONTROL

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Erosion and sediment control measures.

B. Related Sections:
   1. Section 02230 – Site Clearing
   2. Section 02300 - Earthwork
   3. Section 02510 – Water Distribution
   4. Section 02530 – Sanitary Sewerage
   5. Section 02630 – Storm Drainage

C. Reference:
   1. "Wisconsin Construction Site Best Management Practice Handbook".

PART 2 PRODUCTS

2.1 MATERIALS

A. The materials used shall conform to the requirements as specified in the "Wisconsin Construction Site Best Management Practice Handbook".

PART 3 EXECUTION

3.1 CONTROL MEASURES

A. All contractors disturbing soil within the construction zone shall obtain the "Wisconsin Construction Site Best Management Practice Handbook".

B. All erosion and sediment control measures shall be constructed and maintained in accordance with the "Wisconsin Construction Site Best Management Practice Handbook".

C. All sediment control measures shall be adjusted to meet field conditions at the time of construction and installed prior to any grading or disturbance of existing surface material.

D. Periodic inspection and maintenance of all sediment control structures shall

be provided to ensure intended purpose is accomplished. Sediment control measures are to be in working condition at the end of each working day.

E. After any significant rainfall, sediment control structures shall be inspected for integrity. Any damaged structures shall be corrected for integrity.

F. Sediment control measures shall not be removed until the areas served have established vegetative cover.

G. Road base course shall be installed at all construction site exits to prevent tracking of soil.

H. Tracked soil shall be collected from paved roads located near the construction site.

I. All trench water shall be discharged into a settling basin or filtering device prior to release into storm sewer or stream.

J. Storm sewer collection basins shall be protected from runoff by enclosing collection basins with fabric filter fencing.

K. Overland flow shall be prevented from leaving the work site by installing fabric filter fencing parallel to the contours located downhill from the work area.

L. Sediment control for pipeline construction.
   1. Excavated trench material shall be placed on the high side of the trench.
   2. Immediately following pipe installation, the trench shall be backfilled, compacted and stabilized at the end of each working day.

END OF SECTION

SECTION 02300
EARTHWORK

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. Excavating and backfilling for buildings and structures.
   2. Drainage course for slabs-on-grade.
   3. Subbase course for concrete walks and pavements.
   4. Base course for asphalt paving.
   5. Subsurface drainage backfill for walls and trenches.
   6. Excavating and backfilling trenches within building lines.
   7. Excavating and backfilling trenches for buried mechanical and electrical utilities and pits for buried utility structures.

B. Related Sections include the following:
   1. Division 1 Section "Unit Prices" for a schedule of unit prices.
   2. Division 1 Section "Job Site Utilities, Facilities, and Security."
   3. Division 2 Section "Site Clearing" for site stripping, grubbing, removing topsoil, and protecting trees to remain.
   4. Division 3 Section "Cast-in-Place Concrete" for granular course over vapor retarder.
   5. Division 15 and 16 Sections for excavating and backfilling buried mechanical and electrical utilities and buried utility structures.

1.3 DEFINITIONS

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

B. Base Course: Layer placed between the subbase course and asphalt paving.

C. Bedding Course: Layer placed over the excavated subgrade in a trench before

laying pipe.

D. Borrow: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Layer supporting slab-on-grade used to minimize capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations.
   1. Additional Excavation: Excavation below subgrade elevations as directed by Architect after proof-rolling by contractor. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
   2. Bulk Excavation: Excavations more than 10 feet (3 m) in width and pits more than 30 feet (9 m) in either length or width.
   3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

I. Subbase Course: Layer placed between the subgrade and base course for asphalt paving, layer placed between the subgrade and a concrete pavement or walk, or layer placed between the subgrade and layer of permeable "clean stone".

J. Permeable Fill: Layer of crushed stone that does not contain fines.

K. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

L. Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.4 SUBMITTALS

A. Product Data: For the following:
   1. Each type of plastic warning tape.
   2. Drainage fabric.

B. Samples: For the following:
   1. 30-lb (14-kg) samples sealed in airtight containers, of each proposed soil material from on-site or borrow sources.
   2. 12-by-12-inch (300-by-300-mm) sample of drainage fabric.
   3. 12-by-12-inch (300-by-300-mm) sample of separation fabric.

C. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
   1. Classification according to ASTM D 2487 of each on-site or borrow soil material proposed for fill and backfill.
   2. Laboratory compaction curve according to ASTM D 698 for each on-site or borrow soil material proposed for fill and backfill.
   3. Laboratory compaction curve according to ASTM D 1557 for each on-site or borrow soil material proposed for fill and backfill.
   4. Field Compaction test reports.

1.5 QUALITY ASSURANCE

A. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM E 548.

B. Preexcavation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

1.6 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect 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.
   3. Contact utility-locator service for area where Project is located before excavating.

B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

PART 2 PRODUCTS

2.1 SOIL MATERIALS

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

B. Satisfactory Soils: ASTM D 2487 soil classification groups GW, GP, GM, SW, SP, and SM, or a combination of these group symbols; free of rock or gravel larger than 3 inches (75 mm) in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

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

D. Backfill and Fill: Satisfactory soil materials.

E. Subbase: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2- inch (38-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

F. Base: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch (38-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

G. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch (38-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

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

I. Drainage Fill: Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2- inch (38-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.

J. Permeable Fill: 1" clear stone that contains no fines. Material shall meet the

following gradation
1. Maximum 1" stone
2. Minimum ½" stone
3. No Fines

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

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

M. Salvaged asphaltic pavement: Material is to be in accordance with Wisconsin Department of Transportation Standard Specifications for Sewer & Highway Construction, section 410.

2.2 ACCESSORIES

A. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, minimum 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored as follows:
1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

B. Drainage Fabric: Nonwoven geotextile, specifically manufactured as a drainage geotextile; made from polyolefins, polyesters, or polyamides; and with the following minimum properties determined according to ASTM D 4759 and referenced standard test methods:
1. Grab Tensile Strength: 110 lbf (490 N); ASTM D 4632.
2. Tear Strength: 40 lbf (178 N); ASTM D 4533.
3. Puncture Resistance: 50 lbf (222 N); ASTM D 4833.
4. Water Flow Rate: 150 gpm per sq. ft. (100 L/s per sq. m); ASTM D 4491.
5. Apparent Opening Size: No. 50 (0.3 mm); ASTM D 4751.

PART 3 EXECUTION

3.1 PREPARATION

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

B. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.

C. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

D. Demolished asphaltic pavement may be revised on site as "Salvaged asphaltic pavement: for fill or base course material. Reference Wisconsin Department of Transportation Standard Specifications for Sewer & Highway Construction, Section 410.

3.2 DEWATERING

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

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

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

D. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

3.3 EXPLOSIVES

A. Explosives: Do not use explosives.

3.4 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavation to subgrade elevations regardless of the character of surface and subsurface conditions encountered, including rock, soil materials, and obstructions.
   1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

3.5 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch (25 mm). Extend excavations a minimum of 5'-0" and extend 1'-0" per foot of additional excavation from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
   1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
   2. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch (25 mm). Do not disturb bottom of excavations intended for bearing surface.

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

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

3.7 EXCAVATION FOR UTILITY TRENCHES

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

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

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

3. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

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

3.8 APPROVAL OF SUBGRADE

A. Notify Architect when excavations have reached required subgrade.

B. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
   1. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

C. Proof roll subgrade with 20 ton tri-axle truck to identify soft pockets and areas of excess yielding. Do not proof roll wet or saturated subgrades.

D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect.

3.9 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill may be used when approved by Architect.
   1. Fill unauthorized excavations under other construction or utility pipe as directed by Architect.

3.10 STORAGE OF SOIL MATERIALS

A. Stockpile borrow materials and satisfactory excavated soil materials to maximum height of 6'-0". Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
   1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.
   2. Stockpile soil materials within the limits of construction shown on the drawings.

3.11 BACKFILL

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

3.12 UTILITY TRENCH BACKFILL

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

B. Backfill trenches excavated under footings and within 18 inches (450 mm) of bottom of footings; fill with concrete to elevation of bottom of footings.

C. Provide 4-inch- (100-mm-) thick, concrete-base slab support for piping or conduit less than 30 inches (750 mm) below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches (100 mm) of concrete before backfilling or placing roadway subbase.

D. Place and compact initial backfill of subbase material, free of particles larger than 1 inch (25 mm), to a height of 12 inches (300 mm) over the utility pipe or conduit.
   1. Carefully compact material under pipe haunches and bring backfill evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of utility system.

E. Coordinate backfilling with utilities testing.

F. Fill voids with approved backfill materials while shoring and bracing, and as sheeting is removed.

G. Place and compact final backfill of satisfactory soil material to final subgrade.

H. Install warning tape directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

3.13 FILL

A. Preparation: Remove vegetation, topsoil, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface before placing fills.

B. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

C. Place and compact fill material in layers to required elevations as follows:
   1. Under grass and planted areas, use satisfactory soil material.
   2. Under walks and pavements, use satisfactory soil material.
   3. Under steps and ramps, use engineered fill.
   4. Under building slabs, use engineered fill.
   5. Under footings and foundations, use engineered fill.

3.14 MOISTURE CONTROL

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

3.15 COMPACTION OF BACKFILLS AND FILLS

A. Place backfill and fill materials in layers not more than 8 inches (200 mm) in loose depth for material compacted by heavy compaction equipment, and not more than 6 inches (100 mm) in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:
   1. Under walkways, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill material at 95 percent.
   2. Under lawn or unpaved areas, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill material at 85 percent.

3.16 GRADING

A. General: Uniformly grade areas to a smooth surface, free from irregular

surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Lawn or Unpaved Areas: Plus or minus 1 inch (25 mm).
2. Walks: Plus or minus 1 inch (25 mm).
3. Pavements: Plus or minus 1/2 inch (13 mm).

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

3.17 SUBSURFACE VENTING

1. Under all slab on grade, place 6" thick permeable fill separated from soil below and from vapor barrier and concrete slab above with filter fabric.
2. Place 4" perforated schedule 40 PVC piping under slab as indicated in the drawings.
3. Perforated pipe shall be placed so that perforations are on bottom half of pipe.
4. Provide gas venting on both ends of perforated pipe as indicated in drawings.

3.18 SUBBASE AND BASE COURSES

A. Under pavements and walks, place subbase course on prepared subgrade and as follows:

1. Place base course material over subbase.
2. Compact subbase and base courses at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.
3. Shape subbase and base to required crown elevations and cross-slope grades.
4. When thickness of compacted subbase or base course is 6 inches (150 mm) or less, place materials in a single layer.
5. When thickness of compacted subbase or base course exceeds 6 inches (150 mm), place materials in equal layers, with no layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick when compacted.

3.19 DRAINAGE COURSE

A. Under slabs-on-grade, place subbase course and permeable fill course on prepared subgrade and as follows:
   1. Compact drainage course to required cross sections and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.
   2. When compacted thickness of subbase or permeable fill course exceeds 6 inches (150 mm), place materials in equal layers, with no layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick when compacted.

B. Under slabs-on-grade, install vapor barrier on permeable fill course according to manufacturer's written instructions, overlapping sides and ends.

3.20 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.

B. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.

C. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
   1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. (186 sq. m) or less of paved area or building slab, but in no case fewer than three tests.
   2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for each 100 feet (30 m) or less of wall length, but no fewer than two tests.
   3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for each 150 feet (46 m) or less of trench length, but no fewer than two tests.

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

3.21 PROTECTION

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

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
   1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
   1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

3.22 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

B. Disposal: Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Architect.
   1. Remove waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION

SECTION 02411
SELECTIVE STRUCTURE DEMOLITION

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. Demolition and removal of selected portions of building or structure.
   2. Demolition and removal of selected site elements.

B. Related Requirements:
   1. Division 01 Section "Summary of Work" for restrictions on the use of the premises, Owner-occupancy requirements, and phasing requirements.
   2. Division 01 Section "General Requirements" for cutting and patching procedures.
   3. Division 31 Section "Site Clearing" for site clearing and removal of above- and below-grade improvements.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner.

1.4 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.5 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.
   1. Inspect and discuss condition of construction to be selectively demolished.

2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.

1.6 INFORMATIONAL SUBMITTALS

A. Proposed Protection Measures: Submit report, including drawings, that indicates the measures proposed for protecting individuals and property, for dust control. Indicate proposed locations and construction of barriers.

B. Schedule of Selective Demolition Activities: Indicate the following:
   1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's building managers and other tenants' on-site operations are uninterrupted.
   2. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

C. Predemolition Photographs or Video: Submit before Work begins.

1.7 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

1.8 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
   1. Before selective demolition, Owner will remove the following items:
      a. Existing furniture & movable equipment.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
   1. Hazardous materials will be removed by Owner before start of the Work.
   2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be

removed by Owner under a separate contract.

PART 2 - PRODUCTS

2.2 PEFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Review record documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in record documents.

C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

E. Survey of Existing Conditions: Record existing conditions by use of measured drawings preconstruction photographs.
   1. Comply with requirements specified in Division 01 Section "Photographic Documentation."

3.2 PREPARATION

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
   1. Comply with requirements for access and protection specified in Division 01 Section "Temporary Facilities and Controls."

B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
   1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
   2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
   3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
   4. Cover and protect furniture, furnishings, and equipment that have not been removed.
   5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Division 01 Section "Temporary Facilities and Controls."

C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
   1. Strengthen or add new supports when required during progress of selective demolition.

3.3 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
   1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
   2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
   3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
   4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting

operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.

5. Maintain adequate ventilation when using cutting torches.
6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
9. Dispose of demolished items and materials promptly. Comply with requirements in Division 01 Section "Construction Waste Management and Disposal."

3.4 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch (19 mm) at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.

B. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, then remove concrete between saw cuts.

C. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.

D. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.

E. Roofing: Remove no more existing roofing than what can be covered in one day by new roofing and so that building interior remains watertight and weathertight. See Division 07 for new roofing requirements.
   1. Remove existing roof membrane, flashings, copings, and roof accessories.
   2. Remove existing roofing system down to substrate.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property,

remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
4. Comply with requirements specified in Division 01 Section "Construction Waste Management and Disposal."

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.6 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION

SECTION 02465
HELICAL PIERS

PART 1 GENERAL

1.1 SUMMARY

A. The work of this section consists of furnishing and installing steel helical piers.

B. Helical piers consist of a solid steel shaft with one or multiple circular steel plates (helical plates) attached at the lower end of the shaft..

1.2 REFERENCES

A. ASTM A29/A29M Steel Bars, Carbon and Alloy, Hot-Wrought and Cold Finished.

B. ASTM A36/A36M Structural Steel.

C. ASTM A53 Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

D. ASTM A153 Zinc Coating (Hot Dip) on Iron and Steel Hardware.

E. ASTM A193/A193M Alloy-Steel and Stainless Steel Bolting Materials for High Temperature Service.

F. ASTM A500 Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

G. ASTM A572 HSLA Columbium-Vanadium Steels of Structural Quality.

H. ASTM A618 Hot-Formed Welded and Seamless High-Strength Low-Alloy Structural Tubing.

I. ASTM A656 Hot-Rolled Structural Steel, High-Strength Low-Alloy Plate with Improved Formability.

J. ASTM A1018 Steel, Sheet and Strip, Heavy Thickness Coils, Hot Rolled Carbon, Structural, High-Strength, Low-Alloy, Columbium or Vanadium, and High-Strength Low-Alloy with Improved Formability.

K. ASTM D1143 Method of Testing Piles under Static Axial Compressive Load.

L. ASTM D3689 Method of Testing Individual Piles under Static Axial Tensile Load.

M. AWS D1.1 Structural Welding Code – Steel.

N. AWS D1.2 Structural Welding Code – Reinforcing Steel.

1.3 SUBMITTALS

A. Section 01330 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings: Show detailed description of installation procedures and cleaning methods, and all equipment and materials intended to be employed to construct the helical piles including details of drilling method; personnel protection; fabrication, construction, and disposal of excavated materials. Shop Drawings to be signed and sealed by a Professional Engineer licensed in the State of Wisconsin.

C. Calculations: Structural Calculations are to be submitted showing the proposed helical pier installation meets project requirements. Structural Calculations to be signed and sealed by a Professional Engineer licensed in the State of Wisconsin.

D. The Contractor shall keep a record of pier logs for each foundation giving, as a minimum, the following information and shall provide this information to the Architect/Engineer.
   1. Pier number, actual location, final tip and cut-off elevation.
   2. Date and time of start and completion of pier.
   3. Depth augered/drilled through overburden and description of bearing stratum.
   4. Elevation of ground surface.
   5. Elevation of top of foundation.
   6. As-built length of pier.
   7. As-built diameter, plumbness, elevations, and dimensions of drilled pier.
   8. Delays and unusual conditions encountered during pier construction.
   9. Variations from the design including location, plumbness, depth, elevations, and pier diameter.

1.4 CLOSEOUT SUBMITTALS

A. Section 01730 - Execution Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of piers, pier diameter, and pier length.

C. Accurately record the following:

1. Sizes, lengths, and locations of piers.
2. Sequence of placement.
3. Final base and top elevations.
4. Deviation from indicated locations.

1.5 QUALIFICATIONS

A. Installer: Perform Work by a specialty contractor experienced in drilled foundation construction, with suitable equipment and competent personnel. Submit a list, prior to the Award, of at least five projects completed in the last three years installing drilled helical piers of a similar diameter and length as those shown on the Contract Drawings and specified herein. This list of projects shall contain names and telephone numbers of the owners' representatives who can verify the successful performance on those projects.

1.6 PRE-INSTALLATION MEETING

A. Section 01 310 - Project Management and Coordination: Pre-construction conference.

B. Convene one week prior to commencing Work of this Section.

1.7 DESIGN REQUIREMENTS

A. An individual pier shall have a minimum of 3 helical plates (8 inches, 10 inches and 12 inches in diameter).

B. The upper most helical plate shall be a minimum of 12 feet below existing grade and a minimum of 3 helical plate diameters into competent load bearing soils.

C. Individual helical plates shall be spaced a minimum distance equal to 3 times the largest helical plate diameter.

D. Individual helical piers shall be spaced at a minimum of 5 times the largest helical plate diameter.

E. Each helical pier shall have a minimum allowable capacity of 20 kips.

F. The helical piers shall be designed for a maximum settlement of 1/4 inch.

PART 2 PRODUCTS

2.1 CENTRAL STEEL SHAFT

A. Shall be hot rolled Round-Cornered-Square (RCS) solid steel bars meeting the dimensional and workmanship requirements of ASTM A29. The bar shall be High Strength Low Alloy (HSLA), low to medium carbon steel grade with improved strength due to fine grain size.

1. Torsional strength rating: As required to meet Design Requirements and Installation.
2. Minimum yield strength = 90 ksi

2.2 HELICAL BEARING PLATE

A. Per ASTM A656 or A1018 with minimum yield strength of 80 ksi. Plate thickness is 3/8", minimum.

2.3 BOLTS

A. 7/8" diameter bolt per ASTM A193 Grade B7, minimum.

2.4 COUPLINGS

A. Shall be formed as integral part of the plain and helical extension material.

2.5 DISPLACEMENT PLATES/CENTRALIZERS

A. Displacement plates (lead or extension plates) shall be fabricated from steel or other material (not wood) that will not affect the structural integrity of the central steel shaft.

2.6 PLATES, SHAPES, OR PIER CAPS

A. Structural steel plates and shapes for helical pier top attachments shall conform to ASTM A36 or ASTM A572 Grade 50.

2.7 CORROSION PROTECTION

A. Galvanization: All material shall be hot-dipped galvanized in accordance with ASTM A153 or A123 after fabrication.

PART 3 EXECUTION

3.1 PREPARATION

A. Notify utility companies, and exercise caution while exposing utility facilities by hand for at least five feet or as approved by the utility owner.

B. Protection: Protect structures, underground foundations and utilities, and other construction from damage that may be caused by pier construction operations. The Contractor shall be responsible for verifying underground utilities by coordination with the different agencies responsible for utilities crossing the site.

C. Provide surveyed elevation benchmarks before commencing construction of piers. Record and report the elevation of each pier. Should benchmark readings indicate any displacement, halt construction work until acceptable corrective action has been implemented.

D. Protect structures near the Work, from damage.

3.2 EQUIPMENT

A. Shall be rotary type, hydraulic power driven torque motor with clockwise and counter-clockwise rotation capabilities. The torque motor shall be capable of continuous adjustment to revolutions per minute (RPM's) during installation. Percussion drilling equipment shall not be permitted. The torque motor shall have torque capacity 15% greater than the torsional strength rating of the central steel shaft to be installed.

B. Equipment shall be capable of applying adequate down pressure (crowd) and torque simultaneously to suit project soil conditions and load requirements. The equipment shall be capable of continuous position adjustment to maintain proper helical pier alignment.

C. A torque indicator shall be used during helical pier installation. The torque indicator can be an integral part of the installation equipment or externally mounted in-line with the installation tooling.
   1. Shall be capable of providing continuous measurement of applied torque throughout the installation.
   2. Shall be capable of torque measurements in increments of at least 500 ft-lb
   3. Shall be calibrated prior to pre-production testing or start of work. Torque indicators which are an integral part of the installation equipment, shall be calibrated on-site. Torque indicators which are mounted in-line with the installation tooling, shall be calibrated either on-

site or at an appropriately equipped test facility. Indicators that measure torque as a function of hydraulic pressure shall be calibrated at normal operating temperatures.

4. Shall be re-calibrated, if in the opinion of the Owner and/or Contractor reasonable doubt exists as to the accuracy of the torque measurements.

3.3 INSTALLATION - CENTRAL STEEL SHAFT

A. The helical pier installation technique shall be such that it is consistent with the geotechnical, logistical, environmental, and load carrying conditions of the project.

B. The lead section shall be positioned at the location as shown on the working drawings. Battered helical piers can be positioned perpendicular to the ground to assist in initial advancement into the soil before the required batter angle shall be established. The helical pier sections shall be engaged and advanced into the soil in a smooth, continuous manner at a rate of rotation of 5 to 20 RPM's. Extension sections shall be provided to obtain the required minimum overall length and installation torque as shown on the working drawings. Connect sections together using coupling bolt and nut torqued to 40 ft-lb

C. Sufficient down pressure shall be applied to uniformly advance the helical pier sections approximately 3 inches per revolution. The rate of rotation and magnitude of down pressure shall be adjusted for different soil conditions and depths.

3.4 TERMINATION CRITERIA

A. The torque as measured during the installation shall not exceed the torsional strength rating of the central steel shaft.

B. The minimum installation torque and minimum overall length criteria as shown on the working drawings shall be satisfied prior to terminating the helical pier.

C. If the torsional strength rating of the central steel shaft and/or installation equipment has been reached prior to achieving the minimum overall length required, the Contractor shall have the following options:

1. Terminate the installation at the depth obtained subject to the review and acceptance of the Owner, or:
2. Remove the existing helical pier and install a new one with fewer and/or smaller diameter helical plates. The new helix configuration shall be subject to review and acceptance of the Owner. If re-installing in the same location, the top-most helix of the new helical pier shall be

terminated at least (3) three feet beyond the terminating depth of the original helical.

D. If the helical pier is refused or deflected by a subsurface obstruction, the installation shall be terminated and the pile removed. The obstruction shall be removed, if feasible, and the helical pier re-installed. If obstruction cannot be removed, the helical pier shall be installed at an adjacent location, subject to review and acceptance of the Owner.

E. The average torque for the last three feet of penetration shall be used as the basis of comparison with the minimum installation torque as shown required to meet allowable capacity. The average torque shall be defined as the average of the last three readings recorded at one-foot intervals.

3.5 DRILLING TOLERANCES

A. Section 01400 - Quality Requirements Tolerances

B. Tolerances for deviations from design position, orientation and elevation shall be as follows:

1. Centerline of piling shall not be more than 3 inches from indicated plan location.
2. Pile plumbness shall be within 2° of design alignment.
3. Top elevation of pile shall be within +1 inch to -2 inches of the design vertical elevation.
4. Centerline of central steel shaft shall not be more than 3/4 inches from the centerline of the grade beam. Furnish corrective design and construction required to accommodate deviations exceeding any of the tolerances above, including replacement of piers, if necessary, at no additional cost to Owner.

END OF SECTION

SECTION 02511
HOT-MIX ASPHALT PAVING

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. Hot-mix asphalt paving.
   2. Hot-mix asphalt patching.
   3. Pavement-marking paint.
   4. Hot-mix asphalt curbs.

B. Related Sections include the following:
   1. Division 2 Section "Earthwork" for aggregate subbase and base courses and aggregate pavement shoulders.

1.3 SYSTEM DESCRIPTION

A. Provide hot-mix asphalt pavement according to the materials, workmanship, and other applicable requirements of the standard specifications of the state or of authorities having jurisdiction.
   1. Standard Specification: Wisconsin Department of Transportation Standard Specifications for Sewer & Highway Construction, latest edition and addenda.
   2. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

1.4 SUBMITTALS

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

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

C. Shop Drawings: Indicate pavement markings, lane separations, and defined parking spaces. Indicate dedicated handicapped spaces with international

graphics symbol.

D. Material Test Reports: Indicate and interpret test results for compliance of materials with requirements indicated.

E. Material Certificates: Certificates signed by manufacturers certifying that each material complies with requirements.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who has completed hot-mix asphalt paving similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Manufacturer Qualifications: Engage a firm experienced in manufacturing hot-mix asphalt similar to that indicated for this Project and with a record of successful in-service performance.

C. Firm shall be a registered and approved paving mix manufacturer with authorities having jurisdiction or with the DOT of the state in which Project is located.

D. Testing Agency Qualifications: Demonstrate to Architect's satisfaction, based on Architect's evaluation of criteria conforming to ASTM D 3666, that the independent testing agency has the experience and capability to satisfactorily conduct the testing indicated without delaying the Work.

E. Regulatory Requirements: Conform to applicable standards of authorities having jurisdiction for asphalt paving work on public property.

1.6 DELIVERY, STORAGE, AND HANDLING

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

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

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if substrate is wet or excessively damp or if the following conditions are not met:

1. Prime and Tack Coats: Minimum surface temperature of 60 deg F (15.5 deg C).
2. Slurry Coat: Comply with weather limitations of ASTM D 3910.
3. Asphalt Base Course: Minimum surface temperature of 40 deg F (4 deg C) and rising at time of placement.
4. Asphalt Surface Course: Minimum surface temperature of 60 deg F (15.5 deg C) at time of placement.

B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F (4 deg C) for oil-based materials, 50 deg F (10 deg C) for water-based materials, and not exceeding 95 deg F (35 deg C).

PART 2 PRODUCTS

2.1 AGGREGATES

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

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

C. Fine Aggregate: Sharp-edged natural sand or sand prepared from stone; gravel, properly cured blast-furnace slag, or combinations thereof; complying with ASTM D 1073.
   1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.

D. Mineral Filler: Rock or slag dust, hydraulic cement, or other inert material complying with ASTM D 242.

2.2 ASPHALT MATERIALS

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

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

C. Prime Coat: Asphalt emulsion prime conforming to state DOT requirements.

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

E. Water: Potable.

2.3 AUXILIARY MATERIALS

A. Sand: ASTM D 1073, Grade Nos. 2 or 3.

B. Pavement-Marking Paint: Latex, water-base emulsion, ready-mixed, complying with FS TT-P-1952.
   1. Color: As indicated.

2.4 MIXES

A. Hot-Mix Asphalt: Provide dense, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction; designed according to procedures in AI's "Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types"; and complying with the following requirements:
   1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to support paving and imposed loads.

B. Proof-roll subbase using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.

C. Notify Architect in writing of any unsatisfactory conditions. Do not begin paving installation until these conditions have been satisfactorily corrected.

3.2 SURFACE PREPARATION

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

   1)Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.

3.3 HOT-MIX ASPHALT PLACING

A. Machine place hot-mix asphalt mix on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness, when compacted.

1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
2. Spread mix at minimum temperature of 250 deg F (121 deg C).
3. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes, unless otherwise indicated.
4. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

B. Place paving in consecutive strips not less than 10 feet (3 m) wide, except where infill edge strips of a lesser width are required.
   1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete asphalt base course for a section before placing asphalt surface course.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.4 JOINTS

A. Construct joints to ensure continuous bond between adjoining paving sections. Construct joints free of depressions with same texture and smoothness as other sections of hot-mix asphalt course.
   1. Clean contact surfaces and apply tack coat.
   2. Offset longitudinal joints in successive courses a minimum of 6 inches (150 mm).
   3. Offset transverse joints in successive courses a minimum of 24 inches (600 mm).
   4. Construct transverse joints by bulkhead method or sawed vertical face method as described in AI's "The Asphalt Handbook."
   5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
   6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.5 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or vibratory-plate compactors in areas inaccessible to rollers.
   1. Complete compaction before mix temperature cools to 185 deg F (85 deg C).

B. Breakdown Rolling: Accomplish breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Repair surfaces by loosening displaced material, filling with hot-mix asphalt, and rerolling to required elevations.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling, while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
   1. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent nor greater than 96 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while still hot, with back of rake or smooth iron. Compact thoroughly using tamper or other satisfactory method.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials. Remove paving course over area affected and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.6 INSTALLATION TOLERANCES

A. Thickness: Compact each course to produce the thickness indicated within the following tolerances:
   1. Base Course: Plus or minus 1/2 inch (13 mm).
   2. Surface Course: Plus 1/4 inch (6 mm), no minus.

B. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot (3-m) straightedge applied transversely or longitudinally to paved areas:
   1. Base Course: 1/4 inch (6 mm).
   2. Surface Course: 1/8 inch (3 mm).

3.7 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B. Allow paving to cure for 30 days before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce pavement markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils (0.4 mm).

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing agency to perform field inspections and tests and to prepare test reports.
   1. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from specified requirements.

B. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.

C. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.

D. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

E. In-Place Density: Samples of uncompacted paving mixtures and compacted pavement will be secured by testing agency according to ASTM D 979.
   1. Reference laboratory density will be determined by averaging results from 4 samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 1559, and compacted according to job-mix specifications.

F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

END OF SECTION

SECTION 02751
CEMENT CONCRETE PAVEMENT

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 exterior cement concrete pavement for the following:
   1. Walkways and curbs.

B. Related Sections include the following:
   1. Division 2 Section "Earthwork" for subgrade preparation, grading, and subbase course.
   2. Division 3 Section "Cast-in-Place Concrete" for general building applications of concrete.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, expansive hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume.

1.4 SUBMITTALS

A. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements:
   1. Cementitious materials and aggregates.
   2. Steel reinforcement and reinforcement accessories.
   3. Curing compounds.
   4. Joint fillers.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with section 415 of the Wisconsin Department of Transportation Standard Specifications for Sewer & Highway Construction, latest edition and addenda.

B. Installer Qualifications: An experienced installer who has completed pavement work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

C. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
   1. Manufacturer must be certified according to the National Ready Mix Concrete Association's Plant Certification Program.

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

1.6 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 PRODUCTS

2.1 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.
   1. Use flexible or curved forms for curves of a radius 100 feet (30.5 m) or less.
   2. Conform with ACI 301 and 307.

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

2.2 STEEL REINFORCEMENT

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

2.3 CONCRETE MATERIALS

A. General: Use the same brand and type of cementitious material from the same manufacturer throughout the Project.

B. Portland Cement: ASTM C 150, Type I or II.
   1. Fly Ash: ASTM C 618, Class F or C.
   2. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

C. Aggregate: ASTM C 33, uniformly graded, from a single source, with coarse aggregate as follows:
   1. Maximum Aggregate Size: 3/4 inch (19 mm) nominal.
   2. Do not use fine or coarse aggregates containing substances that cause spalling.

D. Water: ASTM C 94.

2.4 ADMIXTURES

A. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cement and to be compatible with other admixtures.

B. Air-Entraining Admixture: ASTM C 260.

C. Water-Reducing Admixture: ASTM C 494, Type A.

2.5 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) dry.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Clear Solvent-Borne Liquid-Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

2.6 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

B. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery with emery aggregate containing not less than 50 percent aluminum oxide and not less than 25 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

2.7 CONCRETE MIXES

A. Prepare design mixes, proportioned according to ACI 211.1 and ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.

B. Proportion mixes to provide concrete with the following properties:
   1. Compressive Strength (28 Days): 3000 psi (20.7 MPa).
   2. Maximum Water-Cementitious Materials Ratio: 0.45.
   3. Slump Limit: 4 inches (100 mm).

C. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 requirements for concrete exposed to deicing chemicals.

D. Coloring Agent: Add coloring agent to mix according to manufacturer's written instructions.

2.8 CONCRETE MIXING

A. Ready-Mixed Concrete: Comply with requirements and with ASTM C 94 and ASTM C 1116.
   1. When air temperature is between 85 deg F (30 deg C) and 90 deg F (32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Comply with requirements and measure, batch, and mix concrete materials and concrete according to ASTM C 94. Mix concrete materials in appropriate drum-type batch machine mixer.
   1. For mixers of 1 cu. yd. (0.76 cu. m) or smaller capacity, continue mixing at least one and one-half minutes, but not more than five minutes after ingredients are in mixer, before any part of batch is released.
   2. For mixers of capacity larger than 1 cu. yd. (0.76 cu. m), increase mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).
   3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mix type, mix time, quantity, and amount of water added.

PART 3 EXECUTION

3.1 PREPARATION

A. Proof-roll prepared subbase surface to check for unstable areas and verify need for additional compaction. Proceed with pavement only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.

B. Remove loose material from compacted subbase surface immediately before placing concrete.

3.2 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form release agent to ensure separation from concrete without damage.

3.3 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating reinforcement and with recommendations in CRSI's "Placing Reinforcing Bars" for placing and supporting reinforcement.
   1. Apply epoxy repair coating to uncoated or damaged surfaces of epoxy-coated reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.4 JOINTS

A. General: Construct construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.
   1. When joining existing pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of

pavement and at locations where pavement operations are stopped for more than one-half hour, unless pavement terminates at isolation joints.

1. Provide preformed galvanized steel or plastic keyway-section forms or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
2. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of pavement strips, unless otherwise indicated.
3. Provide tie bars at sides of pavement strips where indicated.
4. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
5. Use epoxy bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.

1. Locate expansion joints at intervals of 50 feet (15.25 m), unless otherwise indicated.
2. Extend joint fillers full width and depth of joint.
3. Terminate joint filler less than 1/2 inch (12 mm) or more than 1 inch (25 mm) below finished surface if joint sealant is indicated.
4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
6. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with groover tool to the following radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.
   a. Radius: 3/8 inch (10 mm).
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.

E. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to the following radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.
   1. Radius: 3/8 inch (10 mm).

3.5 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcement steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.

B. Remove snow, ice, or frost from subbase surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at the time concrete is placed. Do not place concrete around manholes or other structures until they are at the required finish elevation and alignment.

D. Comply with requirements and with recommendations in ACI 304R for measuring, mixing, transporting, and placing concrete.

E. Do not add water to concrete during delivery, at Project site, or during placement.

F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

G. Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures to consolidate concrete according to recommendations in ACI 309R.
   1. Consolidate concrete along face of forms and adjacent to transverse joints with an 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 dislocating reinforcement, dowels, and joint devices.

H. Place concrete in two operations; strike off initial pour for entire width of placement and to the required depth below finish surface. Lay welded wire fabric or fabricated bar mats immediately in final position. Place top layer of concrete, strike off, and screed.
   1. Remove and replace portions of bottom layer of concrete that have been placed more than 15 minutes without being covered by top layer, or use bonding agent if approved by Architect.

I. Screed pavement surfaces with a straightedge and strike off. Commence initial floating using bull floats or darbies to form an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading dry-shake surface treatments.

J. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
   1. When air temperature has fallen to or is expected to fall below 40 deg F (4.4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
   2. Do not use frozen materials or materials containing ice or snow.
   3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.

K. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows when hot-weather conditions exist:
   1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 deg F (32 deg C). Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
   2. Cover reinforcement steel with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
   3. Fog-spray forms, reinforcement steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.6 CONCRETE FINISHING

A. General: Wetting of concrete surfaces during screeding, initial floating, or finishing operations is prohibited.

B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and the concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots, and fill low spots. Refloat surface immediately to uniform granular texture.
   1. Medium-to-Fine-Textured Broom Finish: Draw a soft bristle broom

across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.

2. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch (1.6 to 3 mm) deep with a stiff-bristled broom, perpendicular to line of traffic.

3.7 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and follow recommendations in ACI 305R for hot-weather protection during curing.

B. Begin curing after finishing concrete, but not before free water has disappeared from concrete surface.

C. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:
   1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
      a. Water
      b. Continuous water-fog spray.

D. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.
   1. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
   2. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.8 PAVEMENT TOLERANCES

A. Comply with tolerances of ACI 117 and as follows:
   1. Elevation: 1/4 inch (6 mm).
   2. Thickness: Plus 3/8 inch (9 mm), minus 1/4 inch (6 mm).
   3. Surface: Gap below 10-foot- (3-m-) long, unleveled straightedge not to exceed 1/4 inch (6 mm).

4. Lateral Alignment and Spacing of Tie Bars and Dowels: 1 inch (25 mm).
5. Vertical Alignment of Tie Bars and Dowels: 1/4 inch (6 mm).
6. Alignment of Tie-Bar End Relative to Line Perpendicular to Pavement Edge: 1/2 inch (13 mm).
7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel 1/4 inch per 12 inches (6 mm per 300 mm).
8. Joint Spacing: 3 inches (75 mm).
9. Contraction Joint Depth: Plus 1/4 inch (6 mm), no minus.
10. Joint Width: Plus 1/8 inch (3 mm), no minus.

3.9 REPAIRS AND PROTECTION

A. Remove and replace concrete pavement that is broken, damaged, or defective, or does not meet requirements in this Section.

B. Drill test cores where directed by Architect when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to pavement with epoxy adhesive.

C. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION

SECTION 02835
TEMPORARY CONSTRUCTION SITE BARRIER AND GATES

PART 1 GENERAL

1.1 SCOPE

A. The work under this section shall consist of providing all work, materials, labor, equipment, and supervision necessary to provide a fully functioning, temporary, construction site barrier and gate installation as provided for in these specifications and on the drawings.

B. The construction site barrier is intended to separate construction site traffic and activities from surrounding properties and activities for safety purposes for the duration of the project construction. The Contractor may also, at his option, wish to construct the barrier for his security purposes unless certain security features of the barrier are specified herein.

1.2 RELATED WORK

A. This section relates to all Division 2 sections of sitework.

1.3 REFERENCE

A. Applicable provisions of Division 1 shall govern work under this section.

1.4 REFERENCE STANDARDS

A. Abbreviations of standards or organizations referenced in this specification are as follows:
   1. ASTM American Society for Testing and Materials

1.5 QUALTIY ASSURANCE

A. Substitution of Materials: Refer to General Conditions of the Contract.

B. Where equipment, accessories, or materials are used which differ in arrangement, configuration, dimensions, ratings, or engineering parameters

from those indicated in the contract documents, the contractor is responsible for all costs involved in integrating the equipment or accessories into the system and for obtaining the intended performance from the system into which these items are placed.

1.6 PROTECTION OF EXISTING WORK AND FACILITIES

A. The Contractor shall verify the locations of, and protect, any signs, paved surfaces, buildings, structures, landscaping, lights, utilities, and all other such facilities that may be encountered or interfered with during the progress of the work. The contractor shall take all measures necessary to safeguard all existing work and facilities which are outside the limits of the work or items which are within the construction limits but are intended to remain.

1.7 SHOP DRAWINGS

A. Shop drawings are not required for temporary construction barriers unless written approvals from the Engineer are required as specified herein.

B. Refer also to Section 1 - General Requirements of the Contract

PART 2 PRODUCTS

2.1 GENERAL

A. The construction site barrier is intended to separate construction site traffic and activities from surrounding properties and activities for safety purposes for the duration of the project construction. The Contractor may also, at his option, wish to construct the barrier for his security purposes, unless certain security features of the barrier are specified herein. The barrier may be constructed of plywood panels, chain link fencing materials, or other durable wood or metal materials approved by the Owner.

B. Plastic barrier fencing and other plastic materials may be used with the Owner's permission to supplement, but not replace, the use of other more durable materials in the construction barrier.

C. Materials furnished shall be new or used materials intended to last for the

duration of the project construction. Salvaged materials from the site may be used only when specified for such use. Salvaged and used materials may be from other project sites, the Contractor's inventory, or from rental companies provided they meet the intentions and requirements of this specification.

2.2 TRAFFIC BARRIERS

A. This specification section is NOT intended for locations where non-construction traffic is in the immediate vicinity of the construction site and traffic barriers are needed for the protection of the work site and/or for the safety of the motoring public. The Contractor shall be fully responsible for the design, location, and construction of such traffic barriers.

2.3 BARRIER HEIGHT

A. The height of the barrier shall be 6'-0". The designated height of the barrier shall be the nominal fabric or panel height.

2.4 LINE POSTS

A. Line posts to support the barrier may be pedestal mounted or anchored to other structures provided they are secure and reasonably vertical and uniformly spaced. The Contractor shall be fully responsible for the method of erection, maintenance of the barrier, barrier removal, and any surface repairs and cleanup to the mounting surface as will best fit the needs of the barrier. Pedestal mounts shall be movable.

B. Posts may be of metal construction, in round, square, roll formed, U-channel, angle or other common metal shapes at the Contractor's option, or may be of wood construction with minimum 4" x 4" nominal cross section.

2.5 GATES

A. Gates shall be constructed of horizontal and vertical members as necessary to assure proper gate operation and the attachment of fabric and hardware.

2.6 GATE HARDWARE

A. Provide at least two (2) hinges for each leaf.

B. All gates shall be lockable with a padlock.

2.7 BARBED WIRE

A. Barbed wire shall NOT be used on the construction barrier.

PART 3 EXECUTION

3.1 SITE WORK

A. Prior to barrier construction, the Contractor shall obtain from the local jurisdiction the approval of all site barriers.

3.2 POSTS AND BRACES

A. Posts shall be set in a vertical position at the required location and alignment. Tops shall be set at the required elevation to provide a reasonably smooth profile at the top rail or tension wire without abrupt changes and in conformity with the general contour and which meets the approval of the Engineer.

3.3 POST BRACING ASSEMBLY

A. Brace each gate, end, and other post locations, as necessary.

3.4 STRETCHER BARS

A. Provide stretcher bars as necessary.

3.5 FABRIC

A. Barrier fabric and/or panels shall be installed, at the OWNER'S request, stretched and securely anchored to each end, corner, gate and brace post and properly attached to each line post. Top, intermediate and bottom rails shall be installed at proper locations.

B. Splices in metal fabric barriers shall be made by interweaving a wire picket through each end loop of each piece of fabric.

3.6 GRADE CLEARANCE

A. The construction site barrier clearance shall be three (3) inches unless an alternate clearance is necessary for drainage or other site conditions. Alternate clearances shall be approved by the Engineer.

3.7 CLEANUP

A. After the project is completed, thoroughly remove all barriers and clean up all debris which may have accumulated at the construction barrier. Replace or repair as required, all surfaces and/or landscape features damaged or disturbed under this contract.

END OF SECTION

SECTION 02920
LAWNS AND GRASSES

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. Sodding.

B. Related Sections include the following:
   1. Division 2 Section "Site Clearing" for topsoil stripping and stockpiling.
   2. Division 2 Section "Earthwork" for excavation, filling and backfilling, and rough grading.
   3. Division 2 Section "Subdrainage" for subsurface drainage.

1.3 DEFINITIONS

A. Finish Grade: Elevation of finished surface of planting soil.

B. Manufactured Soil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

C. Planting Soil: Native or imported topsoil, manufactured topsoil, or surface soil modified to become topsoil; mixed with soil amendments.

D. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill immediately beneath planting soil.

1.4 SUBMITTALS

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

B. Certification of Grass Seed/Sod: From seed/sod vendor for each grass-seed monostand or mixture stating the botanical and common name and percentage by weight of each species and variety, and percentage of purity,

germination, and weed seed. Include the year of production and date of packaging.

1. Certification of each seed mixture for sod, identifying source, including name and telephone number of supplier.

C. Product Certificates: For soil amendments and fertilizers, signed by product manufacturer.

D. Qualification Data: For landscape Installer.

E. Planting Schedule: Indicating anticipated planting dates for each type of planting.

F. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of lawns during a calendar year. Submit before expiration of required maintenance periods.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful lawn establishment.

1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when planting is in progress.

B. Soil-Testing Laboratory Qualifications: An independent laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

C. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Sod: Harvest, deliver, store, and handle sod according to requirements in TPI's "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" in its "Guideline Specifications to Turfgrass Sodding."

1.7 SCHEDULING

A. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit

PART 2 PRODUCTS

2.1 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural limestone containing a minimum 80 percent calcium carbonate equivalent and as follows:
   1. Class: Class T, with a minimum 99 percent passing through No. 8 sieve and a minimum 75 percent passing through No. 60 sieve.

B. Agricultural Gypsum: Finely ground, containing a minimum of 90 percent calcium sulfate.

C. Sand: Clean, washed, natural or manufactured, free of toxic materials.

2.2 ORGANIC SOIL AMENDMENTS

A. Peat: Finely divided or granular texture, with a pH range of 6 to 7.5, containing partially decomposed moss peat, native peat, or reed-sedge peat and having a water-absorbing capacity of 1100 to 2000 percent.

2.3 FERTILIZER

A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

B. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
   1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas to receive lawns and grass for compliance with requirements and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.

3.3 LAWN PREPARATION

A. Limit lawn subgrade preparation to areas to be planted.
   1. Spread planting soil mix to a depth of 4 inches but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.
      a)Reduce elevation of planting soil to allow for soil thickness of sod.

B. Unchanged Subgrades: If lawns are to be planted in areas unaltered or undisturbed by excavating, grading, or surface soil stripping operations, prepare surface soil as follows:
   1. Remove existing grass, vegetation, and turf. Do not mix into surface soil.
   2. Loosen surface soil to a depth of at least of 6 inches. Apply soil amendments and fertilizers according to planting soil mix proportions and mix thoroughly into top 4 inches of soil. Till soil to a homogeneous mixture of fine texture.
   3. Remove stones larger than 1 inch in any dimension and sticks, roots, trash, and other extraneous matter.
   4. Legally dispose of waste material, including grass, vegetation, and turf, off Owner's property.

C. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit fine grading to areas that can be planted in the immediate future.

D. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

E. Restore areas if eroded or otherwise disturbed after finish grading and before planting.

3.4 SODDING

A. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.

B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to subgrade or sod during installation. Tamp and roll lightly to ensure contact with subgrade, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent

grass.
1. Lay sod across angle of slopes exceeding 1:3.

C. Saturate sod with fine water spray within two hours of planting. During first week, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches below sod.

3.5 SATISFACTORY LAWNS

A. Satisfactory Sodded Lawn: At end of maintenance period, a healthy, well-rooted, even-colored, viable lawn has been established, free of weeds, open joints, bare areas, and surface irregularities.

B. Reestablish lawns that do not comply with requirements and continue maintenance until lawns are satisfactory.

3.6 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by lawn work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Erect barricades and warning signs as required to protect newly planted areas from traffic. Maintain barricades throughout maintenance period and remove after lawn is established.

C. Remove erosion-control measures after grass establishment period.

3.7 LAWN MAINTENANCE

A. Begin maintenance immediately after each area is planted and continue until acceptable lawn is established, but for not less than the following periods:
1. Sodded Lawns: 30 days from date of Substantial Completion.

B. Maintain and establish lawn by watering, fertilizing, weeding, mowing, trimming, replanting, and other operations. Roll, regrade, and replant bare or eroded areas to produce a uniformly smooth lawn.

C. Watering: Provide and maintain temporary piping, hoses, and lawn-watering equipment to convey water from sources and to keep lawn uniformly moist to a depth of 3inches.
1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
2. Water lawn at a minimum rate of 1 inch per week.

D. Mow lawn as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 40 percent of grass height. Remove no more than 40 percent of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:
   1. Mow grass 1-1/2 to 2 inches high.

END OF SECTION

SECTION 03100
CONCRETE FORMS AND ACCESSORIES

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes formwork for cast-in place concrete, with shoring, bracing, and anchorage; openings for other work; form accessories; and form stripping.

B. Products Installed But Not Furnished Under This Section:

1. Section 03300 - Cast-in-Place Concrete: Supply of concrete accessories for placement by this Section.

C. Related Sections:
1. Section 03200 - Concrete Reinforcement.
2. Section 03300 - Cast-in-Place Concrete.
3. Section 04810 - Unit Masonry Assemblies.

1.2 REFERENCES

A. ACI (American Concrete Institute) 117 - Standard Specifications for Tolerances for Concrete Construction and Materials.

B. ACI (American Concrete Institute) 301 - Structural Concrete for Buildings.

C. ACI (American Concrete Institute) 318 - Building Code Requirements for Reinforced Concrete.

D. ACI (American Concrete Institute) 347 - Recommended Practice For Concrete Formwork.

E. AF&PA (American Forest & Paper Association) - National Design Specifications for Wood Construction.

F. APA (APA/Engineered Wood Association) PS-PA1 - Construction and Industrial Plywood.

G. ASTM D 1751 - Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-Extruding and Resilient Bituminous types).

H. DFPA - (Douglas Fir Plywood Association) Quality Stamp.

1.3 DESIGN REQUIREMENTS

A. Design, engineer and construct formwork, shoring and bracing to conform to design and code requirements; resultant concrete to conform to required shape, line and dimension.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 347, 301 and 318.

B. For wood products furnished for the work of this Section, the Contractor shall comply with the applicable provisions of AF&PA National Design Specifications for Wood Construction.

1.5 COORDINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Coordinate this Section with other sections of work, which require attachment of components to formwork.

C. If formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement before proceeding, request instructions from the Architect/Engineer.

PART 2 - PRODUCTS

2.1 WOOD FORM MATERIALS

A. Form Materials: At the discretion of the Contractor.

2.2 FORMWORK ACCESSORIES

A. Form Ties: Removable or Snap-off type, fixed or adjustable length, with waterproofing washer, free of defects that could leave holes larger than 1 inch in concrete surface.

B. Spreaders: Standard, non-corrosive metal form clamp assembly, of type acting as spreaders and leaving no metal within 1 inch of concrete face. No wire ties, wood spreaders or through bolts will be permitted.

C. Form Anchors and Hangers: Anchors and hangers used for exposed concrete shall not leave exposed metal at surface. Hangers supporting forms from structural steel shall be symmetrically arranged on supporting members to minimize twisting or rotation of member. Penetration of structural steel members will not be permitted.

D. Form Release Agent: Colorless mineral oil which will not stain concrete, or absorb moisture, or impair natural bonding or color characteristics of coating intended for use on concrete, manufactured by
   1. "Arcal-80"; Arcal Chemical Corporation.
   2. "Synthex"; Industrial Synthetics Company.
   3. "Nox-Crete Form Coating"; Nox-Crete Company.
   4. Substitutions: Not permitted.

E. Vapor Retarder: Where shown on the Drawings, 8 mil thick polyethylene sheet.

F. Bituminous Joint Filler: ASTM D 1751.

G. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.

2.3 COATINGS

A. Approved coatings for aluminum shall be as follows unless otherwise shown on the Contract Drawings.
   1. Conlux:
      a) Primer: Bond Plex 46 or 66 (water-borne urethane).
      b) Top Coat: Epolon Multi-Mil 39 (epoxy polyamide).
   2. Sherwin Williams: Topcoat of Heavy Duty Epoxy B67-B60B3 (epoxy polyamide). Note: Self-priming.
   3. Benjamin Moore:
      a) Primer: Epoxy Rust-Inhibitive Primer (epoxy polyamide).
      b) Top Coat: Epoxy Enamel (epoxy polyamide).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Verify lines, levels, and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

3.2 EARTH FORMS

A. Earth forms are not permitted.

3.3 INSTALLATION

A. Formwork - General: Construct forms to the correct shape and dimensions, mortar-tight, of sufficient strength, and so braced and tied together that the movement of workers, equipment, materials, or the placing and vibrating of the concrete shall be strong enough to maintain their shape under all imposed loads. Camber where necessary to assure level finished soffits unless otherwise shown on the Drawings. Carefully verify the horizontal and vertical positions of forms and correct all inaccuracies before placing concrete in any form. Complete all wedging and bracing before placing concrete.

B. Forms for Surfaces to Receive Membrane Waterproofing: Use plywood or steel forms. After erection of forms, tape form joints to prevent protrusions in concrete.

C. Framing, Studding and Bracing: Space studs at 16 inches on center maximum for boards and 12 inches on center maximum for plywood. Framing, bracing, centering, and supporting members shall be of adequate size and strength to carry safely, without deflection, all dead and live loads to which forms may be subjected, and shall be spaced sufficiently close to prevent any bulging or sagging of forms. Soffits of all beam forms shall be constructed of material a minimum of 2 inch thick. Distribute bracing loads over base area on which bracing is erected. When placed on ground, protect against undermining, settlement or accidental impact.

D. Erect formwork, shoring, and bracing to achieve design requirements, in accordance with requirements of ACI 301.

E. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

F. Provide fillet and chamfer strips on external corners of beams.

G. Install void forms in accordance with manufacturer's recommendations.

3.4 APPLICATION - FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

C. Reuse and Coating of Forms: Thoroughly clean forms and reapply form coating before each reuse. For exposed work, do not reuse any form which cannot be reconditioned to "like new" condition. Apply form coating to all forms in accordance with the manufacturer's specifications, except where "scored finish" is required as shown on the Drawings. Do not coat forms for concrete that is to receive a "scored finish". Apply form coatings before placing reinforcing steel.

3.5 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Provide formed openings where required for items to be embedded in passing through concrete work.

B. Locate and set in place items that will be cast directly into concrete.

C. Coordinate with Work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other Work.

3.6 FIELD QUALITY CONTROL

A. Section 01400 - Quality Requirements: Testing and inspection services.

B. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and items are secure.

C. Notify the Architect/Engineer after placement of reinforcing steel in the forms, but prior to placing any concrete, so that his inspection may be made.

3.7 FORM CLEANING

A. Clean forms as erection proceeds, to remove foreign matter within forms.

B. Clean formed cavities of debris prior to placing concrete.

C. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

D. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

3.8 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads and the removal has been approved by the Architect/Engineer.

B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

C. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.

D. Forms shall be left in place for not less than the total number of days as specified in ACI 347.

3.9 ERECTION TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 301.

B. Tolerances: Construct formwork so that concrete surfaces shall be within construction tolerances specified in ACI 117.

C. Camber slabs and beams 1/4" inch per 10 feet in accordance with ACI 301.

END OF SECTION

SECTION 03200
CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.1 SUMMARY

A Section includes reinforcing steel bars, welded wire fabric and accessories for cast-in-place concrete.

B Related Sections:
1. Section 03100 - Concrete Forms and Accessories.
2. Section 03300 - Cast-in-Place Concrete.
3. Section 03350 - Concrete Finishing
4. Section 04820 - Reinforcement for masonry.

1.2 REFERENCES

A ACI 301 (American Concrete Institute) - Structural Concrete.

B ACI 318 (American Concrete Institute) - Building Code Requirements For Structural Concrete.

C ACI SP-66 (American Concrete Institute) - Detailing Manual.

D ASTM A82 - Steel Wire, Plain, for Concrete Reinforcement.

E ASTM A184 - Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.

F ASTM A185 - Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.

G ASTM A496 - Steel Wire, Deformed, for Concrete Reinforcement.

H ASTM A497 - Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement.

I ASTM A617 - Axle-Steel Deformed and Plain Bars for Concrete Reinforcement.

J AWS D1.4 (American Welding Society) - Structural Welding Code - Reinforcing Steel.

K CRSI (Concrete Reinforcing Steel Institute) - Manual of Practice.

L CRSI (Concrete Reinforcing Steel Institute) - Placing Reinforcing Bars.

1.3 SUBMITTALS

A Section 01330 - Submittal Procedures: Submittal procedures.

B Shop Drawings: Indicate bar sizes, spacings, locations, and quantities of reinforcing steel [and welded wire fabric, bending and cutting schedules, and supporting and spacing devices.

C Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D Submit certified copies of mill test report of reinforcement materials analysis.

1.4 QUALITY ASSURANCE

A Perform Work in accordance with CRSI - Manual of Standard Practice, ACI 301, ACI SP-66, ACI 318.

1.5 QUALIFICATIONS

A Detail reinforcement and prepare shop drawings in accordance with ACI 315.

1.6 COORDINATION

A Section 01300 - Administrative Requirements: Coordination and project conditions.

B Coordinate with placement of formwork, formed openings and other Work.

PART 2 - PRODUCTS

2.1 REINFORCEMENT

A Reinforcing Steel: ASTM A615, 60ksi yield grade; deformed plain billet steel bars, epoxy coated. Epoxy coat all cut ends.

B Welded Steel Wire Fabric: ASTM A497 Deformed Type; in flat sheets or coiled rolls; epoxy coated or hot dipped galvanized.

2.2 ACCESSORY MATERIALS

A Tie Wire: Minimum 16 gage annealed type

B Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions

C Special Chairs, Bolsters, Bar Supports, Spacers Adjacent to Weather Exposed Concrete Surfaces: Plastic-coated steel or Stainless steel type; size and shape as required.

2.3 FABRICATION

A Fabricate concrete reinforcement in accordance with CRSI Manual of Practice, ACI SP-66, ACI 318, ASTM A184

PART 3 - EXECUTION

3.1 PLACEMENT

A Place, support and secure reinforcement against displacement. Do not deviate from required position.

B Do not displace or damage vapor retarder.

C Accommodate placement of formed openings.

END OF SECTION

SECTION 03300
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A Section includes cast-in-place concrete floors, footing and slabs on grade; control, expansion and contraction joint devices associated with concrete work.

B Related Sections:
1. Section 03100 - Concrete Forms and Accessories: Formwork and accessories.
2. Section 03200 - Concrete Reinforcement.
3. Section 03350 - Concrete Finishing.

1.2 REFERENCES

A ACI 301 (American Concrete Institute) - Standard Specification for Structural Concrete for Buildings.

B ACI 302 (American Concrete Institute) - Guide for Concrete Floor and Slab Construction.

C ACI 304R (American Concrete Institute) - Guide for Measuring, Mixing, Transporting and Placing Concrete.

D ACI 305R (American Concrete Institute) - Hot Weather Concreting.

E ACI 306.1 (American Concrete Institute) - Standard Specification for Cold Weather Concreting.

F ACI 308 (American Concrete Institute) - Standard Practice for Curing Concrete.

G ACI 318 (American Concrete Institute) - Building Code Requirements for Structural Concrete and Commentary.

H ASTM C33 - Concrete Aggregates.

I ASTM C94 - Ready-Mixed Concrete.

J ASTM C150 - Portland Cement.

K ASTM C260 - Air Entraining Admixtures for Concrete.

L ASTM C494 - Chemicals Admixtures for Concrete.

M ASTM C618 - Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.

N ASTM C1017 - Chemical Admixtures for Use in Producing Flowing Concrete.

O ASTM C1107 - Packaged Dry, Hydraulic Cement Grout (Nonshrink).

P ASTM D994 - Preformed Expansion Joint Filler for Concrete (Bituminous Type).

Q ASTM D1190 - Concrete Joint Sealer, Hot-Poured Elastic Type.

1.3 QUALITY ASSURANCE

A Perform Work in accordance with ACI 301.

B Acquire cement and aggregate from same source for all Work.

C Conform to ACI 305R when concreting during hot weather.

D Conform to ACI 306.1 when concreting during cold weather.

1.4 COORDINATION

A Section 01300 - Administrative Requirements: Coordination and project conditions.

B Coordinate the placement of joint devices with erection of concrete formwork and placement of form accessories.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

A Cement: ASTM C150, Type I – Normal Portaland type.

B Fine and Coarse Aggregates: ASTM C33.

C Water: Clean and not detrimental to concrete.

2.2 ADMIXTURES

A Air Entrainment: ASTM C260

B Chemical: ASTM C494

C Fly Ash: ASTM C618 Class C.

2.3 ACCESSORIES

A Non-Shrink Grout: ASTM C1107; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 2,400 psi in 48 hours and 7,000 psi in 28 days.

2.4 JOINT DEVICES AND FILLER MATERIALS

A Joint Filler: ASTM D1751 Asphalt impregnated fiberboard or felt, 1/4 inch thick.

2.5 CONCRETE MIX

Provide concrete to the following criteria:

Material and Property	Measurement
Compressive Strength (28 day)	4000 psi
Cement Type	ASTM C150
Aggregate Type	Normal weight
Water-Cement Ratio (maximum)	0.45 by weight
Aggregate Size (maximum)	3/4 inch
Air Content	6 percent plus or minus 1.5 percent
Fly Ash Content:	Maximum 100 lbs per cubic yard

1. Admixtures: Include admixture types and quantities indicated in concrete mix designs only when approved by Architect/Engineer.

2. Use accelerating admixtures in cold weather. Use of admixtures will not relax cold weather placement requirements.

3. Do not use calcium chloride nor admixtures containing calcium chloride.

4. Use set retarding admixtures during hot weather.

5. Add air entrainment admixture to concrete mix for work exposed to freezing and thawing or deicing chemicals.

6. For concrete exposed to deicing chemicals, limit fly ash, pozzolans, silica fume, and slag content as required by applicable code.

7. Average Compressive Strength Reduction: Not permitted.

8. Ready Mixed Concrete: Mix and deliver concrete in accordance with ASTM C94/C94M.

9. Site Mixed Concrete: Not Permitted.

PART 3 -EXECUTION

3.1 EXAMINATION

A Section 01300 - Administrative Requirements: Coordination and project conditions.

B Verify requirements for concrete cover over reinforcement.

C Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not cause hardship in placing concrete.

3.2 PREPARATION

A Prepare previously placed concrete by cleaning with steel brush and applying bonding agent.

B In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout, or epoxy as shown on drawings

3.3 PLACING CONCRETE

A Place concrete in accordance with ACI 301 and ACI 318.

B Notify Architect/Engineer minimum 24 hours prior to commencement of operations.

C Ensure reinforcement, inserts, embedded parts, formed expansion and contraction joints are not disturbed during concrete placement.

D Separate slabs on grade from vertical surfaces with 1/2 inch thick joint filler.

E Place joint filler in floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.

F Extend joint filler from bottom of slab to within 1/4 inch of finished slab surface.

G Install construction joint devices in coordination with floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.

H Install joint device anchors. Maintain correct position to allow joint cover to be flush with floor and wall finish.

I Install joint covers in longest practical length, when adjacent construction activity is complete.

J Apply sealants in joint devices.

K Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

L Place concrete continuously between predetermined expansion, control, and construction joints.

M Do not interrupt successive placement; do not permit cold joints to occur.

N Place floor slabs in saw cut pattern indicated.

O Saw cut joints within 24 hours after placing

3.4 CONCRETE FINISHING

A Finish concrete floor surfaces in accordance with ACI 301 to provide a nonslip finish.

3.5 CURING AND PROTECTION

A Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

C Cure floor surfaces in accordance with ACI 301

3.6 FIELD QUALITY CONTROL

A Section 01400 - Quality Requirements: Testing and Inspection Services
01700 - Execution Requirements: Testing, adjusting, and balancing.

B Field testing will be performed in accordance with ACI 301.

C Provide free access to Work and cooperate with appointed firm.

D Submit proposed mix design to testing firm for review prior to commencement of Work.

E Tests of cement and aggregates may be performed to ensure conformance with specified requirements.

F Three concrete test cylinders will be taken for every 75 cubic yards or less of concrete placed.

G One additional test cylinder will be taken during cold weather concreting, cured on job site under same conditions as concrete it represents.

H One slump test will be taken for each set of test cylinders taken.

I One air content test will be made for each set of test cylinders taken.

3.7 PATCHING

A Allow Architect/Engineer to inspect concrete surfaces immediately upon removal of forms.

B Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Architect/Engineer upon discovery.

C Patch imperfections in accordance with ACI 301

3.8 DEFECTIVE CONCRETE

A Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.

B Repair or replacement of defective concrete will be determined by the Architect/Engineer.

C Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect/Engineer for each individual area.

END OF SECTION

SECTION 03350
CONCRETE FINISHING

PART 1 - GENERAL

1.1 SUMMARY

A Section includes finishing slabs-on-grade.

B Related Sections:
1. Section 03300 - Cast-in-Place Concrete

1.2 REFERENCES

A ACI 301 (American Concrete Institute) - Structural Concrete for Buildings.

B ACI 302 (American Concrete Institute) - Guide for Concrete Floor and Slab Construction.

C ASTM E1155 - Determining Floor Flatness and Levelness Using the F-Number System (Inch-Pound Units).

1.3 QUALITY ASSURANCE

A Perform Work in accordance with ACI 301 and ACI 302.

1.4 ENVIRONMENTAL REQUIREMENTS

A Section 01600 - Product Requirements.

B Do not finish floors until interior heating system is operational.

C Ventilation: Sufficient to prevent injurious gases from temporary heat or other sources affecting concrete.

1.5 COORDINATION

A Section 01300 - Administrative Requirements: Coordination and project conditions.

B Coordinate the Work with concrete floor placement and concrete floor curing.

PART 2 - EXECUTION

2.1 EXAMINATION

A Section 01300 - Administrative Requirements: Coordination and project conditions.

B Verify floor surfaces are acceptable to receive the Work of this section.

2.2 FLOOR FINISHING

A Finish concrete floor surfaces in accordance with ACI 301 and ACI 302.

2.3 TOLERANCES

A Section 01400 - Quality Requirements: Tolerances.

B Maximum Variation of Surface Flatness For Exposed Concrete Floors: 1/8 inch in 10 feet.

C Correct defects in the defined traffic floor by grinding or removal and replacement of the defective Work. Areas requiring corrective Work will be identified. Re-measure corrected areas by the same process.

END OF SECTION

SECTION 03415
PRECAST CONCRETE HOLLOW CORE PLANKS

PART 1 - GENERAL

1.1 SUMMARY

A Section includes roof planks, hangers and grouting plank joint keys.

B Related Sections:

1. Section 03300 - Cast-in-Place Concrete:

1.2 REFERENCES

A ACI 301 (American Concrete Institute) - Specifications for Structural Concrete for Buildings.

B ACI 318 (American Concrete Institute) - Building Code Requirements for Reinforced Concrete.

C ASTM A36/A36M - Carbon Structural Steel.

D ASTM A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

E ASTM A416 - Steel Strand, Uncoated Seven-Wire for Prestressed Concrete.

F ASTM C150 - Portland Cement.

G AWS B2.1 (American Welding Society) - Standard for Welding Procedure and Performance Qualification.

H AWS D1.1 (American Welding Society) - Structural Welding Code - Steel.

I PCI JR-307 (Precast/Prestressed Concrete Institute) - Tolerances for Precast and Prestressed Concrete.

J PCI MNL-116 (Precast/Prestressed Concrete Institute) - Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products.

K PCI MNL-120 (Precast/Prestressed Concrete Institute) - Design Handbook - Precast and Prestressed Concrete.

L PCI MNL-123 (Precast/Prestressed Concrete Institute) - Manual on Design of Connections for Precast Prestressed Concrete.

M PCI MNL-124 (Precast/Prestressed Concrete Institute) - PCI Design for Fire Resistance of Precast Prestressed Concrete.

N PCI MNL-126 (Precast/Prestressed Concrete Institute) - Manual For The Design of Hollow Core Slabs.

O UL - (Underwriters Laboratories Inc.) Fire Resistance Directory.

1.3 DESIGN REQUIREMENTS

A Design components to withstand dead loads and live loads in unrestrained condition:

1. Roof Assembly: 23PSF snow load, 20PSF roof dead load, 5PSF ceiling dead load, 10PSF hanging.

2. Planks to be designed for roof top unit openings. Detail opening connections on shop drawings.

B Maximum Allowable Deflection of Roof Planks: 1/240 span.

C Design components to accommodate construction tolerances, deflection of other building structural members and clearances of intended openings.

D Grouted Keys: Capable of transmitting horizontal shear force of 1,000 lb/ft

E Fire Resistance: Provide designs acceptable to authorities having jurisdiction to achieve hourly ratings as follows:

1. Roof Assembly: 1 hour.

1.4 SUBMITTALS

A Section 01330 - Submittal Procedures: Submittals procedures.

B Shop Drawings: Indicate plank layout, unit identification marks, connection details, edge conditions, bearing requirements, support conditions, dimensions, openings, openings intended to be field cut and relationship to adjacent materials, typical ceiling hanger connection, typical electrical and mechanical hanging connections.

C Product Data: Indicate standard component configuration, design loads, deflections, and cambers fire ratings.

1.5 QUALITY ASSURANCE

A Design planks in accordance with the requirements of:

1. PCI MNL-120 - Design Handbook.
2. PCI MNL-126 - Manual for the Design of Hollow Core Slabs.
3. PCI MNL-124 - Design for Fire Resistance of Precast Prestressed Concrete.
4. ACI 318.
5. ACI 301.

B Design connections in accordance with PCI MNL-123 - Manual on Design of Connections for Precast Prestressed Concrete.

C Design planks under direct supervision of a professional engineer experienced in design of this work and licensed in the State of Wisconsin.

D Produce planks in accordance with requirements of PCI MNL-116. Maintain plant records and quality control program during production of precast planks. Make records available upon request.

1.6 QUALIFICATIONS

A Fabricator: Company specializing in manufacturing Work of this section with 10 years documented experience.

B Erector: Company specializing in erecting Work of this section with 10 years documented experience, approved by fabricator.

C Welder: Qualified within previous 12 months in accordance with AWS B2.1.

1.7 DELIVERY, STORAGE, AND HANDLING

A Section 01600 - Product Requirements: Product storage and handling requirements.

B Lifting or Handling Devices: Capable of supporting member in positions anticipated during manufacture, storage, transportation, and erection.

C Mark each member with date of production and final position in structure.

1.8 COORDINATION

A Section 01300 - Administrative Requirements: Coordination and project conditions.

B Coordinate with framing components directly associated with the Work of this Section.

C Coordinate field cut openings with affected section.

D Coordinate location of hanger tabs and devices for mechanical and electrical work.

PART 2 - PRODUCTS

2.1 FABRICATORS

A Fabricators:

1. Spancrete Product 8" Ultralight Roof Plank. (60 PSF self-weight)

2. Substitutions: Not Permitted.

2.2 MATERIALS

A Concrete Materials: 5,000 psi compressive strength

B Tensioning Steel Tendons: ASTM A416 Grade 250 of diameter appropriate to member design.

C Reinforcing Steel: ASTM A615, deformed steel bars.

D Cement Grout: Minimum compressive strength of 2,500psi

2.3 ACCESSORIES

A Connecting and Supporting Devices: Plates, angles, items cast into concrete and inserts: ASTM A36 carbon steel; prime painted.

B Core Hole End Plugs: Cardboard insert with stiff concrete fill.

C Anchorage Devices for Ceiling Suspension: detail typical connection on shop drawing.

D Anchorage Devices for Mechanical and Electrical Equipment Hangers: detail typical connection on shop drawing.

E Bearing Pads: High density plastic, 1/8 inch thick, smooth on one side.

2.4 FABRICATION

A Planks: Plant cast, prestressed, hollow core.

B Nominal thickness: 8 inches

C Weld reinforcing in accordance with AWS D1.4.

D Cut exposed ends flush.

E Plant Finish: PCI MNL-116.

1. Roof Members: Standard Grade.

2.5 FABRICATION TOLERANCES

A Conform to PCI MNL-116 and PCI JR-307 - Tolerances for Precast and Prestressed Concrete.

PART 3 - EXECUTION

3.1 EXAMINATION

A Section 01300 - Administrative Requirements: Coordination and project conditions.

B Verify that site conditions are ready to receive Work and field measurements are as indicated on shop drawings.

C Verify supporting structure is ready to receive work.

3.2 PREPARATION

A Prepare support devices for the erection procedure and temporary bracing.

3.3 ERECTION

A Erect members without damage to structural capacity, shape, or finish. Replace or repair damaged members.

B Align and maintain uniform horizontal and end joints, as erection progresses.

C Maintain temporary bracing in place until final connections are made. Protect members from staining.

D Install bearing pads at bearing ends of planks.

E Adjust differential camber between precast members to tolerance before final attachment.

F Adjust differential elevation between precast members to tolerance before final attachment.

G Tape seal underside of plank joints to prevent grout leakage.

H Grout longitudinal keys as indicated.

I Make plank-to-plank joints smooth using grout, trowelled smooth. Transition differential elevation of adjoining planks with grout to a maximum slope of 1:12.

3.4 ERECTION TOLERANCES

A Section 01400 - Quality Requirements: Tolerances.

B Erect members level and plumb within allowable tolerances. Conform to PCI MNL-116.

3.5 CLEANING

A Section 01700 - Execution Requirements: Final cleaning.

B Clean weld marks, dirt, and blemishes from surface of exposed members.

3.6 PROTECTION OF INSTALLED CONSTRUCTION

A Section 01700 - Execution Requirements: Protecting installed construction.

B Protect members from damage caused by field welding or erection operations.

C Provide non-combustible shields during welding operations.

END OF SECTION

SECTION 04065
MASONRY MORTAR AND GROUT

PART 1 - GENERAL

1.1 SUMMARY

A Section includes mortar and grout for masonry.

B Related Sections:
1. Section 04810 – Unit Masonry Assemblies.
2. Section 08115 – Standard Steel Frames: Grouting steel door frames

1.2 REFERENCES

A ASTM C144 – Aggregate for Masonry Mortar.

B ASTM C150 – Portland Cement.

C ASTM C207 – Hydrated Lime for Masonry Purposes.

D ASTM C270 – Mortar for Unit Masonry.

E ASTM C387 – Packaged, Dry, Combined Materials for Mortar and Concrete.

F ASTM C404 – Aggregates for Masonry Grout.

G ASTM C476 – Grout for Masonry.

H ASTM C1019 – Method of Sampling and Testing Grout.

I MSJC (Masonry Standards Joint Committee) Code – ACI (American Concrete Institute) 530/ASCE (American Society of Civil Engineers) 5/TMS (The Masonry Society) 402 – Building Code Requirements for Masonry Structures.

J MSJC (Masonry Standards Joint Committee) Specification – ACI (American Concrete Institute) 530.1/ASCE (American Society of Civil Engineers) 6/TMS (The Masonry Society) 602 – Specifications for Masonry Structures.

1.3 SUBMITTALS

A Section 01330 - Submittal Procedures: Submittal procedures.

B Design Data: Submit design mix when the Property specification of ASTM C270 is to be used, required environmental conditions, and admixture limitations.

C Test Reports:
1. Submit reports on mortar indicating conformance of component mortar materials to requirements of ASTM C270.
2. Submit reports on grout indicating conformance of component grout materials to requirements of ASTM C476.

D Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A Perform Work in accordance with the MSJC Code and MSJC Specification.

1.5 ENVIRONMENTAL REQUIREMENTS

A Section 01600 - Product Requirements.

B Hot and Cold Weather Requirements: MSJC Specification.

PART 2 - PRODUCTS

2.1 COMPONENTS

A Portland Cement: ASTM C150, Type I color to match existing.

B Premix Mortar: ASTM C387, Type S, color to match existing.

C Mortar Aggregate: ASTM C144, standard masonry type.

D Hydrated Lime: ASTM C207, Type S.

E Grout Aggregate: ASTM C404, fine.

F Water: Clean and potable.

2.2 MIXES

A Mortar Mixes:

1. Mortar For Structural Masonry: ASTM C270, Type S using the proportion specification.

B Mortar Mixing:

1. Thoroughly mix mortar ingredients in accordance with ASTM C270 in quantities needed for immediate use.
2. Achieve uniformly damp sand immediately before the mixing process.
3. Re-temper only within two hours of mixing.

C Grout Mixes:

1. Grout for Non-Structural Masonry: 2,500 psi strength at 28 days, mixed in accordance with ASTM C476.

D Grout Mixing:

1. Thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C476.

PART 3 - EXECUTION

3.1 EXAMINATION

A Section 01300 - Administrative Requirements: Coordination and project conditions.

B Request inspection of spaces to be grouted.

3.2 INSTALLATION

A Install mortar and grout in accordance with MSJC Specification, and to the requirements of Section 04065.

END OF SECTION

SECTION 04810
UNIT MASONRY ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes concrete masonry units; reinforcement, anchorage, and accessories.

B. Related Sections:
1. Section 04065 - Masonry Mortar and Grout: Mortar and grout.
2. Section 03415 – Precast Concrete Hollow Core Planks
3. Section 07900 - Joint Sealers: Rod and sealant at control and expansion joints.
4. Division 7, Section "Water Repellents" for water repellents applied to concrete unit masonry.
5. Division 7Section "Sheet Metal Flashing and Trim" for exposed sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.

1.2 REFERENCES

A. ASTM A153/A153M - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

B. ASTM A82 - Carbon Steel Wire.

C. ASTM C90 - Load-Bearing Concrete Masonry Units.

D. ASTM A951 – Masonry Joint Reinforcement.

E. MSJC (Masonry Standards Joint Committee) Code - ACI (American Concrete Institute) 530/ASCE (American Society of Civil Engineers) 5/TMS (The Masonry Society) 402 - Building Code Requirements for Masonry Structures.

F. MSJC (Masonry Standards Joint Committee) Specification - ACI (American Concrete Institute) 530.1/ASCE (American Society of Civil Engineers) 6/TMS (The Masonry Society) 602 - Specifications For Masonry Structures.

1.3 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data for masonry units and fabricated wire reinforcement and other accessories.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with MSJC Code and MSJC Specification.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements: Product storage and handling requirements.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Section 01600 - Product Requirements.

B. Hot and Cold Weather Requirements: MSJC Specification.

1.7 COORDINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Coordinate the masonry work with installation of anchors.

PART 2 - PRODUCTS

2.1 COMPONENTS

A. Hollow Load Bearing Concrete Masonry Units (CMU): ASTM C90, Type II - Non-moisture Controlled; normal weight.

B. Solid Load-Bearing Concrete Masonry Units (CMU): ASTM C90, Type II - Non-moisture Controlled; normal weight.

C. Concrete Masonry Unit Size and Shape: Nominal modular size of 12x8x16 inches. Provide special units for 90 degree corners, bond beams, lintels, coved base, and bullnosed corners.

D. Provide bullnose units for outside corners unless otherwise indicated.

E. Integral Water Repellent: Provide units made with integral water repellent for exposed units and where indicated.

1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested according to ASTM E 514 as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, shall show no visible water or leaks on the back of test specimen.
   a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      1) ACM Chemistries, Inc.; RainBloc.
      2) BASF; Rheopel Plus
      3) Grace Construction Products, W. R. Grace & Co. - Conn.; Dry-Block.

F. Decorative CMUs: ASTM C 90
1. Density Classification: Normal Weight
2. Size (Width): Manufactured to dimensions specified in "CMUs" Paragrah
   a. CMU-12B: 12" CMU burnished block – Premier Block "Black Warmstone"
3. Pattern and Texture: Standard pattern, ground faced finish. **To Match Architect's Sample.**
4. Provide Burnished Block with Bullnosed outside corners.

G. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs, containing integral water repellent by same manufacturer.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Chemistries, Inc.; RainBloc for Mortar.
   b. BASF; Rheopel Mortar Admixture.
   c. Grace Construction Products, W. R. Grace & Co. - Conn.; Dry-Block Mortar Admixture.

2.2 ACCESSORIES

A. Single Wythe Joint Reinforcement: Truss type; hot dip galvanized to ASTM A153-B2 after fabrication, 9 gage wire conforming to ASTM A82.

B. Reinforcing Steel: specified in Section 03200.

C. Anchor Bolts: Headed, J-shaped or L-shaped.

D. Mortar and Grout: As specified in Section 04065.

E. Joint Filler: Closed cell polyethylene; oversized 50 percent to joint width; self-expanding; maximum lengths.

F. Building Paper: ASTM D226, No. 15 asphalt saturated felt.

G. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

H. Lintels: size, as indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

B. Verify items provided by other sections of work are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.2 PREPARATION

A. Direct and coordinate placement of metal anchors supplied to other sections.

B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent support.

3.3 INSTALLATION

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form bed and head joints of uniform thickness.

C. Coursing of Concrete Masonry Units:
1. Bond: Running.
2. Coursing: One unit and one mortar joint to equal 8 inches.
3. Mortar Joints: Concave.

D. Placing And Bonding:
1. Lay solid masonry units in full bed of mortar, with full head joints.
2. Lay hollow masonry units with face shell bedding on head and bed joints.
3. Buttering corners of joints or excessive furrowing of mortar joints are not permitted.
4. Remove excess mortar as work progresses.
5. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

6. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

E. Joint Reinforcement And Anchorage - Single Wythe Masonry:

1. Install horizontal joint reinforcement 16 inches oc.
2. Place masonry joint reinforcement in first horizontal joint above openings. Extend minimum 16 inches each side of opening.
3. Place joint reinforcement continuous in first joint below top of walls.
4. Lap joint reinforcement ends minimum 6 inches.

F. Lintels:

1. Install reinforced unit masonry lintels over openings as shown.
2. Do not splice reinforcing bars.
3. Support and secure reinforcing bars from displacement.
4. Place and consolidate grout fill without displacing reinforcing.
5. Allow masonry lintels to attain specified strength before removing temporary supports.
6. Maintain minimum 8 inch bearing on each side of opening.

G. Grouted Components:

1. Reinforce bond beam as shown.
2. Reinforce pilaster and wall as shown.
3. Lap splices bar diameters as shown on drawing general notes.
4. Support and secure reinforcing bars from displacement.
5. Place and consolidate grout fill without displacing reinforcing.
6. At bearing locations, fill masonry cores with grout for a minimum 8 inches both sides of opening.

H. Reinforced Masonry:

1. Lay masonry units with cells vertically aligned and clear of mortar and unobstructed.
2. Place reinforcement bars as indicated.
3. Splice reinforcement as shown on drawing general notes.
4. Support and secure reinforcement from displacement.
5. Place and consolidate grout fill without displacing reinforcing.
6. Place grout in accordance with MSJC Specification.

I. Control And Expansion Joints:

1. Do not continue horizontal joint reinforcement through control and expansion joints.

2. Form control joint with a sheet building paper bond breaker fitted to one side of the hollow contour end of the block unit. Fill the resultant core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant.
3. Size control joint in accordance with Section 07900 for sealant performance.
4. Form expansion joint by omitting mortar and cutting unit to form an open space.

J. Built-In Work:
1. As work progresses, anchor bolts, plates, and other items to be built-in the work and furnished by other sections.
2. Install built-in items plumb and level.
3. Bed anchors of metal door frames in adjacent mortar joints. Fill frame voids solid with grout or mortar. Fill adjacent masonry cores with grout minimum 8 inches from framed openings.
4. Do not build in materials subject to deterioration.

K. Cutting And Fitting:
1. Cut and fit for chases, pipes, conduit, sleeves, and grounds. Coordinate with other sections of work to provide correct size, shape, and location.
2. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.4 ERECTION TOLERANCES

A. Section 01400 - Quality Requirements: Tolerances.

B. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.

C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.

D. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

E. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.

F. Maximum Variation of Joint Thickness: 1/8 inch in 3 ft.

G. Maximum Variation for Steel Reinforcement:
1. Plus or minus 1/2 inch when distance from centerline of steel to opposite face of masonry is 8 inches or less.
2. Plus or minus 2 inches from the location along the face of the wall.

3.5 CLEANING

A. Section 01700 - Execution Requirements: Final cleaning.

B. Remove excess mortar and mortar smears as work progresses.

C. Replace defective mortar. Match adjacent work.

D. Clean soiled surfaces with cleaning solution.

E. Use non-metallic tools in cleaning operations.

3.6 SEALER

A. Apply sealer to Exterior Burnished Block per Division 7, "Water Repellents".

END OF SECTION

SECTION 05500
METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Steel framing and supports for applications where framing and supports are not specified in other Sections.
   2. Metal ladder & protective cage.
   3. Metal bollards.
   4. Miscellaneous pipe and equipment guards.

B. Products furnished, but not installed, under this Section:
   1. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

C. Related Sections:
   1. Division 03 Section "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
   2. Division 04 Section "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.
   3. Division 05 Section "Structural Steel Framing."

1.3 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
   1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

B. Structural Performance: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:
2. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction.
3. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
4. Uniform and concentrated loads need not be assumed to act concurrently.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Paint products.
   2. Grout.

B. Shop Drawings: Show fabrication and installation details for metal fabrications.
   1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified professional engineer.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Welding Qualifications: Qualify procedures and personnel according to the following:
   1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
   2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
   3. AWS D1.6, "Structural Welding Code - Stainless Steel."

1.7 PROJECT CONDITIONS

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

1.8 COORDINATION

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

B. Coordinate installation of anchorages and steel weld plates and angles for casting into concrete. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and

items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.2 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

C. Abrasive-Surface Floor Plate: Steel plate with abrasive granules rolled into surface or with abrasive material metallically bonded to steel.

D. Steel Tubing: ASTM A 500, cold-formed steel tubing.

E. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40) unless otherwise indicated.

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.

C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593 (ASTM F 738M); with hex nuts, ASTM F 594 (ASTM F 836M); and, where indicated, flat washers; Alloy Group 1 (A1).

D. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
   1. Hot-dip galvanize or provide mechanically deposited, zinc coating where

item being fastened is indicated to be galvanized.

E. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

F. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.

G. Post-Installed Anchors: Torque-controlled expansion anchors.
   1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
   2. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

2.4 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

E. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

F. Concrete: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa).

2.5 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
   1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches (3.2 by 38 mm), with a minimum 6-inch (150-mm) embedment and 2-inch (50-mm) hook, not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c., unless otherwise indicated.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
   1. Furnish inserts for units installed after concrete is placed.

C. Galvanize all exterior miscellaneous framing and supports.

D. Unless noted otherwise prime all miscellaneous framing and supports with zinc-rich primer. Primer compatible with mill finish steel or galvanized steel.

2.7 METAL LADDERS AND CAGE

A. Provide metal ships' ladders where indicated. Fabricate of open-type construction with channel or plate stringers and pipe and tube railings unless otherwise indicated. Provide brackets and fittings for installation.
   1. Fabricate ships' ladders, including railings from steel.
   2. Fabricate treads and platforms from welded or pressure-locked steel bar grating. Limit openings in gratings to no more than 1/2 inch (12 mm) in least dimension.

B. Prime steel ships' ladders, including treads, railings, brackets, and fasteners, with zinc-rich primer.

2.8 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
   1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Prime miscellaneous steel trim with zinc-rich primer.

2.9 METAL BOLLARDS

A. Fabricate metal bollards from Schedule 40 steel pipe Schedule 80 steel pipe shapes, as indicated.

1. Cap bollards with 1/4-inch- (6.4-mm-) thick steel plate.
2. Where bollards are indicated to receive controls for door operators, provide necessary cutouts for controls and holes for wire.
3. Where bollards are indicated to receive light fixtures, provide necessary cutouts for fixtures and holes for wire.

B. Fabricate sleeves for bollard anchorage from steel pipe or tubing with 1/4-inch- (6.4-mm-) thick steel plate welded to bottom of sleeve. Make sleeves not less than 8 inches (200 mm) deep and 3/4 inch (19 mm) larger than OD of bollard.

2.10 PIPE GUARDS

A. Fabricate pipe guards from 3/8-inch- (9.5-mm-) thick by 12-inch- (300-mm-) wide steel plate, bent to fit flat against the wall or column at both ends and to fit around pipe with 2-inch (50-mm) clearance between pipe and pipe guard. Drill each end for two 3/4-inch (19-mm) anchor bolts.

B. Galvanize exterior guards.

2.11 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.12 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize all exterior items and items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
   1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
   2. All exterior metal fabrications to be hot dipped galvanized unless noted otherwise.

B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor supports for operable partitions securely to and rigidly brace from building structure.

3.3 INSTALLING METAL BOLLARDS

A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.
   1. Do not fill removable bollards with concrete.

B. Anchor bollards in concrete with pipe sleeves preset and anchored into concrete. Fill annular space around bollard solidly with nonshrink, nonmetallic grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch (3 mm) toward bollard.

C. Fill bollards solidly with concrete, mounding top surface to shed water.
   1. Do not fill removable bollards with concrete.

3.4 INSTALLING PIPE GUARDS

A. Provide pipe guards at exposed vertical pipes in parking garage where not protected by curbs or other barriers. Install by bolting to wall or column with expansion anchors. Provide four 3/4-inch (19-mm) bolts at each pipe guard. Mount pipe guards with top edge 26 inches (660 mm) above driving surface.

3.5 RAILING CONNECTIONS

A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

3.6 ANCHORING POSTS

A. Form or core-drill holes not less than 5 inches (125 mm) deep and 3/4 inch (20 mm) larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout or[anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Leave anchorage joint exposed with 1/8-inch (3-mm) buildup, sloped away from post.

3.7 ATTACHING RAILINGS

A. Anchor railing ends at walls with round flanges anchored to wall construction and welded to railing ends or connected to railing ends using nonwelded connections.

B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends or connected to railing ends using nonwelded connections.

C. Attach railings to wall with wall brackets, except where end flanges are used. Provide brackets with 1-1/2-inch (38-mm) clearance from inside face of handrail and finished wall surface.
   1. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
      a. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt or predrilled hole for exposed bolt anchorage.
      b. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
   2. Secure wall brackets and railing end flanges to building construction as follows:
      a. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
      b. For hollow masonry anchorage, use toggle bolts.

3.8 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
   1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 09 painting Sections.

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION

SECTION 06105
MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Wood blocking, cants, and mailers.
   2. Wood furring and grounds.
   3. Plywood backing panels.

B. Related Requirements:
   1. Division 06 Section "Sheathing."
   2. Division 06 Section "Shop-Fabricated Wood Trusses."
   3. Division 06 finish carpentry Sections for nonstructural carpentry items exposed to view and not specified in another Section.

1.3 DEFINITIONS

A. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) or greater but less than 5 inches nominal (114 mm actual) in least dimension.

B. Lumber grading agencies, and the abbreviations used to reference them, include the following:
   1. NHLA: National Hardwood Lumber Association.
   2. NLGA: National Lumber Grades Authority.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
   1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
   2. Include data for fire-retardant treatment from chemical treatment

manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.

3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

B. Maximum Moisture Content of Lumber: 15 percent unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with the ground, Use

Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat items indicated on Drawings, and the following:
   1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
   2. Wood sills, sleepers, blocking, furring, and similar concealed members in contact with masonry or concrete.
   3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
   4. Wood framing members that are less than 18 inches (460 mm) above the ground in crawl spaces or unexcavated areas.
   5. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.
   1. Use treatment that does not promote corrosion of metal fasteners.
   2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where

indicated.

3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.

C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to maximum moisture content of 15 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.

E. Application: Treat items indicated on Drawings:

2.4 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
   1. Blocking.
   2. Nailers.
   3. Cants.
   4. Furring.
   5. Grounds.

B. For items of dimension lumber size, provide Standard, Stud, or No. 3 grade lumber of any species.

C. For concealed boards, provide lumber with 19 percent maximum moisture content of any species.

D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.5 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: fire-retardant treated, in thickness indicated or, if

not indicated, not less than 3/4-inch (19-mm) nominal thickness.

2.6 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
   1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM a 153/A 153M.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

E. Screws for Fastening to Metal Framing: ASTM C 1002, length as recommended by screw manufacturer for material being fastened.

F. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).

G. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
   1. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or A4).

2.7 METAL FRAMING ANCHORS

A. Hot-Dip Heavy-Galvanized Steel Sheet: ASTM A 653/A 653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 (Z550) coating designation; and not less than 0.036 inch (0.9 mm) thick.

2.8 MISCELLANEOUS MATERIALS

A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a

pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch (0.6 mm).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

B. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

C. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

D. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant treated plywood backing panels with classification marking of testing agency exposed to view.

E. Metal Framing Anchors: Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

F. Do not splice structural members between supports unless otherwise indicated.

G. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
   1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches (406 mm) o.c.

H. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

I. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.

J. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
1. NES NER-272 for power-driven fasteners.
2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.

K. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 WOOD GROUND, BLOCKING, AND NAILER INSTALLATION

A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches (38 mm) wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect miscellaneous rough carpentry from weather. If, despite protection, miscellaneous rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION

SECTION 07190
WATER REPELLENTS

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 penetrating water-repellent treatments for the following vertical and horizontal surfaces:
   1. Concrete unit masonry.

B. Related Sections:
   1. Division 04 Section "Concrete Unit Masonry" for integral water-repellent admixture for unit masonry assemblies.

1.3 PERFORMANCE REQUIREMENTS

A. General Performance: Water repellents shall meet performance requirements indicated without failure due to defective manufacture, fabrication, or installation.

   1. Water Repellents: Comply with performance requirements specified, as determined by testing on manufacturer's standard substrate assemblies representing those indicated for this Project.

B. Water Absorption: Minimum 90 percent reduction of water absorption after 24 hours in comparison of treated and untreated specimens.
   1. Concrete Masonry Units: ASTM C 140.

1.4 PRECONSTRUCTION TESTING

A. Preconstruction Testing: Installed water repellents shall comply with performance requirements indicated, as evidenced by reports of tests performed on manufacturer's standard substrate assemblies by a qualified testing agency.

1.5 SUBMITTALS

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

1. Include manufacturer's printed statement of VOC content.
2. Include manufacturer's recommended number of coats for each type of substrate and spreading rate for each separate coat.

B. Product Certificates: For each type of water repellent, from manufacturer.

C. Preconstruction Testing Reports: For water-repellent-treated substrates.

D. Field quality-control reports.

E. Warranty: Special warranty specified in this Section.

1.6 PROJECT CONDITIONS

A. Limitations: Proceed with application only when the following existing and forecasted weather and substrate conditions permit water repellents to be applied according to manufacturers' written instructions and warranty requirements:

1. Concrete surfaces and mortar have cured for not less than 28 days.
2. Ambient temperature is above 40 deg F (4.4 deg C) and below 100 deg F (37.8 deg C) and will remain so for 24 hours.
3. Substrate is not frozen and substrate-surface temperature is above 40 deg F (4.4 deg C) and below 100 deg F (37.8 deg C).
4. Rain or snow is not predicted within 24 hours.
5. Not less than seven days have passed since surfaces were last wet.
6. Windy conditions do not exist that might cause water repellent to be blown onto vegetation or surfaces not intended to be treated.

PART 2 - PRODUCTS

2.1 PENETRATING WATER REPELLENTS

A. Silicone eslastomer, Penetrating Water Repellent: Clear, containing 9% percent or more solids of active solids and with 725 g/L or less of VOCs.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. PROSOCO, Inc.; Sure Klean Weather Seal Blok-Guard & Graffiti Control

b. Approved Equal

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements and conditions affecting performance of the Work.

1. Verify that surfaces are clean and dry according to water-repellent manufacturer's requirements. Check moisture content in three representative locations by method recommended by manufacturer.
2. Inspect for previously applied treatments that may inhibit penetration or performance of water repellents.
3. Verify that there is no efflorescence or other removable residues that would be trapped beneath the application of water repellent.
4. Verify that required repairs are complete, cured, and dry before applying water repellent.

B. Test pH level according to water-repellent manufacturer's written instructions to ensure chemical bond to silica-containing or siliceous minerals.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Cleaning: Before application of water repellent, clean substrate of substances that could impair penetration or performance of product according to water-repellent manufacturer's written instructions and as follows:

1. Concrete Unit Masonry: Remove oil, curing compounds, laitance, and other substances that inhibit penetration or performance of water repellents according to ASTM E 1857.

B. Protect adjoining work, including mortar and sealant bond surfaces, from spillage or blow-over of water repellent. Cover adjoining and nearby surfaces of aluminum and glass if there is the possibility of water repellent being deposited on surfaces. Cover live vegetation.

C. Coordination with Mortar Joints: Do not apply water repellent until pointing mortar for joints adjacent to surfaces receiving water-repellent treatment has been installed and cured.

D. Coordination with Sealant Joints: Do not apply water repellent until sealants for joints adjacent to surfaces receiving water-repellent treatment have been installed and cured.

1. Water-repellent work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, water repellent, and sealant materials identical to those required.

3.3 APPLICATION

A. Apply a heavy-saturation coating of water repellent, on surfaces indicated for treatment, using roller to the point of saturation. Apply coating in dual passes of uniform, overlapping strokes. Remove excess material; do not allow material to puddle beyond saturation. Comply with manufacturer's written instructions for application procedure unless otherwise indicated.

B. Apply a second saturation coating, repeating first application. Comply with manufacturer's written instructions for limitations on drying time between coats and after rainstorm wetting of surfaces between coats. Consult manufacturer's technical representative if written instructions are not applicable to Project conditions.

3.4 CLEANING

A. Immediately clean water repellent from adjoining surfaces and surfaces soiled or damaged by water-repellent application as work progresses. Correct damage to work of other trades caused by water-repellent application, as approved by Architect.

B. Comply with manufacturer's written cleaning instructions.

END OF SECTION 071900

SECTION 07210
BUILDING INSULATION

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. Foam-plastic board insulation.
2. Glass-fiber blanket insulation.
3. Vapor retarders.

B. Related Sections:

1. Section 03 "Concrete"
2. Section 06 "Sheathing" for foam-plastic board sheathing over wood or steel framing
3. Section 09 for installation in wood- and metal-framed assemblies of insulation specified by referencing this Section.

1.3 ACTION SUBMITTALS

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

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam-plastic board insulation as follows:

1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 FOAM-PLASTIC BOARD INSULATION

A. Extruded-Polystyrene Board Insulation: ASTM C 578, of type and minimum compressive strength indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
1. Type VII, 60 psi (414 kPa).

B. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

2.2 GLASS-FIBER BLANKET INSULATION

A. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

B. Sustainability Requirements: Provide glass-fiber blanket insulation as follows:

1. Free of Formaldehyde: Insulation manufactured with 100 percent acrylic binders and no formaldehyde.
2. Low Emitting: Insulation tested according to ASTM D 5116 and shown to emit less than 0.05-ppm formaldehyde.

2.3 VAPOR RETARDERS

A. Polyethylene Vapor Retarders: ASTM D 4397, 6 mils (0.15 mm) thick, with maximum permeance rating of 0.13 perm (7.5 ng/Pa x s x sq. m).

B. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

C. Vapor-Retarder Fasteners: Pancake-head, self-tapping steel drill screws; with fender washers.

D. Single-Component Nonsag Urethane Sealant: ASTM C 920, Type I, Grade NS, Class 25, Use NT related to exposure, and Use O related to vapor-barrier-related substrates.

E. Adhesive for Vapor Retarders: Product recommended by vapor-retarder manufacturer and has demonstrated capability to bond vapor retarders securely to substrates indicated.

PART 3 - EXECUTION

3.1 PREPARATION

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

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.3 INSTALLATION OF BELOW-GRADE INSULATION

A. On vertical footing and foundation wall surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.

B. On horizontal surfaces under slabs, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

3.4 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Foam-Plastic Board Insulation: Seal joints between units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.

C. Glass-Fiber or Mineral-Wool Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
4. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
5. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
6. Vapor-Retarder-Faced Blankets: Tape joints and ruptures in vapor-retarder facings, and seal each continuous area of insulation to ensure airtight installation.

a. Exterior Walls: Set units with facing placed toward as indicated on Drawings.
b. Interior Walls: Set units with facing placed as indicated on Drawings.

3.5 INSTALLATION OF VAPOR RETARDERS

A. Place vapor retarders on side of construction indicated on Drawings. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives or other anchorage system as indicated. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.

B. Seal vertical joints in vapor retarders over framing by lapping no fewer than two studs.

1. Before installing vapor retarders, apply urethane sealant to flanges of metal framing including runner tracks, metal studs, and framing around door and window openings. Seal overlapping joints in vapor retarders with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Seal butt joints with vapor-retarder tape. Locate all joints over framing members or other solid substrates.

C. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.

D. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

3.6 PROTECTION

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

END OF SECTION

SECTION 07532
ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING

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. Loosely laid and ballasted EPDM membrane roofing system.
   2. Vapor retarder.
   3. Roof insulation.

B. Related Sections:
   1. Division 06 Section "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
   2. Division 07 Section "Sheet Metal Flashing and Trim" for metal roof penetration flashings, flashings, and counterflashings.
   3. Division 07 Section "Joint Sealants" for joint sealants, joint fillers, and joint preparation.

1.3 DEFINITIONS

A. Roofing Terminology: See ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

1.4 PERFORMANCE REQUIREMENTS

A. General Performance: Installed membrane roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.

C. Energy Performance: Provide roofing system that is listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low slope roof products.

D. 20 PSF maximum roofing dead load imposed on precast plank.

1.5 ACTION SUBMITTALS

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

B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work.
   1. Base flashings and membrane terminations.
   2. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.

1.6 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of membrane roofing system.

B. Warranties: Sample of special warranties.

1.7 CLOSEOUT SUBMITTALS

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

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is UL listed for membrane roofing system identical to that used for this Project.

B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by membrane roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

C. Source Limitations: Obtain components including roof insulation, fasteners for membrane roofing system from same manufacturer as membrane roofing or approved by membrane roofing manufacturer.

D. Preinstallation Roofing Conference: Conduct conference at Project site.
   1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work

interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.

2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
   1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.10 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according

to manufacturer's written instructions and warranty requirements.

1.11 WARRANTY

A. Special Warranty: Manufacturer's standard or customized form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period.
   1. Special warranty includes membrane roofing, base flashings, roof insulation, fasteners, substrate board, roofing accessories, roof pavers, and other components of membrane roofing system.
   2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 EPDM MEMBRANE ROOFING

A. EPDM: ASTM D 4637, Type II, scrim or fabric internally reinforced, uniform, flexible EPDM sheet.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Carlisle SynTec Incorporated.
      b. Firestone Building Products.
      c. GAF Materials Corporation.
      d. Johns Manville.
      e. Mule-Hide Products Co., Inc.
   2. Thickness: 60 mils (1.5 mm)], nominal.
   3. Exposed Face Color: Black.

2.2 AUXILIARY MEMBRANE ROOFING MATERIALS

A. General: Auxiliary membrane roofing materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.
   1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

B. Sheet Flashing: 60-mil- (1.5-mm-) thick EPDM, partially cured or cured, according to application.

C. Bonding Adhesive: Manufacturer's standard, water based.

D. Lap Sealant: Manufacturer's standard, single-component sealant, colored to

match membrane roofing.

E. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.

F. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick; with anchors.

G. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening membrane to substrate, and acceptable to roofing system manufacturer.

H. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, reinforced EPDM securement strips, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories.

2.3 VAPOR RETARDER

A. Polyethylene Film: ASTM D 4397, 6 mils (0.15 mm) thick, minimum, with maximum permeance rating of 0.13 perm (7.5 ng/Pa x s x sq. m).
   1. Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
   2. Adhesive: Manufacturer's standard lap adhesive, FM Approvals approved for vapor-retarder application.

2.4 ROOF INSULATION

A. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.

B. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.5 INSULATION ACCESSORIES

A. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with membrane roofing.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.

C. Full-Spread Applied Insulation Adhesive: Insulation manufacturer's recommended spray-applied, low-rise, two-component urethane adhesive

formulated to attach roof insulation to substrate or to another insulation layer.

2.6 AGGREGATE BALLAST

A. Aggregate Ballast: Provide aggregate ballast that will withstand weather exposure without significant deterioration and will not contribute to membrane degradation, of the following type and size:
   1. Aggregate Type: Smooth, washed, riverbed gravel or other acceptable smooth-faced stone.
   2. Size: ASTM D 448, Size 2, ranging in size from 1-1/2 to 2-1/2 inches (38 to 63 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
   1. Verify that roof openings and penetrations are in place and curbs are set and braced and that roof drain bodies are securely clamped in place.
   2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
   3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Division 05 Section "Steel Decking."
   4. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
   5. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
   6. Verify that concrete curing compounds that will impair adhesion of roofing components to roof deck have been removed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-

drain plugs when no work is taking place or when rain is forecast.

C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

D. Install acoustical roof deck rib insulation strips, specified in Division 05 Section "Steel Decking," according to acoustical roof deck manufacturer's written instructions, immediately before installation of overlying construction and to remain dry.

3.3 VAPOR-RETARDER INSTALLATION

A. Polyethylene Film: Loosely lay polyethylene-film vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of 2 inches (50 mm) and 6 inches (150 mm), respectively.
   1. Continuously seal side and end laps with adhesive.

B. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into membrane roofing system.

3.4 INSULATION INSTALLATION

A. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with membrane roofing system and insulation manufacturer's written instructions for installing roof insulation.

C. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches (68 mm) or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.
   1. Where installing composite and noncomposite insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.

D. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

E. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
   1. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and

penetrations.

3.5 LOOSELY LAID AND BALLASTED MEMBRANE ROOFING INSTALLATION

A. Loosely lay membrane roofing over area to receive roofing according to roofing system manufacturer's written instructions. Unroll membrane roofing and allow to relax before installing.

B. Start installation of membrane roofing in presence of roofing system manufacturer's technical personnel.

C. Accurately align membrane roofing, without stretching, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

D. Apply membrane roofing with side laps shingled with slope of deck where possible.

E. Adhesive Seam Installation: Clean both faces of splice areas, apply splicing cement, and firmly roll side and end laps of overlapping membrane roofing according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of membrane roofing terminations.
   1. Apply a continuous bead of in-seam sealant before closing splice if required by membrane roofing system manufacturer.

F. Leave seams uncovered until inspected by membrane roofing system manufacturer testing agency.

G. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.

H. Spread sealant or mastic bed over deck drain flange at roof drains and securely seal membrane roofing in place with clamping ring.

I. Install membrane roofing and auxiliary materials to tie in to existing roofing to maintain weather-tightness of transition and to not void warranty for existing membrane roofing system.

J. Aggregate Ballast: Apply uniformly over membrane roofing at the rate required by membrane roofing system manufacturer, but not less than the following, spreading with care to minimize possibility of damage to membrane roofing system. Lay ballast as membrane roofing is installed, leaving membrane roofing ballasted at the end of the workday.

1. Ballast Weight: Size 2 aggregate, 13 lb/sq. ft. (65 kg/sq. m), at corners and perimeter; Size 4 aggregate, 10 lb/sq. ft. (50 kg/sq. m), elsewhere.

3.6 BASE FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.

B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.

E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing agency to perform inspections.

B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.

C. Repair or remove and replace components of membrane roofing system where inspections indicate that they do not comply with specified requirements.

D. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.8 PROTECTING AND CLEANING

A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements, repair substrates and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SECTION 07620
SHEET METAL FLASHING AND TRIM

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. Manufactured Products:
      a. Manufactured through-wall flashing and counterflashings.
      b. Manufactured reglets and counterflashings.
   2. Formed Products:
      a. Formed roof drainage sheet metal fabrications.
      b. Formed low-slope roof sheet metal fabrications.
      c. Formed wall sheet metal fabrications.
      d. Formed equipment support flashing.

B. Related Sections:
   1. Division 6 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
   2. Division 7 "EPDM Roofing" for installing sheet metal flashing and trim integral with roofing.
   3. Division 7 "Metal Wall Panels" for sheet metal flashing and trim integral with metal wall & soffit panels.
   4. Division 7 "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.

1.3 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies as indicated shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Fabricate and install roof edge flashing and copings capable of resisting the following forces according to recommendations in FMG Loss Prevention Data

Sheet 1-49:

1. Wind Zone 1: For velocity pressures of 21 to 30 lbf/sq. ft. (1.00 to 1.44 kPa): 60-lbf/sq. ft. (2.87-kPa) perimeter uplift force, 90-lbf/sq. ft. (4.31-kPa) corner uplift force, and 30-lbf/sq. ft. (1.44-kPa) outward force.

C. Thermal Movements: Provide sheet metal flashing and trim that allows for thermal movements from ambient and surface temperature changes.
   1. Temperature Change (Range): 120 deg F (67 deg C), ambient material surfaces.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

B. Shop Drawings: Show fabrication and installation layouts of sheet metal flashing and trim, including plans, elevations, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled works. Include the following:
   1. Identification of material, thickness, weight, and finish for each item and location in Project.
   2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
   3. Details for joining, supporting, and securing sheet metal flashing and trim, including layout of fasteners, cleats, clips, and other attachments. Include pattern of seams.
   4. Details of termination points and assemblies, including fixed points.
   5. Details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction.
   6. Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
   7. Details of special conditions.
   8. Details of connections to adjoining work.
   9. Detail formed flashing and trim.

C. Samples for Initial Selection: For each type of sheet metal flashing, trim, and accessory indicated with factory-applied color finishes involving color selection.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
   1. Sheet Metal Flashing: 12 inches (300 mm) long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats,

clips, closures, and other attachments.

2. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 inches (300 mm) long and in required profile. Include fasteners and other exposed accessories.
3. Accessories and Miscellaneous Materials: Full-size Sample.
4. Anodized Aluminum Samples: Samples to show full range to be expected for each color required.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified fabricator.

B. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sheet metal flashing, trim, and accessories to include in maintenance manuals.

1.7 QUALITY ASSURANCE

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

B. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal flashing and trim installation.

1.9 WARRANTY

A. Special Warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within

specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
   a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
   b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
   c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.

B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required.
   1. Exposed Coil-Coated Finishes:
      a. Two-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   2. Color: As selected by Architect from manufacturer's full range.
   3. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

2.2 UNDERLAYMENT MATERIALS

A. Slip Sheet: Building paper, 3-lb/100 sq. ft. (0.16-kg/sq. m) minimum, rosin sized.

2.3 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
   1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
      a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating.
      b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
      c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
   2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.

C. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.

D. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

E. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

F. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

G. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

H. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.4 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.

1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
2. Obtain field measurements for accurate fit before shop fabrication.
3. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.

B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

C. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

D. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.

E. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.

F. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

G. Fabricate cleats and attachment devices of sizes as recommended by SMACNA's "Architectural Sheet Metal Manual" and by FMG Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.

H. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints where necessary for strength.

I. Do not use graphite pencils to mark metal surfaces.

2.5 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Roof-Edge Flashing (Gravel Stop) and Fascia Cap: Fabricate in minimum 96-inch- (2400-mm-) long, but not exceeding 10-foot- (3-m-) long, sections. Furnish with 6-inch- (150-mm-) wide, joint cover plates.

1. Joint Style: Butt, with 6-inch- (150-mm-) wide, exposed cover plates.
2. Fabricate with scuppers, of dimensions required with 4-inch- (100-mm-) wide flanges and base extending 4 inches (100 mm) beyond cant or tapered strip into field of roof. Fasten gravel guard angles to base of scupper.
3. Fabricate from the following materials:
   a. Aluminum: 0.050 inch (1.27 mm) thick.

B. Copings: Fabricate in minimum 96-inch- (2400-mm-) long, but not exceeding 10-foot- (3-m-) long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and drill elongated holes for fasteners on interior leg. Miter corners, seal, and solder or weld watertight.
   1. Coping Profile: SMACNA figure designation as indicated on drawings.
   2. Joint Style: Butt, with 12-inch- (300-mm-) wide, concealed backup plate and 6-inch- (150-mm-) wide, exposed cover plates.
   3. Fabricate from the following materials:
      a. Aluminum: 0.050 inch (1.27 mm) thick.

C. Base Flashing: Fabricate from the following materials:
   1. Aluminum: 0.040 inch (1.02 mm) thick.

D. Counterflashings: Fabricate from the following materials:
   1. Aluminum: 0.032 inch (0.81 mm) thick.

E. Flashing Receivers: Fabricate from the following materials:
   1. Aluminum: 0.032 inch (0.81 mm) thick.

F. Roof-Penetration Flashing: Fabricate from the following materials:
   1. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch (0.71 mm) thick.

G. Roof-Drain Flashing: Fabricate from the following materials:
   1. Zinc-Tin Alloy-Coated Stainless Steel: 0.015 inch (0.38 mm) thick.

2.6 WALL SHEET METAL FABRICATIONS

A. Opening Flashings in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend 4 inches (100 mm) beyond wall openings. Form head and sill flashing with 2-inch- (50-mm-) high, end dams. Fabricate from the following materials:
   1. Aluminum: 0.032 inch (0.81 mm) thick.

2.7 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following materials:

1. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch (0.71 mm) thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of the Work.
   1. Verify compliance with requirements for installation tolerances of substrates.
   2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

B. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

A. General: Install underlayment as indicated on Drawings.

B. Felt Underlayment: Install felt underlayment with adhesive for temporary anchorage to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches (50 mm).

3.3 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
   1. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
   2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
   3. Space cleats not more than 12 inches (300 mm) apart. Anchor each cleat

with two fasteners. Bend tabs over fasteners.

4. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
5. Install sealant tape where indicated.
6. Torch cutting of sheet metal flashing and trim is not permitted.
7. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.
   1. Coat back side of uncoated aluminum and stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
   2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with sealant concealed within joints.

D. Fastener Sizes: Use fasteners of sizes that will penetrate wood sheathing not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws. Metal decking not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Seal joints as shown and as required for watertight construction.
   1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).
   2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

F. Rivets: Rivet joints in uncoated aluminum where indicated and where necessary for strength.

3.4 ROOF FLASHING INSTALLATION

A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at 24-inch (600-mm) centers.

C. Copings: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.
   1. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at 24-inch (600-mm) centers.
   2. Anchor interior leg of coping with screw fasteners and washers at 24-inch (600-mm) centers.

D. Pipe or Post Counterflashings: Install counterflashings umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches (100 mm) over base flashing. Install stainless-steel draw band and tighten.

E. Counterflashings: Coordinate installation of counterflashings with installation of base flashing. Insert counterflashings in reglets or receivers and fit tightly to base flashing. Extend counterflashings 4 inches (100 mm) over base flashing. Lap counterflashings joint a minimum of 4 inches (100 mm) and bed with sealant. Secure in a waterproof manner by means of interlocking folded seam or blind rivets and sealant.

F. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

3.5 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches (100 mm) beyond wall openings.

3.6 MISCELLANEOUS FLASHING INSTALLATION

A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

3.7 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

B. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

3.8 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder.

C. Clean off excess sealants.

D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturers written installation instructions. On completion of installation, remove unused materials and clean finished surfaces. Maintain in a clean condition during construction.

E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 07841
PENETRATION FIRESTOPPING

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. Penetrations in fire-resistance-rated walls.
   2. Penetrations in horizontal assemblies.
   3. Penetrations in smoke barriers.

B. Related Sections:
   1. Division 07 Section "Fire-Resistive Joint Systems" for joints in or between fire-resistance-rated construction, at exterior curtain-wall/floor intersections, and in smoke barriers.

1.3 ACTION SUBMITTALS

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

B. Product Schedule: For each penetration firestopping system. Include location and design designation of qualified testing and inspecting agency.
   1. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping condition, submit illustration, with modifications marked, approved by penetration firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.4 INFORMATIONAL SUBMITTALS

A. Installer Certificates: From Installer indicating penetration firestopping has been installed in compliance with requirements and manufacturer's written recommendations.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for penetration firestopping.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."

B. Installer Qualifications: A firm experienced in installing penetration firestopping similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its penetration firestopping products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

C. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:
   1. Penetration firestopping tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
   2. Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems complying with the following requirements:
      a. Penetration firestopping products bear classification marking of qualified testing and inspecting agency.
      b. Classification markings on penetration firestopping correspond to designations listed by the following:
         1) UL in its "Fire Resistance Directory."

D. Preinstallation Conference: Conduct conference at Project site.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install penetration firestopping when ambient or substrate temperatures are outside limits permitted by penetration firestopping manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

B. Install and cure penetration firestopping per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.7 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that

penetration firestopping is installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping.

C. Notify Owner's testing agency at least seven days in advance of penetration firestopping installations; confirm dates and times on day preceding each series of installations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. A/D Fire Protection Systems Inc.
   2. Grace Construction Products.
   3. Hilti, Inc.
   4. 3M Fire Protection Products.

2.2 PENETRATION FIRESTOPPING

A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
   1. Fire-resistance-rated walls include smoke-barrier walls and fire partitions.
   2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Penetrations in Horizontal Assemblies: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
   1. Horizontal assemblies include floors, floor/ceiling assemblies and ceiling membranes of roof/ceiling assemblies.
   2. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.

3. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.

D. Penetrations in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.

E. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

F. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.
   1. Permanent forming/damming/backing materials, including the following:
      a. Slag-wool-fiber or rock-wool-fiber insulation.
      b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
      c. Fire-rated form board.
      d. Fillers for sealants.
   2. Temporary forming materials.
   3. Substrate primers.

2.3 FILL MATERIALS

A. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.

B. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Clean out openings immediately before installing penetration firestopping to comply with manufacturer's written instructions and with the following requirements:
   1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping.
   2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping. Remove loose particles remaining from cleaning operation.
   3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

A. General: Install penetration firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
   1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.

C. Install fill materials for firestopping by proven techniques to produce the following results:
   1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
   2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
   3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Identify penetration firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestopping. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
   1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
   2. Contractor's name, address, and phone number.
   3. Designation of applicable testing and inspecting agency.
   4. Date of installation.
   5. Manufacturer's name.
   6. Installer's name.

3.5 FIELD QUALITY CONTROL

A. Owner will engage a qualified testing agency to perform tests and inspections.

B. Where deficiencies are found or penetration firestopping is damaged or removed because of testing, repair or replace penetration firestopping to comply with requirements.

C. Proceed with enclosing penetration firestopping with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping is without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping and install new materials to produce systems complying with specified requirements.

3.7 PENETRATION FIRESTOPPING SCHEDULE

A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory".

B. Firestopping as required for rated partitions & shaft assemblies.

C. 2009 – IBC – 601 – TABLE 601 & 602 – TYPE IB
   1. Floor construction, primary & secondary members – 2hr min. rating required. (3-hr required at floor structure above electrical room T138A). NEC requirement.
   2. 1 hr reduction in fire protection for fully sprinklered building will not be allowed for this building.

D. Firestopping as required for MEP penetrations into & through rated partitions are by MEP respective trades.

END OF SECTION

SECTION 07844
FIRE-RESISTIVE JOINT SYSTEMS

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. Joints in or between fire-resistance-rated constructions.
   2. Joints in smoke barriers.

B. Related Sections:
   1. Division 07 Section "Penetration Firestopping" for penetrations in fire-resistance-rated walls, horizontal assemblies, and smoke barriers.

1.3 ACTION SUBMITTALS

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

B. Product Schedule: For each fire-resistive joint system. Include location and design designation of qualified testing agency.
   1. Where Project conditions require modification to a qualified testing agency's illustration for a particular fire-resistive joint system condition, submit illustration, with modifications marked, approved by fire-resistive joint system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.4 INFORMATIONAL SUBMITTALS

A. Installer Certificates: From Installer indicating fire-resistive joint systems have been installed in compliance with requirements and manufacturer's written recommendations.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fire-resistive joint systems.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Global

according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with UL's "Qualified Firestop Contractor Program Requirements."

B. Installer Qualifications: A firm experienced in installing fire-resistive joint systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its fire-resistive joint system products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

C. Fire-Test-Response Characteristics: Fire-resistive joint systems shall comply with the following requirements:
   1. Fire-resistive joint systems are identical to those tested per testing standard referenced in "Fire-Resistive Joint Systems" Article. Provide rated systems complying with the following requirements:
      a. Fire-resistive joint system products bear classification marking of qualified testing agency.
      b. Fire-resistive joint systems correspond to those indicated by reference to designations listed by the following:
         1) UL in its "Fire Resistance Directory."

D. Preinstallation Conference: Conduct conference at Project site.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install fire-resistive joint systems when ambient or substrate temperatures are outside limits permitted by fire-resistive joint system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Install and cure fire-resistive joint systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.7 COORDINATION

A. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.

B. Coordinate sizing of joints to accommodate fire-resistive joint systems.

C. Notify Owner's testing agency at least seven days in advance of fire-resistive

joint system installations; confirm dates and times on day preceding each series of installations.

PART 2 - PRODUCTS

2.1 FIRE-RESISTIVE JOINT SYSTEMS

A. Where required, provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which fire-resistive joint systems are installed. Fire-resistive joint systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.

B. Joints in or between Fire-Resistance-Rated Construction: Provide fire-resistive joint systems with ratings determined per ASTM E 1966 or UL 2079:
   1. Joints include those installed in or between fire-resistance-rated walls floor or floor/ceiling assemblies an] roofs or roof/ceiling assemblies.
   2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of construction they will join.
   3. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. A/D Fire Protection Systems Inc.
      b. Grace Construction Products.
      c. Hilti, Inc.
      d. 3M Fire Protection Products.

C. Joints in Smoke Barriers: Provide fire-resistive joint systems with ratings determined per UL 2079.
   1. L-Rating: Not exceeding 5.0 cfm/ft (0.00775 cu. m/s x m) of joint at 0.30 inch wg (74.7 Pa) at both ambient and elevated temperatures.

D. Exposed Fire-Resistive Joint Systems: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

E. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials that are needed to install fill materials and to maintain ratings required. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing agency for systems indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Clean joints immediately before installing fire-resistive joint systems to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
   1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of fill materials.
   2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with fill materials. Remove loose particles remaining from cleaning operation.
   3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by fire-resistive joint system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent fill materials of fire-resistive joint system from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing fire-resistive joint system's seal with substrates.

3.3 INSTALLATION

A. General: Install fire-resistive joint systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming materials and other accessories of types required to support fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
   1. After installing fill materials and allowing them to fully cure, remove

combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.

C. Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:
   1. Fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
   2. Apply fill materials so they contact and adhere to substrates formed by joints.
   3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 FIELD QUALITY CONTROL

A. Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Where deficiencies are found or fire-resistive joint systems are damaged or removed due to testing, repair or replace fire-resistive joint systems so they comply with requirements.

C. Proceed with enclosing fire-resistive joint systems with other construction only after inspection reports are issued and installations comply with requirements.

3.5 CLEANING AND PROTECTING

A. Clean off excess fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by fire-resistive joint system manufacturers and that do not damage materials in which joints occur.

B. Provide final protection and maintain conditions during and after installation that ensure fire-resistive joint systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

3.6 FIRE-RESISTIVE JOINT SYSTEM SCHEDULE

A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory".

B. Floor-to-Floor, Fire-Resistive Joint Systems.

C. Wall-to-Wall, Fire-Resistive Joint Systems.

D. Bottom-of-Wall, Fire-Resistive Joint Systems.

E. Perimeter Fire-Resistive Joint Systems.

END OF SECTION

SECTION 07920
JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Silicone joint sealants.
   2. Acoustical joint sealants.

B. Related Sections:
   1. Division 04 Section "Unit Masonry" for masonry control and expansion joint filers and gaskets.
   2. Division 07 Section "Fire-Resistive Joint Systems" for sealing joints in fire-resistance-rated construction.
   3. Division 09 Section "Gypsum Board" for sealing perimeter joints.

1.3 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer and testing agency.

B. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.

D. Warranties: Sample of special warranties.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.

C. Product Testing: Test joint sealants using a qualified testing agency.
   1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
   2. Test according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C 920 for adhesion and cohesion under cyclic movement, adhesion-in-peel, and indentation hardness.

1.6 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:
   1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (5 deg C).
   2. When joint substrates are wet.
   3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
   4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7 WARRANTY

A. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
   1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
   2. Disintegration of joint substrates from natural causes exceeding design specifications.
   3. Mechanical damage caused by individuals, tools, or other outside agents.
   4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

C. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

D. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 SILICONE JOINT SEALANTS

A. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT as listed below:
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Dow Corning Corporation; Dow 795 Silicone
      b. Pecora Corporation; 895 Silicone
      c. GE Corporation, SilPruf SCS-2000
      d. Tremco Incorporated; Spectrum 2

2.3 ACOUSTICAL JOINT SEALANTS

A. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

2.4 JOINT SEALANT BACKING

A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.5 PRE-COMPRESSED JOINT SEALANT

A. Pre-Compressed Silicone Joint Sealants to be a product of one of the following:
   1. Watson Bowman; Weather Seal II.
   2. Sunshine Industrial; Polytite N
   3. X-Calibur; X-Seal JointTite
   4. Schul International Co.; Sealtite Standard.

B. Pre-Compressed joint sealant to be designed to provide constant pressure and weather-tight seal and allow expansion of up to 100%.

C. Pre-Compressed joint sealant shall be polyurethane impregnated with a waterproof polymer sealing compound and have a release agent on the exposed surface.

D. Primer as required by manufacturer.

2.6 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
   1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
   2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
      a. Concrete.
      b. Masonry.
      c. Exterior finish systems.
   3. Remove laitance and form-release agents from concrete.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
   1. Do not leave gaps between ends of sealant backings.
   2. Do not stretch, twist, puncture, or tear sealant backings.
   3. Remove absorbent sealant backings that have become wet before sealant

application and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
   1. Place sealants so they directly contact and fully wet joint substrates.
   2. Completely fill recesses in each joint configuration.
   3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
   1. Remove excess sealant from surfaces adjacent to joints.
   2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
   3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
   4. Provide flush joint profile where indicated per Figure 8B in ASTM C 1193.
   5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 8C in ASTM C 1193.

G. Acoustical Sealant Installation: At sound-rated assemblies and elsewhere as indicated, seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations.

3.4 FIELD QUALITY CONTROL

A. Evaluation of Field-Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.7 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.
   1. Joint Locations:
      a. Isolation joints in cast-in-place concrete slabs.
   2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

B. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.
   1. Joint Locations:
      a. Control and expansion joints on exposed interior surfaces of exterior walls.
      b. Perimeter joints of exterior openings where indicated.
      c. Vertical joints on exposed surfaces of interior unit masonry, concrete, walls and partitions.
      d. Perimeter joints between interior wall surfaces and frames of interior doors, windows.
   2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

C. Joint-Sealant Application: Interior acoustical joints in vertical surfaces and horizontal nontraffic surfaces.
   1. Joint Location:
      a. Acoustical joints where indicated.
   2. Joint Sealant: Acoustical.
   3. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

END OF SECTION

SECTION 08111
HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes hollow-metal work.

B. Related Requirements:
   1. Division 8, Section "Door Hardware" for door hardware for hollow-metal doors.

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.4 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.

B. Shop Drawings: Include the following:
   1. Elevations of each door type.
   2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
   3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
   4. Locations of reinforcement and preparations for hardware.

5. Details of each different wall opening condition.
6. Details of anchorages, joints, field splices, and connections.
7. Details of accessories.
8. Details of moldings, removable stops, and glazing.
9. Details of conduit and preparations for power, signal, and control systems.

1.6 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
   1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch- (102-mm-) high wood blocking. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Ceco Door Products; an Assa Abloy Group company.
   2. Curries Company; an Assa Abloy Group company.
   3. LaForce, Inc.
   4. Steelcraft; an Ingersoll-Rand company.

B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.2 REGULATORY REQUIREMENTS

A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings and temperature-rise limits indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

2.3 INTERIOR DOORS AND FRAMES

A. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Commercial Hollow-Metal Doors and Frames: NAAMM-HMMA 861. At locations indicated in the Door and Frame Schedule.
   1. Physical Performance: Level A according to SDI A250.4.
   2. Doors:
      a. Type: As indicated in the Door and Frame Schedule.
      b. Thickness: 1-3/4 inches (44.5 mm.)
      c. Face: Metallic-coated, cold-rolled steel sheet, minimum thickness of 0.042 inch (1.0 mm).
      d. Edge Construction: Continuously welded with no visible seam.
      e. Core: Steel stiffened.
   3. Frames:
      a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch (1.3 mm).
      b. Construction: Full profile welded.
   4. Exposed Finish: Prime.

2.4 FRAME ANCHORS

A. Jamb Anchors:
   1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch (1.0 mm) thick, with corrugated or perforated straps not less than 2 inches (51 mm) wide by 10 inches (254 mm) long; or wire anchors not less than 0.177 inch (4.5 mm) thick.
   2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch (1.0 mm) thick.
   3. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch- (9.5-mm-) diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch (1.0 mm), and as follows:
   1. Separate Topping Concrete Slabs: Adjustable-type anchors with

extension clips, allowing not less than 2-inch (51-mm) height adjustment. Terminate bottom of frames at finish floor surface.

2.5 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.

D. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.
   1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

F. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

G. Grout: ASTM C 476, except with a maximum slump of 4 inches (102 mm), as measured according to ASTM C 143/C 143M.

H. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

I. Glazing: Comply with requirements in Section 088000 "Glazing."

J. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.6 FABRICATION

A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Hollow-Metal Doors:
   1. Steel-Stiffened Door Cores: Provide minimum thickness 0.026 inch (0.66 mm), steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches (152 mm) apart. Spot weld to face sheets no more than 5 inches (127 mm) o.c. Fill spaces between stiffeners with glass- or mineral-fiber insulation.
   2. Fire Door Cores: As required to provide fire-protection ratings indicated.
   3. Vertical Edges for Single-Acting Doors: Bevel edges 1/8 inch in 2 inches (3.2 mm in 51 mm).
   4. Top Edge Closures: Close top edges of doors with inverted closures, except provide flush closures at exterior doors of same material as face sheets.
   5. Bottom Edge Closures: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets.
   6. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
   7. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch (19 mm) beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.

C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
   1. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
   2. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
   3. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
   4. Jamb Anchors: Provide number and spacing of anchors as follows:
      a. Masonry Type: Locate anchors not more than 16 inches (406 mm) from top and bottom of frame. Space anchors not more than 32

inches (813 mm) o.c., to match coursing, and as follows:
1) Two anchors per jamb up to 60 inches (1524 mm) high.
2) Three anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
3) Four anchors per jamb from 90 to 120 inches (2286 to 3048 mm) high.
4) Four anchors per jamb plus one additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 120 inches (3048 mm) high.

b. Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
1) Three anchors per jamb up to 60 inches (1524 mm) high.
2) Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
3) Five anchors per jamb from 90 to 96 inches (2286 to 2438 mm) high.
4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 96 inches (2438 mm) high.

c. Postinstalled Expansion Type: Locate anchors not more than 6 inches (152 mm) from top and bottom of frame. Space anchors not more than 26 inches (660 mm) o.c.

5. Head Anchors: Two anchors per head for frames more than 42 inches (1067 mm) wide and mounted in metal-stud partitions.
6. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
   a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
   b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
7. Terminated Stops: Terminate stops 6 inches (152 mm) above finish floor with a 90-degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.

D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.

E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.

F. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
4. Provide loose stops and moldings on inside of hollow-metal work.
5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

2.7 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2.8 ACCESSORIES

A. Grout Guards: Formed from same material as frames, not less than 0.016 inch (0.4 mm) thick.

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 embedded and built-in anchors to verify actual locations before frame installation.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.

B. Hollow-Metal Frames: Install hollow-metal frames of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.
   1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
      a. At fire-rated openings, install frames according to NFPA 80.
      b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
      c. Install door silencers in frames before grouting.
      d. Remove temporary braces necessary for installation only after frames have been properly set and secured.
      e. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
      f. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.
   2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
      a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
   3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
   4. Masonry Walls: Coordinate installation of frames to allow for solidly

filling space between frames and masonry with grout.

5. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
   a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
   c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
   1. Non-Fire-Rated Steel Doors:
      a. Between Door and Frame Jambs and Head: 1/8 inch (3.2 mm) plus or minus 1/32 inch (0.8 mm).
      b. Between Edges of Pairs of Doors: 1/8 inch (3.2 mm) to 1/4 inch (6.3 mm) plus or minus 1/32 inch (0.8 mm).
      c. At Bottom of Door: 5/8 inch (15.8 mm) plus or minus 1/32 inch (0.8 mm).
      d. Between Door Face and Stop: 1/16 inch (1.6 mm) to 1/8 inch (3.2 mm) plus or minus 1/32 inch (0.8 mm).
   2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.
   1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (51 mm) o.c. from each corner.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow-metal work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION

SECTION 08141
FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Solid-core doors with wood-veneer faces.
   2. Factory finishing flush wood doors.
   3. Factory fitting flush wood doors to frames and factory machining for hardware.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of door indicated. Include details of core and edge construction and trim for openings. Include factory-finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.
   1. Indicate dimensions and locations of mortises and holes for hardware.
   2. Indicate dimensions and locations of cutouts.
   3. Indicate requirements for veneer matching.
   4. Indicate doors to be factory finished and finish requirements.

1.4 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain flush wood doors and wood paneling from single manufacturer.

B. Quality Standard: In addition to requirements specified, comply with AWI's "Architectural Woodwork Quality Standards Illustrated."

1. Provide AWI Quality Certification Labels or an AWI letter of licensing for Project indicating that doors comply with requirements of grades specified.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in cardboard cartons and wrap bundles of doors in plastic sheeting.

C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

B. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining temperature between 60 and 90 deg F (16 and 32 deg C) and relative humidity between 25 and 55 percent during the remainder of the construction period.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Warping (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a 42-by-84-inch (1067-by-2134-mm) section.
      b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 76.2-mm) span.
   2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
   3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Algoma Hardwoods, Inc.
   2. Eggers Industries.
   3. Graham; an Assa Abloy Group company.
   4. Oshkosh Architectural Door Company.

2.2 DOOR CONSTRUCTION, GENERAL

A. Particleboard-Core Doors:
   1. Particleboard: Straw-based particleboard complying with ANSI A208.1, Grade LD-2 or M-2, except for density.
   2. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware:
      a. 5-inch (125-mm) top-rail blocking, in doors indicated to have closers.
      b. 5-inch (125-mm) bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.
      c. 5-inch (125-mm) midrail blocking, in doors indicated to have exit devices.
   3. Provide doors with either glued-wood-stave or structural-composite-lumber cores instead of particleboard cores for doors indicated to receive exit devices.

B. Structural-Composite-Lumber-Core Doors:
   1. Structural Composite Lumber: WDMA I.S.10.
      a. Screw Withdrawal, Face: 700 lbf (3100 N).

2.3 VENEERED-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors:
   1. Grade: Premium, with Grade A faces.
   2. Species: Red oak.
   3. Cut: Plain sliced (flat sliced).
   4. Match between Veneer Leaves: Book match.
   5. Assembly of Veneer Leaves on Door Faces: Balance match.
   6. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
   7. Exposed Vertical and Top Edges: Same species as faces or a compatible species.
   8. Core: Structural composite lumber.
   9. Construction: Five or seven plies. Stiles and rails are bonded to core,

then entire unit abrasive planed before veneering. Faces are bonded to core using a hot press.

10. Construction: Seven plies, either bonded or nonbonded construction.
11. WDMA I.S.1-A Performance Grade: Heavy Duty.

2.4 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
   1. Comply with requirements in NFPA 80 for fire-rated doors.

B. Transom and Side Panels: Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles.
   1. Fabricate door and transom panels with full-width, solid-lumber, rabbeted, meeting rails. Provide factory-installed spring bolts for concealed attachment into jambs of metal door frames.

C. Openings: Cut and trim openings through doors in factory.
   1. Light Openings: Trim openings with moldings of material and profile indicated.
   2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Division 08 Section "Glazing."

2.5 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
   1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

B. Finish doors at factory.

C. Finish doors at factory that are indicated to receive transparent finish. Field finish doors indicated to receive opaque finish.

D. Finish doors at factory where indicated in schedules or on Drawings as factory finished.

E. Transparent Finish:
   1. Grade: Premium.
   2. Finish: AWI conversion varnish or catalyzed polyurethane system.

3. Staining: As selected by Architect from manufacturer's full range to match existing building standard..
4. Effect: Semi filled finish, produced by applying an additional finish coat to partially fill the wood pores.
5. Sheen: Semigloss.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames before hanging doors.
   1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
   2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Division 08 Section "Door Hardware."

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.

C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION

SECTION 08311
ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Access doors and frames for walls and ceilings.

B. Related Requirements:
   1. Section 07 "Roof Accessories" for roof hatches.
   2. Division 15 for heating and air-conditioning duct damper access doors requirements.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, fire ratings, materials, individual components and profiles, and finishes.

B. Shop Drawings:
   1. Include plans, elevations, sections, details, and attachments to other work.
   2. Detail fabrication and installation of access doors and frames for each type of substrate.

PART 2 - PRODUCTS

2.1 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Access Panel Solutions.
   2. Babcock-Davis.
   3. J. L. Industries, Inc.; Div. of Activar Construction Products Group.

B. Source Limitations: Obtain each type of access door and frame from single source from single manufacturer.

C. Aluminum Flush Access Doors (Non rated conditions):
   1. Assembly Description: Fabricate door to fit flush to frame. Provide manufacturer's standard-width exposed flange, proportional to door size.
   2. Locations: Wall and ceiling.
   3. Door Size: As noted on drawings
   4. Aluminum Sheet for Door: Nominal 0.045 inch (1.15 mm).
      a. Finish: Mill.
   5. Frame Material: Same material, thickness, and finish as door.
   6. Hinges: Manufacturer's standard.
   7. Hardware: Latch.

D. Hardware:
   1. Latch: Self-latching bolt operated by screwdriver with interior release.

2.2 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304. Remove tool and die marks and stretch lines or blend into finish.

C. Frame Anchors: Same type as door face.

D. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

2.3 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access doors to types of supports indicated.
   1. For concealed flanges with drywall bead, provide edge trim for gypsum board and gypsum base securely attached to perimeter of frames.
   2. Provide mounting holes in frames for attachment of units to metal or

wood framing.

3. Provide mounting holes in frame for attachment of masonry anchors.

D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
   1. For cylinder locks, furnish two keys per lock and key all locks alike.
   2. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.

2.4 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Stainless-Steel Finishes:
   1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
   2. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
      a. Run grain of directional finishes with long dimension of each piece.
   3. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
   4. Directional Satin Finish: No. 4.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.3 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION

SECTION 08411
ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

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. Storefront framing for punched openings.
   2. Flush Aluminum Doors
   3. Insulated metal panels framed into window framing system.

B. Related Sections:
   Division 08 Section "Glazing".

1.3 PERFORMANCE REQUIREMENTS

A. General Performance: Aluminum-framed systems shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction:
   1. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
   2. Dimensional tolerances of building frame and other adjacent construction.
   3. Failure includes the following:
      a. Deflection exceeding specified limits.
      b. Thermal stresses transferring to building structure.
      c. Framing members transferring stresses, including those caused by thermal and structural movements to glazing.
      d. Noise or vibration created by wind and by thermal and structural movements.
      e. Loosening or weakening of fasteners, attachments, and other components.
      f. Sealant failure.
      g. Failure of operating units.

B. Delegated Design: Design aluminum-framed systems, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Structural Loads:
   1. Wind Loads: As indicated on Structural Drawings.

D. Deflection of Framing Members:
   1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane shall not exceed L/175 of the glass edge length for each individual glazing lite] or an amount that restricts edge deflection of individual glazing lites to 3/4 inch (19 mm), whichever is less.
   2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components directly below them to less than 1/8 inch (3.2 mm) and clearance between members and operable units directly below them to less than 1/16 inch (1.5 mm).

E. Structural-Test Performance: Provide aluminum-framed systems tested according to ASTM E 330 as follows:
   1. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.

F. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. (0.03 L/s per sq. m) of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 1.57 lbf/sq. ft. (75 Pa).

G. Water Penetration under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa).

H. Water Penetration under Dynamic Pressure: Provide aluminum-framed systems that do not evidence water leakage through fixed glazing and framing areas when tested according to AAMA 501.1 under dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa).
   1. Maximum Water Leakage: According to AAMA 501.1 No uncontrolled water penetrating aluminum-framed systems or water appearing on systems' normally exposed interior surfaces from sources other than

condensation. Water leakage does not include water controlled by flashing and gutters that is drained to exterior and water that cannot damage adjacent materials or finishes.

I. Thermal Movements: Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
   2. Test Performance: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.
      a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F (82 deg C).
      b. Low Exterior Ambient-Air Temperature: 0 deg F (minus 18 deg C).
   3. Interior Ambient-Air Temperature: 75 deg F (24 deg C).

J. Condensation Resistance: Provide aluminum-framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than 45 when tested according to AAMA 1503.

K. Thermal Conductance: Provide aluminum-framed systems with fixed glazing and framing areas having an average U-factor of not more than 0.57 Btu/sq. ft. x h x deg F (3.23 W/sq. m x K) when tested according to AAMA 1503.

L. Sound Transmission: Provide aluminum-framed systems with fixed glazing and framing areas having the following sound-transmission characteristics:
   1. Sound Transmission Class (STC): Minimum 30 STC when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 413.
   2. Outdoor-Indoor Transmission Class (OITC): Minimum 30 OITC when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 1332.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for aluminum-framed systems.

B. Shop Drawings: For aluminum-framed systems. Include plans, elevations,

sections, details, and attachments to other work.
1. Include details of provisions for system expansion and contraction and for drainage of moisture in the system to the exterior.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Delegated-Design Submittal: For aluminum-framed systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
1. Detail fabrication and assembly of aluminum-framed systems.
2. Include design calculations.

1.5 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for aluminum-framed systems, indicating compliance with performance requirements.

B. Warranties: Sample of special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.

C. Engineering Responsibility: Prepare data for aluminum-framed systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in systems similar to those indicated for this Project.

D. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including

preconstruction testing, field testing, and in-service performance.

1. Do not revise intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If revisions are proposed, submit comprehensive explanatory data to Architect for review.

E. Source Limitations for Aluminum-Framed Systems: Obtain from single source from single manufacturer.

F. Welding Qualifications: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code - Aluminum."

1.8 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Structural failures including, but not limited to, excessive deflection.
   b. Noise or vibration caused by thermal movements.
   c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   d. Water leakage through fixed glazing and framing areas.
   e. Failure of operating components.
2. Warranty Period: Five years from date of Substantial Completion.

B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes do not comply with requirements or that fail in materials or workmanship within specified warranty period. Warranty does not include normal weathering.

1. Warranty Period: ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available

manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Manko Window Systems. 1145 Series design basis
2. EFCO Corporation.
3. Kawneer North America; an Alcoa company.

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
   1. Sheet and Plate: ASTM B 209 (ASTM B 209M).
   2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
   3. Extruded Structural Pipe and Tubes: ASTM B 429.
   4. Structural Profiles: ASTM B 308/B 308M.
   5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

B. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer, complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.
   1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
   2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
   3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.3 FRAMING SYSTEMS

A. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.
   1. Construction: Thermally broken.
   2. Glazing System: Retained mechanically with gaskets on four sides.
   3. Glazing Plane: Front.

B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
   1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.

2. Reinforce members as required to receive fastener threads.
3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.

D. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts, complying with ASTM A 123/A 123M or ASTM A 153/A 153M.

E. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

F. Framing System Gaskets and Sealants: Manufacturer's standard, recommended by manufacturer for joint type.

2.4 GLAZING SYSTEMS

A. Glazing: As specified in Division 08 Section "Glazing."

B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, molded or extruded, of profile and hardness required to maintain watertight seal.

C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

2.5 INSULATED METAL PANELS

A. Insulated metal panels to consist of a finished face metal laminated to a face stabilizer, and insulating core, back stabilizer and back face. Components to be laminated into one monolithic unit.
   1. Face and back Material: .Aluminum, .032
      a. Color: Anodized to match Framing System
   2. Face and back Substrate: Asbestos free cement board, 4mm thick
   3. Insulating Core: Polystyrene, 2 lb density

B. Panel Thickness: 1.75″ nominal

C. Panel R-Value: 7.8

2.6 FLUSH ALUMINUM DOORS

A. Flush Doors: Manufacturer's standard flush doors for manual-swing operation.
   1. Door Construction: 2-inch (50.8-mm) overall thickness, with minimum 0.188-inch- (4.8-mm-).
   2. Door Face Sheet: Architectural Quality 5005 alloy aluminum sheet 0.062″

(1.6mm) thick, embossed.
3. Door Core: Foam in place urethane foam. 5.0 lb/cu. ft. density.
4. R-Value: minimum 9

B. Fasteners: Aluminum, nonmagnetic stainless steel or other materials to be non-corosive and compatible with aluminum framed flush door members, trim hardware, anchors and other componants.

C. Reinforcing Members: Aluminum, non-magnetic stainless steel, or nickel chrome-plated steel complying with ASTM B 456 for Type SC3 severe series conditions.

D. Hardware: Provide manufacturer;s standard hardware fabricated from aluminum, stainless steel or other corrosive resistant material compatible with aluminum, designed to smoothly operate, tightly close, and securely operate.

2.7 ACCESSORY MATERIALS

A. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Division 07 Section "Joint Sealants."

B. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30-mil (0.762-mm) thickness per coat.

2.8 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:
1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
4. Physical and thermal isolation of glazing from framing members.
5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
6. Fasteners, anchors, and connection devices that are concealed from view

to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. Storefront Framing: Fabricate components for assembly using shear-block system.

F. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.9 ALUMINUM FINISHES

A. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
   1. Color: Dark Bronze

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General:
   1. Comply with manufacturer's written instructions.
   2. Do not install damaged components.
   3. Fit joints to produce hairline joints free of burrs and distortion.
   4. Rigidly secure nonmovement joints.
   5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
   6. Seal joints watertight unless otherwise indicated.

B. Metal Protection:
   1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or applying sealant or tape, or by installing nonconductive spacers as recommended by manufacturer for this purpose.

2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

D. Set continuous sill members and flashing in full sealant bed as specified in Division 07 Section "Joint Sealants" to produce weathertight installation.

E. Install components plumb and true in alignment with established lines and grades, and without warp or rack.

F. Install glazing as specified in Division 08 Section "Glazing."

G. Install perimeter joint sealants as specified in Division 07 Section "Joint Sealants" to produce weathertight installation.

3.3 ERECTION TOLERANCES

A. Install aluminum-framed systems to comply with the following maximum erection tolerances:
   1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet (3 mm in 3.7 m); 1/4 inch (6 mm) over total length.
   2. Alignment:
      a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch (1.5 mm).
      b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch (0.8 mm).

B. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch (3 mm).

END OF SECTION

SECTION 08710
DOOR HARDWARE

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. Mechanical door hardware for the following:
      a. Swinging doors.
   2. Cylinders for door hardware specified in other Sections.
   3. Electrified door hardware.

B. Related Sections:
   1. Division 08 Section "Hollow Metal Doors and Frames".
   2. Division 08 Section "Flush Wood Doors".
   3. Division 16 Sections for connections to electrical power system and for low-voltage wiring work.

C. Products furnished, but not installed, under this Section include the products listed below. Coordinating and scheduling the purchase and delivery of these products remain requirements of this Section.
   1. Lock cylinders to be installed under other Sections.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Details of electrified door hardware, indicating the following:
   1. Wiring Diagrams: For power, signal, and control wiring and including the following:
      a. Details of interface of electrified door hardware and building safety and security systems.
      b. Schematic diagram of systems that interface with electrified door hardware.

c. Point-to-point wiring.
d. Risers.
e. Elevations doors controlled by electrified door hardware.

2. Operation Narrative: Describe the operation of doors controlled by electrified door hardware.

C. Samples for Initial Selection: For plastic protective trim units in each finish, color, and texture required for each type of trim unit indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For electrified door hardware, from the manufacturer.
1. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.

B. Product Test Reports: For compliance with accessibility requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.

C. Warranty: Special warranty specified in this Section.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware schedule.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and an Architectural Hardware Consultant who is available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.
1. Warehousing Facilities: In Project's vicinity.
2. Scheduling Responsibility: Preparation of door hardware and keying schedules.
3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Source Limitations: Obtain each type of door hardware from a single manufacturer.
1. Provide electrified door hardware from same manufacturer as mechanical

door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

C. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated, provide door hardware rated for use in assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C, unless otherwise indicated.

D. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meet requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
   1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at the tested pressure differential of 0.3-inch wg (75 Pa) of water.

E. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

F. Means of Egress Doors: Latches do not require more than 15 lbf (67 N) to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

G. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.
   1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22.2 N).
   2. Comply with the following maximum opening-force requirements:
      a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.
      b. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
   3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high.
   4. Adjust door closer sweep periods so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches (75 mm) from the latch, measured to the leading edge of the door.

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

In addition to Owner, Construction Manager, Contractor, and Architect, conference participants shall also include Installer's Architectural Hardware Consultant and Owner's security consultant. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:

1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
2. Preliminary key system schematic diagram.
3. Requirements for key control system.
4. Requirements for access control.
5. Address for delivery of keys.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

1.8 COORDINATION

A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

E. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including excessive deflection, cracking, or breakage.
      b. Faulty operation of doors and door hardware.
      c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
   2. Warranty Period: Three years from date of Substantial Completion, unless otherwise indicated.
      a. Electromagnetic and Delayed-Egress Locks: Five years from date of Substantial Completion.
      b. Exit Devices: Two years from date of Substantial Completion.
      c. Manual Closers: 10 years from date of Substantial Completion.

1.10 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

B. Maintenance Service: Beginning at Substantial Completion, provide six months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door and door hardware operation. Provide parts and supplies that are the same as those used in the manufacture and installation of original products.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. Provide door hardware for each door as scheduled on Drawings & Specifications to comply with requirements in this Section.
   1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and products equivalent in function and comparable in quality to named products.

B. Designations: Requirements for design, grade, function, finish, size, and other

distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Schedule" Article. Products are identified by using door hardware designations, as follows:

1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Schedule" Article.

2.2 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by Architect.
   1. Manufacturer's identification is permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.

C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.
   1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
   2. Fire-Rated Applications:
      a. Wood or Machine Screws: For the following:
         1) Hinges mortised to doors or frames; use threaded-to-the-head wood screws for wood doors and frames.
         2) Strike plates to frames.
         3) Closers to doors and frames.
      b. Steel Through Bolts: For the following unless door blocking is provided:
         1) Surface hinges to doors.
         2) Closers to doors and frames.
         3) Surface-mounted exit devices.

3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
4. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."
5. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.3 BUTTS AND HINGES

A. Hinges: BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

Type	McKinney	Hager	Stanley	Bommer
Type 1	T4A3795	BB1262	FBB268	BB5024
Type 2	TA2714	BB1279	FBB179	BB5000
Type 3	TA2314	BB1191	FBB191	BB5002
Type 4	T4A3786	BB1168	FBB168	BB5004
Type 5	T4A3386	BB1199	FBB199	BB5006

B. Application:
   1. Exterior out swinging doors Type 5 x NRP
   2. Exterior inswinging doors and vestibule doors Type 4
   3. Interior doors with closers Type 2 or 4
   4. Interior doors over 36 inches wide Type 4
   5. Interior doors 36 inches or less without closer Type 2
   6. Provide NRP (non-removable pins) at out-swinging lockable doors.

C. Size:
   1. 2-1/4 inch Doors: 5 inch by 5 inch
   2. 1-3/4 inch Doors: 4-1/2 inch by 4-1/2 inch
   3. 1-3/8 inch Doors: 3-1/3 inch by 3-1/2 inch

D. Quantity:
   1. (2) Hinges per leaf for openings through 60 inches high.
   2. (1) Additional hinge per leaf for each additional 30 inches in height or fraction thereof.
   3. (4) Dutch doors up to 90 inches in height.

E. Drill 5/32 inch hole and use No. 12, 1-1/4 inch steel threaded to the head wood screws for hinges on wood doors.

2.4 ELECTRIC HINGES

A. Acceptable manufacturers:

McKinney	Hager	Stanley
CC	ETW	CE

B. Provide sufficient number of concealed wires to accommodate electric function of specified hardware.

C. Electric hinges to be located at second hinge from bottom. Where electric hinges are used in conjunction with exit devices, locate hinge nearest to exit device.

D. Provide mortar guard similar to McKinney MG-16 for each electric hinge specified.

2.5 CONTINUOUS HINGES

A. Acceptable manufacturers:

Roton	Stanley	Pemko	McKinney
780-112HD	501 Series	FM83SLFHD	MCK-12HD
780-224HD	521 Series	FM83HD	MCK-25HD

1. Provide one of the above two models of continuous hinges as appropriate for the type, inset, and thickness of door where specified. Coordinate hinge types with the door supplier.

2.6 MECHANICAL LOCKS AND LATCHES

A. Lock Functions: As indicated in door hardware schedule.

B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
   1. Mortise Locks: Minimum 3/4-inch (19-mm) latchbolt throw.
   2. Deadbolts: Minimum 1-inch (25-mm bolt throw.

C. Lock Backset: 2-3/4 inches (70 mm), unless otherwise indicated.

D. Lock Trim:
   1. Levers: Cast.
   2. Knobs: Wrought.
   3. Escutcheons (Roses): Wrought.
   4. Dummy Trim: Match lever lock trim and escutcheons.

5. Operating Device: Lever with escutcheons (roses).

E. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.

2.7 LOCKSETS – cylindrical

A. Acceptable Manufacturer and Series:

Manufacturer	Series
Schlage	ND-Series x Athens – Lever locksets

1. Cylinders: Manufacturer's standard removable core 6-pin.
2. Backsets: 2-3/4 inches.
3. Strikes: Provide wrought boxes and strikes with proper lip length to protect trim but not to project more than 1/8 inch beyond trim, frame or inactive leaf. Where required, provide open back strike and protected to allow practical and secure operation.
4. Contractor to provide cylinders compatible with "Primus" lock system
5. Keying by owner. Furnish two blanks per lockset and deadlock
6. Security card access hardware and locations (when scheduled), to be determined by owner

2.8 LOCKSETS – KEYLESS PUSHBUTTON – Not used

2.9 AUXILIARY LOCKS

A. Bored Auxiliary Locks: BHMA A156.5: Grade 1; with strike that suits frame.
   1. Manufacturers
      a. Schlage Commercial Lock Division; an Ingersoll-Rand company.
   2. Contractor to provide cylinders compatible with "Primus" lock system
   3. Keying by owner. Furnish two blanks per lockset and deadlock

2.10 EXIT DEVICES

A. Acceptable Manufacturers:

Von Duprin	Sargent	Precision	Yale
98/99 Series	80 Series	Apex Series	

1. Provide exit device series and functions as specified in Hardware Groups.
2. All exit devices shall be UL listed for panic. Exit devices for labeled doors shall be UL tested as "Fire Exit Hardware".
3. Where lever trim is specified, provide lever design to match lockset levers.
4. Contractor to provide cylinders compatible with "Primus" lock system
5. Keying by owner. Furnish two blanks per lockset and deadlock
6. Provide cylinders for exit devices with locking trim and cylinder dogging.
7. Provide cylinder dogging feature for non-rated exit devices.
8. Provide keyed removable mullions, as specified in the Hardware Groups

2.11 DELAYED EGRESS EXIT DEVICES – Not used

2.12 ELECTRIC STRIKES – Not Used

2.13 ELECTROMECHANICAL LOCKS– Not used

2.14 MAGNETIC LOCKS - Not Used

2.15 KEYING

A. Contractor to provide cylinders compatible with "Primus" lock system

B. Keying by owner. Furnish two blanks per lockset and deadlock

C. High-Security Lock Cylinders: BHMA A156.30; Grade 1; Type M, mechanical;

D. Provide removable core cylinders for each lock with construction masterkeying. Permanent cores shall be installed upon completion of the project.

2.16 DOOR TRIM

A. Operating Trim: BHMA A156.6; stainless steel, unless otherwise indicated.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

Hiawatha	Quality	Rockwood
200H	40-6" x 16"	Equivalent
200F	40-4" x 16"	Equivalent
1081F	473	Equivalent
658A	521	Equivalent

536A	163-10"	Equivalent
523A	161-8"	Equivalent
DE-2AJ	16	Equivalent

B. Push Plates:
   1. Hiawatha type 200H 6 inches by 16 inch unless otherwise indicated.
   2. 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.

C. Push Bars:
   1. Hiawatha type 1081 LBP, unless otherwise indicated.

D. Pulls:
   1. Hiawatha Series 658A, unless otherwise indicated.
   2. Where required, mount back to back with push bars.

E. Kick Plates and Armor Plates: Minimum of 0.050 inch thick, beveled 4 edges.
   1. At single doors provide width 1-1/2 inch less than door width on stop side and one inch less than door width on face side.
   2. At pairs of doors provide width one inch less than door width on both sides.
   3. Height of 10 inches, unless otherwise indicated.
   4. Edge Guards: Minimum .050 inch thick, stainless steel,
   5. Hiawatha type DE-2AJ x 42 inches high as noted in Hardware Groups.

2.17 DOOR CLOSERS

A. BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.
   1. Manufacturers:

LCN (design basis)	Campus standard	No exceptions taken
4041 series	Heavy duty	

B. Provide non-sized closers, adjustable to meet maximum opening force requirements of ADA.

C. Provide drop plates, brackets, or adapters for arms as required to suit details.

D. Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.

E. Provide back-check for closers.

F. Provide hold-open arms at main interior entrances.

G. Provide closers for doors as noted in Hardware Groups and, in addition, provide closers for labeled doors whether or not specifically noted in group.

H. Provide closers meeting the requirements of UBC 7-2 and UL 10C positive pressure tests.

2.18 OVERHEAD STOPS – Not used

2.19 WALL STOPS AND HOLDERS

A. Acceptable Manufacturers and Types:

Rockwood	Ives	Quality
Equivalent	407	W307
Equivalent	407	W302
Equivalent	443	417ES
Equivalent	451	418ES

B. Provide 50W Series wall stop as applicable, for each door leaf except where wall stops WB11X are specified in Hardware Groups, or where conditions require the use of an overhead stop.

C. Provide 1540 Series overhead stops for doors that swing more than 140 degrees before striking a wall.

D. Floor or base stops shall be used only where definitely specified or absolutely unavoidable.

2.20 THRESHOLDS

A. Acceptable Manufacturers: Pemko, Reese Enterprises, and National Guard Products.

Pemko	Reese	National Guard
171A	S205A	425 Alum

B. Where thresholds are specified in hardware groups, provide 171A thresholds unless detailed otherwise.

C. Refer to drawings for special details. Provide accessories, shims and fasteners.

D. Where thresholds occur at openings with one or more mullions, they shall be cut for the mullions and extended continuously for the entire opening.

2.21 WEATHERSTRIPING

A. Acceptable Manufacturers and Product:

	Pemko	Reese	National Guard
Sweeps	315CN	323A	200N
Jambs	303AS	378C	135N
Door top drips	346C	R201A	16AD

B. Where weather-stripping is specified in hardware groups, provide 316AV unless detailed otherwise.

C. Provide self-tapping fasteners for weatherstripping being applied to hollow metal frames.

D. Where sweeps are specified in hardware groups, provide 315CN unless detailed otherwise.

E. Where rain drips are specified in hardware groups, provide 346C x full frame width, unless detailed otherwise.

2.22 GASKETING

A. Acceptable Manufacturers: Pemko, Reese Enterprises, and National Guard Products. Refer to drawings for special details. Provide accessories, shims and fasteners.

Pemko	Reese	National Guard
PK55D	F-897B	2525

B. Where smoke gasket is specified in hardware groups, provide PK55D, unless detailed otherwise.

C. Provide gaskets for 20-minute doors and doors designated for smoke control.

D. Provide gaskets in conformance with the requirements of UBC 7-2 and UL 10C positive pressure tests.

2.23 SOUND GASKETING

A. Acceptable Manufacturers:
   1. Acoustical gasketing and door bottoms:

TYPE	Pemko	Reese	National Guard
Automatic Door Bottoms	4301CRL	330C	420A
Jambs	379CR	33C	107NA

B. Where gasketing is specified in hardware groups, provide 4301 CRL and 379 CR unless detailed otherwise.

C. Provide self-tapping fasteners being applied to hollow metal doors and frames.

2.24 DOOR POSITION SWITCHES

A. Acceptable Manufacturers and Types:

Securitron	Sentrol	Detex
DPS	1078CW	MS-2049F

B. Coordinate door and frame preparations with door and frame suppliers.

C. Switches shall be installed in frame head approximately 4" from latching door edge.

2.25 LATCH PROTECTORS

A. Acceptable Manufacturers and types:

Rockwood	Don-Jo
equivalent	110-32D

B. Latch protectors shall be stainless steel of the type required to work with the specified latch.

2.26 FASTENERS

A. Including, but not limited to, wood or machine screws, bolts, bolts, nuts, anchors, etc. of proper type, material, and finish required for installation of hardware.

B. Use Phillips head for exposed screws. Do not use aluminum screws to attach hardware.

C. Provide self-tapping (TEC) screws for attachment of sweeps and stop-applied weatherstripping.

2.27 TYPICAL FINISHES AND MATERIALS

A. Standard: Comply with BHMA A156.18.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. BHMA Designations: Comply with base material and finish requirements indicated by the following:

E. Finishes, unless otherwise specified:
   1. US 26D satin chrome finish (interior) 619 satin nickel (exterior).

2.28 AUXILIARY DOOR HARDWARE

A. Auxiliary Hardware: BHMA A156.16.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Hager Companies.
      b. Rockwood Manufacturing Company.
      c. Stanley Commercial Hardware; Div. of the Stanley Works.

2.29 AUXILIARY ELECTRIFIED DOOR HARDWARE – Not used

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.

B. Wood Doors: Comply with DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.
   1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
   2. Custom Steel Doors and Frames: HMMA 831.
   3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 09 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
   1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
   2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever

is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

D. Lock Cylinders: Install construction cores to secure building and areas during construction period.
   1. Replace construction cores with permanent cores as directed by Owner.
   2. Furnish permanent cores to Owner for installation.

E. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

F. Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings. Verify location with Architect.
   1. Configuration: Provide least number of power supplies required to adequately serve doors with electrified door hardware.

G. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

H. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.

I. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

J. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

K. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
   1. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
   2. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

B. Occupancy Adjustment: Approximately three months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.5 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Division 01 Section "Demonstration and Training."

3.7 HARDWARE GROUPS AND SUFFIXES

A. 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.

B. Refer to the door schedule for hardware group required at each door opening. Ignore hardware groups not used on the door schedule.

C. Hardware group suffixes used in door schedule:

"A" Add armor plate (2 for double-acting doors). Apply to push side of door. Refer to preamble for detailed information.

"D" Add delayed action function to specified closer.

"E" Add closer/holder life safety device unit. Refer to preamble for detailed information.

"G" Add door edge guard. Refer to preamble for detailed information. Use Hiawatha DE-1A or approved equal.

"H" Add hold-open feature to closer or magnetic holder as detailed if labeled opening.

"K" Add kickplate. Refer to preamble for detailed information.

"L" All mortised hardware shall be lead-lined, including roses. Add L147 pivot with ML19 intermediate pivots spaced at same intervals as hinges. Add door edge guards and kickplates.

"M" Add door position switch. Refer to preamble for detailed information.

"P" Change specified closer to stop type arm. Use brackets or spacers as required for proper application.

"S" Provide sound gasket, threshold, and automatic door bottom as specified.

"W" Furnish weatherstrip. Sweep strip, and threshold as required. For exterior pairs, furnish astragal similar to Pemko 18041_P for each leaf.

PART 4 HARDWARE GROUPS

GROUP 12 - Office, no closer

Function: Latchbolt retracted by lever either side unless outside lever is locked by turn button on inside (cyl) or toggle on lock front (mort). Key outside retracts latchbolt.
Hinges as specified
1 each Lockset
Deadlocking latchbolt.
1 each Stop

GROUP 14 - Storeroom, no closer

Function: Latchbolt retracted by lever inside only. Outside lever is always RIGID. Key outside retracts latchbolt. Deadlocking latchbolt.
Hinges as specified
1 each Lockset
1 each Stop

GROUP 83 - Exit with lever trim

Function: Latch bolt retracted by outside lever, unless outside lever locked by key

outside. Key locks or unlocks outside lever.
Hinges as specified
1 each Exit Devices, 8713 x ET or 12-8713 x ET
1 each Closers
1 each Kick plates
1 each Stops

GROUP 95 - Push/Pull, single with deadbolt
Function: Deadbolt operated by key outside side, thumb turn to exit inside.
Hinges as specified
1 each Deadlock double cylinder
1 each Push Plate, Hiawatha 200H
1 each Pull Plate, Hiawatha 523A x 200F
1 each Closer
1 each Kick plate
1 each Stop

GROUP 100 - Exit only, aluminum
Function: No outside operation.
1 each Continuous Hinge as specified
1 each Exit Device, 8510 x less dogging
1 each Closer
1 each Overhead Stop, 690S
1 each Threshold
1 each Sweep

GROUP 110 - vestibule, push/pull
Function: passage. Single door unlocked at all times. Push Pull HW.
1 each Continuous Hinge as specified
1 each Push Bar, Hiawatha 1081LBP
1 each Pull, 658A
1 each Closer
1 each Overhead Stop, 690S

GROUP 206 - Single door, aluminum with card reader/keypad access control
Function: Latch bolt retracted by exit device inside, lever outside. Single door mechanically locked at all times unless unlocked by key, or dogged open, . Door opening to be prepped for future electric latch retraction (ELR) function.
Continuous Hinge x EPT prep
1 each EPT prep for door and frame, with cover plates
1 each exit device
1 each Closer

1 each Kick plate
1 each Threshold
1 each Sweeps
Weather-stripping by Aluminum Door Supplier.

Door to be prepped for future electronic access control. Will require addition of ELR kit and electric power transfer, along with all necessary card readers, controllers, power supplies, etc to make complete system. When installed, door will be locked at all times, and will be unlocked (latch retracted) upon valid card read.

END OF SECTION

SECTION 08800
GLAZING

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 glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
   1. Doors.
   2. Storefront framing.

B. Related Sections:
   1. Division 07 Section "HM doors & frames, wood doors".
   2. Division 08 Section "Aluminum framed entrances & storefronts."

1.3 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

C. Interspace: Space between lites of an insulating-glass unit.

1.4 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Delegated Design: Design glass, including comprehensive engineering analysis according to ICC's 2009 International Building Code by a qualified

professional engineer, using the following design criteria:
1. Design Wind Pressures: As indicated on Structural Drawings.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
1. Differential values in subparagraph below (for aluminum in particular) are suitable for most of the U.S.
2. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.5 ACTION SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches (300 mm) square.

1. Insulating glass.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturers of insulating-glass units with sputter-coated, low-e coatings.

B. Product Certificates: For glass and glazing products, from manufacturer.

C. Warranties: Sample of special warranties.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved and certified by coated-glass manufacturer.

B. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

D. Source Limitations for Glass: Obtain insulating glass from single source from single manufacturer for each glass type.

E. Source Limitations for Glazing Accessories: Obtain from single source from

single manufacturer for each product and installation method.

F. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

G. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

H. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

I. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, test standard, whether glazing is for use in fire doors or other openings, whether or not glazing passes hose-stream test, whether or not glazing has a temperature rise rating of 450 deg F (250 deg C), and the fire-resistance rating in minutes.

J. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F (4.4 deg C).

1.10 WARRANTY

A. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
   1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GLASS PRODUCTS, GENERAL

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Viracon Industries
   2. PPG Industries.
   3. Guardian Industries

B. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.

C. Minimum Glass Thickness for Exterior Lites: Not less than 6.0 mm.

D. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.

E. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
   1. For monolithic-glass lites, properties are based on units with lites 6.0 mm

thick of thickness indicated.

2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
3. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F (W/sq. m x K).
4. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
5. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.2 GLASS PRODUCTS

A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.

B. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.
   1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
   2. For uncoated glass, comply with requirements for Condition A.
   3. For coated vision glass, comply with requirements for Condition C (other coated glass).

2.3 INSULATING GLASS

A. Insulating-Glass Units: Preassembled units consisting of sealed lites of glass separated by a dehydrated interspace, and complying with ASTM E 774 for Class CBA units and with requirements specified in this Article and in the Insulating-Glass Schedule.
   1. Provide Kind HS (heat-strengthened) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in "Performance Requirements" Article. Provide Kind FT (fully tempered) where safety glass is indicated.

B. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated in the Insulating-Glass Schedule are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.

C. Sealing System: Dual seal, with primary and secondary sealants as follows:
   1. Polyisobutylene and silicone.

D. Spacer Specifications: Manufacturer's standard spacer material and construction complying with the following requirements:
   1. Aluminum with mill or clear-anodized finish.
   2. Corner Construction: Manufacturer's standard corner construction.

2.4 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:
   1. Neoprene complying with ASTM C 864.
   2. EPDM complying with ASTM C 864.
   3. Silicone complying with ASTM C 1115.
   4. Thermoplastic polyolefin rubber complying with ASTM C 1115.

2.5 GLAZING SEALANTS

A. General:
   1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
   2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
   3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

2.6 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

G. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

2.7 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
   1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
   2. Presence and functioning of weep systems.
   3. Minimum required face and edge clearances.
   4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass

immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm).
   1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
   2. Provide 1/8-inch (3-mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

J. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

K. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
   1. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

C. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Install gaskets so they protrude past face of glazing stops.

3.5 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face

clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.6 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

PART 4 - SCHEDULE

4.1 SINGLE PANE GLAZING TYPES – GL-1

A. Single Glass:
   1. Clear Glass (GL-1): ¼ inch thickness unless otherwise indicated; comply with ASTM C1036, Type I (transparent glass, flat), Class 1 (clear), Quality q3 (glazing select).

2. Clear Tempered Glass (GL-1T): ¼ inch thickness unless otherwise indicated; comply with ASTM C1036, Type I (transparent glass, flat), Class 1 (clear), Quality q3 (glazing select), and further processed to comply with ASTM C1048, Kind FT (fully tempered).

4.2 INSULATING-GLASS TYPES – GL-20

A. Glass Type GL-20: Low-e-coated, clear insulating glass. Viracon, VNE 1-63 (desing basis).
   1. Overall Unit Thickness: 1 inch (25 mm).
   2. Outdoor Lite: 1/4" Float glass.
   3. Interspace Content: Air
   4. Indoor Lite: 1/4" Float glass.
   5. Low-E Coating: Sputtered on second surface.
   6. Visible Light Transmittance: 62 percent minimum.
   7. Winter Nighttime U-Factor: 0.29 maximum.
   8. Summer Daytime U-Factor: 0.26 maximum.
   9. Solar Heat Gain Coefficient: 0.29 maximum.

B. Glass Type GL-20T: Low-e-coated, clear insulating glass. Tempered. Viracon, VNE 1-63 (desing basis).

   1. Overall Unit Thickness: 1 inch (25 mm).
   2. Outdoor Lite: 1/4" tempered glass.
   3. Interspace Content: Air
   4. Indoor Lite: 1/4" tempered glass.
   5. Low-E Coating: Sputtered on second surface.
   6. Visible Light Transmittance: 62 percent minimum.
   7. Winter Nighttime U-Factor: 0.29 maximum.
   8. Summer Daytime U-Factor: 0.26 maximum.
   9. Solar Heat Gain Coefficient: 0.29 maximum.

END OF SECTION

SECTION 09221
NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Non-load-bearing steel framing systems for interior gypsum board assemblies.
   2. Suspension systems for interior gypsum ceilings, soffits, and grid systems.

B. Related Requirements:
   1. Division 05 Section "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs; floor joists; roof rafters and ceiling joists; and roof trusses.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 FRAMING SYSTEMS

A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
   1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
   2. Protective Coating: ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized unless otherwise indicated.

B. Studs and Runners: ASTM C 645. Use either steel studs and runners or dimpled steel studs and runners.
   1. Steel Studs and Runners:
      a. Minimum Base-Metal Thickness: 0.027 inch (0.68 mm).
      b. Depth: As indicated on Drawings.
   2. Dimpled Steel Studs and Runners:
      a. Minimum Base-Metal Thickness: 0.025 inch (0.64 mm).
      b. Depth: As indicated on Drawings.

C. Slip-Type Head Joints: Where indicated, provide one of the following:
   1. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
      a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
         1) Dietrich Metal Framing; SLP-TRK Slotted Deflection Track.
         2) MBA Building Supplies;
         3) Telling Industries;

D. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
   1. Minimum Base-Metal Thickness: 0.027 inch (0.68 mm).

E. Cold-Rolled Channel Bridging: Steel, 0.053-inch (1.34-mm) minimum base-metal thickness, with minimum 1/2-inch- (13-mm-) wide flanges.
   1. Depth: As indicated on Drawings.
   2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches (38 by 38 mm), 0.068-inch- (1.72-mm-) thick, galvanized steel.

F. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
   1. Minimum Base-Metal Thickness: 0.018 inch (0.45 mm).
   2. Depth: As indicated on Drawings.

2.3 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.
   1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide one of the following:
   1. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
   1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

B. Coordination with Sprayed Fire-Resistive Materials:
   1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches (610 mm) o.c.
   2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754.
   1. Gypsum Plaster Assemblies: Also comply with requirements in ASTM C 841 that apply to framing installation.
   2. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C 1063 that apply to framing installation.
   3. Gypsum Veneer Plaster Assemblies: Also comply with requirements in ASTM C 844 that apply to framing installation.
   4. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

C. Install bracing at terminations in assemblies.

D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
   1. Single-Layer Application: 6 inches (406 mm) o.c. unless otherwise indicated.
   2. Tile Backing Panels: 16 inches (406 mm) o.c. unless otherwise indicated.

B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction.

D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
   1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
   2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

a. Install two studs at each jamb unless otherwise indicated.
b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (13-mm) clearance from jamb stud to allow for installation of control joint in finished assembly.
c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.

E. Direct Furring:
1. Screw to wood framing.
2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.

F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

END OF SECTION

SECTION 09290
GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Interior gypsum board.

B. Related Requirements:
   1. Division 09 Section "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board panels.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not

limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. CertainTeed Corp.
   2. Georgia-Pacific Gypsum LLC.
   3. National Gypsum Company.
   4. USG Corporation.

B. Gypsum Board, Type X: ASTM C 1396/C 1396M.
   1. Thickness: 5/8 inch (15.9 mm).
   2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.
   3. Face Paper: 100% recycled natural finish paper
   4. Liner Paper: 100% recycled paper

2.4 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.
   1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.
   2. Shapes:

a. Cornerbead.
b. LC-Bead: J-shaped; exposed long flange receives joint compound.
c. U-Bead: J-shaped; exposed short flange does not receive joint compound.
d. Curved-Edge Cornerbead: With notched or flexible flanges.

B. Exterior Trim: ASTM C 1047.
1. Material: Hot-dip galvanized steel sheet, plastic, or rolled zinc.
2. Shapes:
a. Cornerbead.
b. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.

2.5 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:
1. Interior Gypsum Board: Paper.
2. Exterior Gypsum Soffit Board: Paper.
3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.

C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
a. Use setting-type compound for installing paper-faced metal trim accessories.
3. Fill Coat: For second coat, use setting-type, sandable topping compound.
4. Finish Coat: For third coat, use setting-type, sandable topping compound.
5. Skim Coat: For final coat of Level 5 finish, use high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.

D. Joint Compound for Exterior Applications:
1. Exterior Gypsum Soffit Board: Use setting-type taping compound and setting-type, sandable topping compound.
2. Glass-Mat Gypsum Sheathing Board: As recommended by sheathing board manufacturer.

2.6 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
   1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
   2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

C. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
   1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

D. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Pecora Corporation; AIS-919.
      b. Specified Technologies, Inc.; Smoke N Sound Acoustical Sealant.
      c. USG Corporation; SHEETROCK Acoustical Sealant.

E. Thermal Insulation: As specified in Division 07 Section "Thermal Insulation."

F. Vapor Retarder: As specified in Division 07 Section "Thermal Insulation."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panel's not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
   1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
   2. Fit gypsum panels around ducts, pipes, and conduits.
   3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8- inches- (6.4- to 9.5-mm-) wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2- inches- (6.4- to 12.7-mm-) wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.

J. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

K. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:
   1. Wallboard Type: As indicated on Drawings.
   2. Type X: Where required for fire-resistance-rated assembly.

B. Single-Layer Application:
   1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
   2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
      a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
      b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
   3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
   4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

3.4 APPLYING EXTERIOR GYPSUM PANELS FOR CEILINGS AND SOFFITS

A. Apply panel's perpendicular to supports, with end joints staggered and located over supports.
   1. Install with 1/4-inch (6.4-mm) open space where panels abut other

construction or structural penetrations.
2. Fasten with corrosion-resistant screws.

3.5 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:
   1. Cornerbead: Use at outside corners unless otherwise indicated.
   2. LC-Bead: Use at exposed panel edges.
   3. Curved-Edge Cornerbead: Use at curved openings.

D. Exterior Trim: Install in the following locations:
   1. Cornerbead: Use at outside corners.

3.6 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
   1. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
      a. Primer and its application to surfaces are specified in other Division 09 Sections.

E. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.

F. Glass-Mat Faced Panels: Finish according to manufacturer's written instructions.

3.7 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

SECTION 09300
TILING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Ceramic tile.
   2. Quarry tile
   3. Crack isolation membrane.
   4. Metal edge strips.

B. Related Sections:
   1. Division 07 Section "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
   2. Division 09 Section "Gypsum Board" for glass-mat, water-resistant backer board.

1.3 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

B. ANSI A108 Series: Contained in "American National Standard Specifications for Installation of Ceramic Tile."

C. Module Size: Actual tile size plus joint width indicated.

D. Face Size: Actual tile size, excluding spacer lugs.

1.4 ACTION SUBMITTALS

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

B. Samples for Initial Selection: For each type of tile and grout indicated. Include Samples of accessories involving color selection.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of product, signed by product manufacturer.

1.6 QUALITY ASSURANCE

A. Source Limitations for Tile: Obtain tile of each type and color or finish from one source or producer.
   1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from one manufacturer and each aggregate from one source or producer.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer for each product:
   1. Crack isolation membrane.
   2. Joint sealants.
   3. Metal edge strips.

D. Preinstallation Conference: Conduct conference at Project site.
   1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

D. Store liquid materials in unopened containers and protected from freezing.

E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
   1. Provide tile complying with Standard grade requirements unless otherwise indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCA installation methods specified in tile installation schedules, and other requirements specified.

C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.

E. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.2 TILE PRODUCTS

A. Ceramic (CT) or Porcelain Tile (POR). See Room finish schedule (RFS) for design basis. Manufacturer, series, color, pattern.

B. Tile Type CT-1 wall and floor tile.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Dal-tile, Concrete Connection (design basis)
      b. American Olean
      c. Crossville, Inc
   2. Module Size: See room finish schedule & details

3. Thickness: 3/8 inch (8 mm).
4. Face: Pattern of design indicated, with manufacturer's standard edges.
5. Tile Color and Pattern: See room finish schedule & details.
6. Grout Color: As selected by Architect from manufacturer's full range.
7. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes.

C. Tile Type CT-2 quarry tile.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Dal-tile, Quarry Tile
   b. Endicott Tile Ltd.
   c. Seneca Tiles, Inc
2. Module Size: See room finish schedule & details
3. Thickness: 1/2 inch.
4. Face: Pattern of design indicated, with manufacturer's standard edges.
5. Tile Color and Pattern: See room finish schedule & details.
6. Grout Color: As selected by Architect from manufacturer's full range.
7. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:

2.3 CRACK ISOLATION MEMBRANE

A. General: Manufacturer's standard product that complies with ANSI A118.12 for high performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Urethane Crack Isolation Membrane and Tile-Setting Adhesive: One-part, liquid-applied urethane in a consistency suitable for trowel application and intended for use as both waterproofing and tile-setting adhesive in a two-step process.

2.4 SETTING MATERIALS

A. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4.
1. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
2. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in

ANSI A118.4.

2.5 GROUT MATERIALS

A. Polymer-Modified Tile Grout: ANSI A118.7.
   1. Polymer Type: Ethylene vinyl acetate or acrylic additive, in dry, redispersible form, prepackaged with other dry ingredients.

B. Grout for Pregrouted Tile Sheets: Same product used in factory to pregrout tile sheets.

2.6 ELASTOMERIC SEALANTS

A. General: Provide sealants, primers, backer rods, and other sealant accessories that comply with the following requirements and with the applicable requirements in Division 07 Section "Joint Sealants."
   1. Use primers, backer rods, and sealant accessories recommended by sealant manufacturer.

B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints unless otherwise indicated.

C. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.

2.7 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Corner Bead: Schluter-RONDEC clear anodized corner bead at all outside corners.

C. Temporary Protective Coating; Product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.

   1. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile.

D. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

E. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints and that does not change color or appearance of grout.

2.8 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

1. Verify that substrates for setting tile are firm, dry, clean, and free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
2. Verify that concrete substrates for tile floors installed with adhesives, bonded mortar bed or thin-set mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.

   a) Verify that surfaces that received a steel trowel finish have been mechanically scarified.

   b) Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with adhesives or thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot (1:50) toward drains.

C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

D. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.3 TILE INSTALLATION

A. Comply with TCA's "Handbook for Ceramic Tile Installation" for TCA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out

tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

E. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:

1. Wall and Floor Tile: 1/8 inch
2. Quarry Tile: 3/8"

F. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

G. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

H. Metal Edge Strips: Install at locations indicated and where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.

3.4 CRACK ISOLATION MEMBRANE INSTALLATION

A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness and bonded securely to substrate.

B. Do not install tile or setting materials over crack isolation membrane until membrane has cured.

3.5 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
   1. Remove epoxy and latex-portland cement grout residue from tile as soon as possible.
   2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
   3. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.

B. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

D. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

END OF SECTION

SECTION 09511
ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes acoustical panels and exposed suspension systems for ceilings.

B. Standard tiles and moisture resistant tiles.

C. Related Requirements:

D. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified, 6 inches (150 mm) in size.

C. Samples for Initial Selection: For components with factory-applied color finishes.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed,

conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
   1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.
   2. Smoke-Developed Index: 50 or less.

2.2 ACOUSTICAL PANELS, GENERAL

A. Acoustical Ceiling Panel (ACT): See Room finish schedule (RFS) for design basis. Manufacturer, series, color, pattern

B. Source Limitations:
   1. Obtain each type from single source from single manufacturer.
   2. Suspension System: Obtain each type from single source from single manufacturer.

C. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system from single source from single manufacturer.

D. Glass-Fiber-Based Panels: Made with binder containing no urea

formaldehyde.

E. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances unless otherwise indicated.
   1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface according to ASTM E 795.

F. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
   1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

2.3 ACOUSTICAL PANELS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Armstrong World Industries, Inc. (design basis)
   2. Chicago Metallic Corporation.
   3. USG Interiors, Inc.; Subsidiary of USG Corporation.

B. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:
   1. ACT-1 - Type and Form: Type III, mineral base with painted finish; Form 1, nodular.
      a. Pattern: As indicated by manufacturer's designation.
      b. Color: As indicated in a schedule.
      c. LR: Not less than 0.82.
      d. NRC: Not less than 0.55.
      e. Edge/Joint Detail: As indicated in a schedule.
      f. Thickness: 3/4 inch (19 mm).
      g. Modular Size: 48 by 24 inches (610 by 610 mm.
      h. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273

and evaluated according to ASTM D 3274 or ASTM G 21.

2. ACT-2 - Type and Form: Type IV, mineral base with painted finish; Form 2, nodular.
   a. Pattern: As indicated by manufacturer's designation.
   b. Color: As indicated in a schedule.
   c. LR: Not less than 0.9.
   d. NRC: Not less than 0.70.
   e. Edge/Joint Detail: As indicated in a schedule.
   f. Thickness: 3/4 inch (19 mm).
   g. Modular Size: 48 by 24 inches (610 by 610 mm.
   h. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

2.4 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension-System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.
   1. High-Humidity Finish: Comply with ASTM C 635/C 635M requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.

B. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
   1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing according to ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
      a. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.
      b. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Group 1 Alloy 304 or 316 for bolts; Alloy 304 or 316 for anchor.
      c. Corrosion Protection: Components fabricated from nickel-copper-

alloy rods complying with ASTM B 164 for UNS No. N04400 alloy.

C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
   1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
   2. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304, nonmagnetic.
   3. Nickel-Copper-Alloy Wire: ASTM B 164, nickel-copper-alloy UNS No. N04400.
   4. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.135-inch- (3.5-mm-) diameter wire.

D. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.

E. Impact Clips: Where indicated, provide manufacturer's standard impact-clip system designed to absorb impact forces against acoustical panels.

2.5 METAL SUSPENSION SYSTEM

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Armstrong World Industries, Inc.
   2. Chicago Metallic Corporation.
   3. USG Interiors, Inc.; Subsidiary of USG Corporation.

B. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 (Z90) coating designation; with prefinished 15/16-inch- (24-mm-) wide metal caps on flanges.
   1. Structural Classification: Heavy-duty system.
   2. End Condition of Cross Runners: Override (stepped) or butt-edge type.
   3. Face Design: Flat, flush.
   4. Cap Material: Steel or aluminum cold-rolled sheet.
   5. Cap Finish: Painted white.

2.6 METAL EDGE MOLDINGS AND TRIM

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Armstrong World Industries, Inc.
2. Chicago Metallic Corporation.
3. Fry Reglet Corporation.
4. Gordon, Inc.
5. USG Interiors, Inc.; Subsidiary of USG Corporation.

B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.
   1. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners unless otherwise indicated.
   2. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
   3. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

A. General: Install acoustical panel ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Suspend ceiling hangers from building's structural members and as follows:
   1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
   2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
   3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
   4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
   5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
   6. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
   7. Do not attach hangers to steel deck tabs.
   8. Do not attach hangers to steel roof deck. Attach hangers to structural members.
   9. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
   10. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal

forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
   1. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.
   2. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
   1. Arrange directionally patterned acoustical panels as follows:
      a. As indicated on reflected ceiling plans.
      b. Install panels with pattern running in one direction parallel to short axis of space.
      c. Install panels in a basket-weave pattern.
   2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
   3. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
   4. For reveal-edged panels on suspension-system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension-system surfaces and panel faces flush with bottom face of runners.
   5. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
   6. Install impact clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions unless otherwise indicated.

3.4 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned

and repaired to permanently eliminate evidence of damage.

END OF SECTION

SECTION 09651
RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Resilient base. Straight & Cove
   2. Transition Strips between adjacent floor materials.

B. Related Sections:
   1. Division 09 Section "Resilient Tile Flooring" for resilient floor tile.

1.3 ACTION SUBMITTALS

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

B. Samples for Initial Selection: For each type of product indicated.

1.4 MATERIALS MAINTENANCE SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Furnish not less than 10 linear feet (3 linear m) for every 500 linear feet (150 linear m) or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.5 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
   1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range

recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C).

1.7 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive resilient products during the following time periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 RESILIENT BASE

A. Resilient Base (VB). See Room finish schedule (RFS) for design basis. Manufacturer, series, color, pattern.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Johnsonite. (design basis)
   2. Armstrong World Industries, Inc.
   3. Flexco, Inc.
   4. Mondo Rubber International, Inc.

C. Resilient Base Standard: ASTM F 1861.
   1. Material Requirement: Type TP (rubber, thermoplastic).
   2. Manufacturing Method: Group I (solid, homogeneous).
   3. VB-1: Cove (base with toe).
   4. VB-2: Straight

D. Minimum Thickness: 0.125 inch (3.2 mm).

E. Height: 4 inches (102 mm).

F. Lengths: Coils in manufacturer's standard length.

G. Outside Corners: preformed.

H. Inside Corners: Preformed.

I. Finish: As selected by Architect from manufacturer's full range.

J. Colors and Patterns: As selected by Architect from full range of industry colors.

2.2 RESILIENT MOLDING ACCESSORY

A. Resilient Molding Accessory.
   1. Transition strips: To be used at all flooring transitions between different adjacent flooring materials.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Johnsonite. (design basis)
   2. Armstrong World Industries, Inc.
   3. Flexco, Inc.
   4. Mondo Rubber International, Inc.

C. Material: Rubber

D. Profile and Dimensions: As selected by architect from manufacturer's standard profiles.

E. All profiles used should comply with ADA and ANSI Accessibility requirements and dimension.

F. Colors and Patterns: As selected by Architect from full range of industry colors.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, Portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

C. Do not install resilient products until they are same temperature as the space where they are to be installed.
   1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

D. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Preformed Corners: Install preformed corners before installing straight pieces.

H. Job-Formed Corners:
   1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Butt to adjacent materials and tightly adhere to substrate throughout length of each piece. Install reducer strips at edges of carpet and resilient floor covering that would otherwise be exposed.

C. Transitions to occur under door thresholds.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.

B. Perform the following operations immediately after completing resilient product installation:
   1. Remove adhesive and other blemishes from exposed surfaces.
   2. Sweep and vacuum surfaces thoroughly.
   3. Damp-mop surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Remove soil, visible adhesive and surface blemishes from resilient stair treads before applying liquid floor polish.
   1. Apply two coat(s).

E. Cover resilient products until Substantial Completion.

END OF SECTION

SECTION 09651
RESILIENT TILE FLOORING

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. Vinyl composition floor tile.

B. Related Sections:
   1. Division 09 Section "Resilient Base and Accessories" for resilient base, reducer strips, and other accessories installed with resilient floor coverings.
   2. Division 09 Section "Resilient Sheet Flooring" for resilient sheet floor

1.3 ACTION SUBMITTALS

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

B. Samples for Initial Selection: For each type of floor tile indicated.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.5 QUALITY ASSURANCE

1. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
2. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store floor tiles on flat surfaces.

1.7 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive floor tile during the following time periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

C. Close spaces to traffic during floor tile installation.

D. Close spaces to traffic for 48 hours after floor tile installation.

E. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 VINYL COMPOSITION FLOOR TILE

A. Vinyl Composition floor tile (VCT). See Room finish schedule (RFS) for design basis. Manufacturer, series, color, pattern.

B. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   1. Mannington Mills, Inc.;
   2. Johnsonite, Inc.;
   3. Armstrong World Industries, Inc.;
   4. Tarkett, Inc.;

C. Tile Standard: ASTM F 1066, Class 2, through-pattern tile.

D. Wearing Surface: Smooth.

E. Thickness: 0.125 inch (3.2 mm).

F. Size: 12 by 12 inches (305 by 305 mm).

G. Colors and Patterns: Per RFS

2.2 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit floor tile and substrate conditions indicated.

C. Floor Polish: Provide protective liquid floor polish products as recommended by manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F 710.
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
   3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
   4. Moisture Testing: Perform tests recommended by manufacturer and as

follows. Proceed with installation only after substrates pass testing.

a. Follow manufacturer's requirements for moisture testing. Retain one or both subparagraphs below.

b. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.

c. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75% relative humidity level measurement.

C. Access Flooring Panels: Remove protective film of oil or other coating using method recommended by access flooring manufacturer.

D. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

E. Do not install floor tiles until they are same temperature as space where they are to be installed.

F. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

G. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.3 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles square with room axis.

C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

D. Lay tiles in pattern of colors and sizes indicated.

E. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and

door frames.

F. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.

H. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

I. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

J. Provide one unopened box of tiles to City for attic stock.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of floor tile.

B. Perform the following operations immediately after completing floor tile installation:
   1. Remove adhesive and other blemishes from exposed surfaces.
   2. Sweep and vacuum surfaces thoroughly.
   3. Damp-mop surfaces to remove marks and soil.

C. Protect floor tile products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Remove soil, visible adhesive and surface blemishes from floor tile surfaces before applying liquid floor polish.

E. Apply two coat(s).

F. Cover floor tile until Substantial Completion.

END OF SECTION

SECTION 09681
TILE CARPETING

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 modular, carpet tile.

B. Related Requirements:
   1. Section 02 "Selective Structure Demolition" for removing existing floor coverings.
   2. Section 09 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet tile.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Review methods and procedures related to carpet tile installation including, but not limited to, the following:
      a. Review delivery, storage, and handling procedures.
      b. Review ambient conditions and ventilation procedures.
      c. Review subfloor preparation procedures.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
   2. Include installation recommendations for each type of substrate.

B. Shop Drawings: Show the following:
   1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
   2. Carpet tile type, color, and dye lot.
   3. Type of subfloor.
   4. Type of installation.
   5. Pattern of installation.

6. Pattern type, location, and direction.
7. Pile direction.
8. Type, color, and location of insets and borders.
9. Type, color, and location of edge, transition, and other accessory strips.
10. Transition details to other flooring materials.

C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
   1. Carpet Tile: Full-size Sample.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:
   1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
   2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd. (8.3 sq. m).

1.8 QUALITY ASSURANCE

A. Fire-Test-Response Ratings: Where indicated, provide carpet tile identical to those of assemblies tested for fire response according to NFPA 253 by a qualified testing agency.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104.

1.10 FIELD CONDITIONS

A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.

C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.11 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
   1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
   2. Failures include, but are not limited to, more than 10 percent edge raveling, snags, runs, dimensional stability, excess static discharge, loss of tuft bind strength, loss of face fiber, and delamination.
   3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE

A. Modular tufted Carpet Tile (CPT). To be the product of one of the following manufacturers:
   1. Lees – By Mohawk: Faculty IV, Loop with action bac.
   2. Bentley Prince Street, Loop with cushion backing
   3. Mannington Carthage, Infinity modular loop
   4. Approved Equal.

B. Applied Soil-Resistance Treatment: manufacturer's standard material.

C. Applied or Integral Antimicrobial Treatment

D. Performance Characteristics: As follows:
   1. Fiber content – Antron Legacy CF Nylon, or Duracolor with Antron, or

Ultron Type 6.6 nylon.

2. Fiber weight – 30 oz/sq. yd. min.
3. Construction – tufted textured loop pile
4. Gauge - 1/8
5. Pile Thickness - .145" ave
6. Total weight – 140 oz./Sq. yd.
7. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm.
8. Dry Breaking Strength: Not less than 100 lbf (445 N) according to ASTM D 2646.
9. Tuft Bind: Not less than 8 lbf (36 N) according to ASTM D 1335.
10. Dimensional Tolerance: Within 1/32 inch (0.8 mm) of specified size dimensions, as determined by physical measurement.
11. Dimensional Stability: 0.2 percent or less according to ISO 2551 (Aachen Test).
12. Resistance to Insects: Comply with AATCC 24.
13. Colorfastness to Crocking: Not less than 4, wet and dry, according to AATCC 165.
14. Colorfastness to Light: Not less than 4 after 60 AFU (AATCC fading units) according to AATCC 16, Option E.
15. Electrostatic Propensity: Less than 3.0 kV according to Standard Shuffle Test.

2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.

C. Metal Edge/Transition Strips: Extruded aluminum with mill finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity

range, installation tolerances, and other conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
   1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet tile manufacturer.
   2. Subfloor finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" for slabs receiving carpet tile.
   3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch (3 mm) wide or wider and protrusions more than 1/32 inch (0.8 mm) unless more stringent requirements are required by manufacturer's written instructions.

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.

D. Clean metal substrates of grease, oil, soil and rust, and prime if directed by adhesive manufacturer. Rough sand painted metal surfaces and remove loose paint. Sand aluminum surfaces, to remove metal oxides, immediately before applying adhesive.

E. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

A. General: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.

C. Maintain dye lot integrity. Do not mix dye lots in same area.

D. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

E. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

G. Install pattern parallel to walls and borders.

H. Provide two full unopened boxes to city for attic stock.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:
   1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
   2. Remove yarns that protrude from carpet tile surface.
   3. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with CRI 104, Section 16, "Protecting Indoor Installations."

C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION

SECTION 09911
EXTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes surface preparation and the application of paint systems on the following exterior substrates:
   1. Concrete Substrates
   2. Metals.

B. Related Requirements:
   1. Division 05 Sections for shop priming of metal substrates with primers specified in this Section.
   2. Division 08 Sections for factory priming windows and doors with primers specified in this Section.
   3. Division 09 Section "Interior Painting" for surface preparation and the application of paint systems on interior substrates.

1.3 DEFINITIONS

A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

B. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

C. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

D. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

E. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.

F. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

B. Samples for Initial Selection: For each type of topcoat product.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.

1.6 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

B. 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Benjamin Moore & Co.
   2. Hallman Lindsay Paints.
   3. ICI Paints.
   4. PPG Architectural Finishes, Inc.
   5. Sherwin-Williams Company (The).

2.2 PAINT, GENERAL

A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."

B. Material Compatibility:
   1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service

and application as demonstrated by manufacturer, based on testing and field experience.

2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

C. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.

D. Colors: Match Architect's samples.

2.3 BLOCK FILLERS

A. Block Filler, Latex, Interior/Exterior: MPI #4.

2.4 METAL PRIMERS

A. Primer, Galvanized: As recommended in writing by topcoat manufacturer.

2.5 SOLVENT-BASED PAINTS

A. Alkyd, Exterior Gloss (Gloss Level 6): MPI #9.

2.6 TEXTURED AND HIGH-BUILD COATINGS

A. Primer for Latex, Exterior, High Build: As recommended in writing by topcoat manufacturer.

B. Intermediate Coat for Latex, Exterior, High Build: As recommended in writing by topcoat manufacturer.

C. Latex, Exterior, High Build: MPI #40.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
   1. Concrete: 12 percent.
   2. Masonry (Clay and CMU): 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Proceed with coating application only after unsatisfactory conditions have been corrected.
   1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
   1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
   1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

E. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Manual."
   1. Use applicators and techniques suited for paint and substrate indicated.
   2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
   3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
   4. Paint entire exposed surface of window frames and sashes.

5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
6. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. 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.

E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
   1. Paint the following work where exposed to view:
      a. Equipment, including panelboards and switch gear.
      b. Uninsulated metal piping.
      c. Pipe hangers and supports.
      d. Metal conduit.
      e. Tanks that do not have factory-applied final finishes.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
   1. Contractor shall touch up and restore painted surfaces damaged by testing.
   2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or

damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 EXTERIOR PAINTING SCHEDULE

A. Concrete Substrates, Nontraffic Surfaces:
   1. High-Build Latex System: Dry film thickness not less than 10 mils (0.25 mm).
      a. Prime Coat: As recommended in writing by topcoat manufacturer.
      b. Intermediate Coat: As recommended in writing by topcoat manufacturer.
      c. Topcoat: Latex, exterior, high build, MPI #40.

B. Galvanized-Metal Substrates:
   1. Alkyd System:
      a. Prime Coat: Primer, galvanized metal, as recommended in writing by topcoat manufacturer for exterior use on galvanized-metal substrates with topcoat indicated.
      b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
      c. Topcoat: Alkyd, exterior, gloss (Gloss Level 5), MPI #9.

END OF SECTION

SECTION 09912
INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes surface preparation and the application of paint systems on the following interior substrates:
   1. Concrete.
   2. Concrete masonry units (CMU).
   3. Steel.
   4. Gypsum board.

B. Related Requirements:
   1. Division 05 Sections for shop priming of metal substrates with primers specified in this Section.
   2. Division 06 Sections for shop priming carpentry with primers specified in this Section.
   3. Division 08 Sections for factory priming windows and doors with primers specified in this Section.
   4. Division 09 painting Sections for high-performance and special-use coatings.
   5. Division 09 Section "Exterior Painting" for surface preparation and the application of paint systems on exterior substrates.

1.3 DEFINITIONS

A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

B. Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

C. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

D. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85

degrees, according to ASTM D 523.

E. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

F. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.

G. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

B. Samples for Initial Selection: For each type of topcoat product.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.

1.6 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

B. Do not apply paints 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Interior Paint (PT). See Room finish schedule (RFS) for design basis. Manufacturer, series, color, pattern.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Sherwin-Williams Company (Design basis).
   2. Benjamin Moore & Co.

3. Hallman Lindsay Paints.
4. ICI Paints.
5. PPG Architectural Finishes, Inc.

2.2 PAINT, GENERAL

A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."

B. Material Compatibility:
   1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
   2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for interior paints and coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   1. Flat Paints and Coatings: 50 g/L.
   2. Nonflat Paints and Coatings: 150 g/L.
   3. Dry-Fog Coatings: 400 g/L.
   4. Primers, Sealers, and Undercoaters: 200 g/L.
   5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
   6. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
   7. Pretreatment Wash Primers: 420 g/L.
   8. Floor Coatings: 100 g/L.
   9. Shellacs, Clear: 730 g/L.
   10. Shellacs, Pigmented: 550 g/L.

D. Colors: Match Architect's samples.

2.3 BLOCK FILLERS

A. Block Filler, Latex, Interior/Exterior: MPI #4.

2.4 PRIMERS/SEALERS

A. Primer Sealer, Latex, Interior: MPI #50.

B. Primer, Alkali Resistant, Water Based: MPI #3.

2.5 METAL PRIMERS

A. Primer, Alkyd, Anti-Corrosive, for Metal: MPI #79.

B. Primer, Alkyd, Quick Dry, for Metal: MPI #76.

2.6 WATER-BASED PAINTS

A. Latex, Interior, High Performance Architectural, Semi-Gloss (Gloss Level 5): MPI #141.

2.7 SOLVENT-BASED PAINTS

A. Alkyd, Interior, Gloss (Gloss Level 6): MPI #48.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
   1. Concrete: 12 percent.
   2. Masonry (Clay and CMU): 12 percent.
   3. Wood: 15 percent.
   4. Gypsum Board: 12 percent.
   5. Plaster: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Plaster Substrates: Verify that plaster is fully cured.

E. Spray-Textured Ceiling Substrates: Verify that surfaces are dry.

F. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

G. Proceed with coating application only after unsatisfactory conditions have been corrected.
   1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
   1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
   1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceed that permitted in manufacturer's written instructions.

F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
   1. SSPC-SP 2, "Hand Tool Cleaning."
   2. SSPC-SP 3, "Power Tool Cleaning."
   3. SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."
   4. SSPC-SP 11, "Power Tool Cleaning to Bare Metal."

G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
   1. Use applicators and techniques suited for paint and substrate indicated.
   2. Paint surfaces behind movable equipment and furniture same as similar

exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.

3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. 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.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. 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.

E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
   1. Paint the following work where exposed in equipment rooms:
      a. Equipment, including panelboards.
      b. Uninsulated metal piping.
      c. Pipe hangers and supports.
      d. Metal conduit.
      e. Tanks that do not have factory-applied final finishes.
      f. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
   2. Paint the following work where exposed in occupied spaces:
      a. Uninsulated metal piping.
      b. Pipe hangers and supports.
      c. Metal conduit.
      d. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
      e. Other items as directed by Architect.
      f. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified

testing and inspecting agency to inspect and test paint for dry film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

A. Concrete Substrates, Nontraffic Surfaces:
   1. High-Performance Architectural Latex System:
      a. Prime Coat: Primer, alkali resistant, water based, MPI #3.
      b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
      c. Topcoat: Latex, interior, high performance architectural, semi-gloss (Gloss Level 5), MPI #141.

B. CMU Substrates:
   1. High-Performance Architectural Latex System:
      a. Block Filler: Block filler, latex, interior/exterior, MPI #4.
      b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
      c. Topcoat: Latex, interior, high performance architectural, semi-gloss (Gloss Level 5), MPI #141.

C. Steel Substrates:
   1. Alkyd System:

a. Prime Coat: Shop primer specified in Division 05 Section where substrate is specified.
b. Intermediate Coat: Alkyd, interior, matching topcoat.
c. Topcoat: Alkyd, interior, (Gloss Level 3), MPI #51.

D. Gypsum Board Substrates:
1. High-Performance Architectural Latex System:
a. Prime Coat: Primer sealer, latex, interior, MPI #50.
b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
c. Topcoat: Latex, interior, high performance architectural, semi-gloss (Gloss Level 5), MPI #141.

END OF SECTION

SECTION 10110
VISUAL DISPLAY SURFACES

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. Markerboards.

1.3 DEFINITIONS

A. Visual Display Board Assembly: Visual display surface that is factory fabricated into composite panel form, either with or without a perimeter frame; includes chalkboards, Markerboards.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for visual display surfaces.

B. Shop Drawings: For visual display surfaces. Include plans, elevations, sections, details, and attachments to other work.
   1. Show locations of panel joints.
   2. Include sections of typical trim members.

1.5 INFORMATIONAL SUBMITTALS

A. Warranties: Sample of special warranties.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain visual display surfaces from single source from single manufacturer.

B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-built visual display surfaces, including factory-applied trim where indicated, completely assembled in one piece without joints, where possible. If dimensions exceed maximum manufactured panel size, provide two or more pieces of equal length as acceptable to Architect. When overall dimensions require delivery in separate units, prefit components at the factory, disassemble for delivery, and make final joints at the site.

B. Store visual display surfaces vertically with packing materials between each unit.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install visual display surfaces until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

B. Field Measurements: Verify actual dimensions of construction contiguous with visual display surfaces by field measurements before fabrication.
   1. Allow for trimming and fitting where taking field measurements before fabrication might delay the Work.

1.9 WARRANTY

A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer's standard form in which manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Surfaces lose original writing and erasing qualities.
      b. Surfaces exhibit crazing, cracking, or flaking.
   2. Warranty Period: 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Porcelain-Enamel Face Sheet: Porcelain-enamel-clad, ASTM A 463/A 463M, Type 1, stretcher-leveled aluminized steel, with 0.024-inch uncoated thickness;

with porcelain-enamel coating fused to steel at approximately 1000 deg F.

B. Hardboard: ANSI A135.4, tempered.

C. Particleboard: ANSI A208.1, Grade M-1.

D. Fiberboard: ASTM C 208.

E. Extruded Aluminum: ASTM B 221, Alloy 6063.

2.2 MARKERBOARD ASSEMBLIES

A. Porcelain-Enamel Markerboards: Balanced, high-pressure, factory-laminated markerboard assembly of three-ply construction consisting of backing sheet, core material, and 0.021-inch- (0.53-mm-) thick, porcelain-enamel face sheet with low-gloss finish.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   2. AARCO Products, Inc.
   3. Claridge Products and Equipment, Inc.
   4. PolyVision Corporation; a Steelcase company.

   5. Manufacturer's Standard Core: Minimum 1/4 inch (6 mm) thick, with manufacturer's standard moisture-barrier backing.
   6. Laminating Adhesive: Manufacturer's standard, moisture-resistant thermoplastic type.

2.3 MARKERBOARD ACCESSORIES

A. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch- (1.57-mm) thick extruded aluminum; standard size and shape.
   1. Factory-Applied Trim: Manufacturer's standard.

B. Chalktray: Manufacturer's standard, continuous.
   1. Box Type: Extruded aluminum with slanted front, grooved tray, and cast-aluminum end closures.

2.4 FABRICATION

A. Porcelain-Enamel Visual Display Assemblies: Laminate porcelain-enamel face sheet and backing sheet to core material under heat and pressure with manufacturer's standard flexible, waterproof adhesive.

B. Visual Display Boards: Factory assemble visual display boards unless

otherwise indicated.

1. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display boards at manufacturer's factory before shipment.

C. Factory-Assembled Visual Display Units: Coordinate factory-assembled units with trim and accessories indicated. Join parts with a neat, precision fit.

1. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, as indicated on approved Shop Drawings.
2. Provide manufacturer's standard vertical-joint spline system between abutting sections of markerboard.
3. Where size of visual display boards or other conditions require support in addition to normal trim, provide structural supports or modify trim as indicated or as selected by Architect from manufacturer's standard structural support accessories to suit conditions indicated.

D. Aluminum Frames and Trim: Fabricate units straight and of single lengths, keeping joints to a minimum. Miter corners to a neat, hairline closure.

1. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display units at manufacturer's factory before shipment.

2.5 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.6 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

2.7 VISUAL DISPLAY SURFACE SCHEDULE

A. Visual Display Board: Factory assembled.

1. Markerboard: Porcelain-enamel markerboard assembly.

a. Color: White.
2. Corners: Square.
3. Width: As indicated on Drawings.
4. Height: As indicated on Drawings.
5. Mounting: Wall.
6. Mounting Height: As indicated on Drawings.
7. Factory-Applied Aluminum Trim: Manufacturer's standard with clear anodic finish.
8. Accessories:
   a. Chalktray: Box type.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical power systems to verify actual locations of connections before installation of motor-operated, sliding visual display units.

C. Examine walls and partitions for proper preparation and backing for visual display surfaces.

D. Examine walls and partitions for suitable framing depth where sliding visual display units will be installed.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances that could impair the performance of and affect the smooth, finished surfaces of visual display boards, including dirt, mold, and mildew.

3.3 INSTALLATION, GENERAL

A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings.

3.4 CLEANING AND PROTECTION

A. Clean visual display surfaces according to manufacturer's written instructions. Attach one cleaning label to visual display surface in each room.

B. Touch up factory-applied finishes to restore damaged or soiled areas.

C. Cover and protect visual display surfaces after installation and cleaning.

END OF SECTION

SECTION 10211
TOILET COMPARTMENTS

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. Stainless-steel toilet compartments configured as toilet enclosures and urinal screens.

B. Related Sections:
   1. Section 05 "Metal Fabrications" for supports that attach floor-and-ceiling-anchored compartments to overhead structural system.
   2. Section 10 "Toilet, Bath, and Laundry Accessories" for toilet tissue dispensers, grab bars, purse shelves, and similar accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For toilet compartments. Include plans, elevations, sections, details, and attachments to other work.
   1. Show locations of cutouts for compartment-mounted toilet accessories.
   2. Show locations of reinforcements for compartment-mounted grab bars.
   3. Show locations of centerlines of toilet fixtures.
   4. Show ceiling grid and overhead support or bracing locations.

C. Samples for Initial Selection: For each type of unit indicated. Include Samples of hardware and accessories involving material and color selection.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For toilet compartments to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Comply with requirements in GSA's CID-A-A-60003, "Partitions, Toilets, Complete."

B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84, or another standard acceptable to authorities having jurisdiction, by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: 25 or less.
   2. Smoke-Developed Index: 450 or less.

C. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities" and ICC/ANSI A117.1 for toilet compartments designated as accessible.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

PART 2 PRODUCTS

2.1 MATERIALS

A. Powder coated baked enamel on galvanized steel, 22 and 20 gauge.

B. Stainless-Steel Castings: ASTM A 743/A 743M.

C. Stainless-Steel Hardware: ASTM A 743/A 743M.

2.2 BAKED ENAMEL UNITS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Metpar Corp.
      a. Design Basis: The Corinthian, FP-500, Floor-mounted, over-head braced.
   2. Bradley Corporation.
      a. Sentinel, Series 400 Floor-mounted, over-head braced.

3. Approved Equal

B. Urinal-Screen Style: Wall hung flat panel.

C. Door, Panel, and Pilaster Construction: Seamless, metal facing sheets pressure laminated to core material; with continuous, interlocking molding strip or lapped-and-formed edge closures; corners secured by welding or clips and exposed welds ground smooth. Provide with no-sightline system. Exposed surfaces shall be free of pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections.
   1. Core Material: Manufacturer's standard sound-deadening honeycomb of resin-impregnated kraft paper in thickness required to provide finished thickness of 1 inch for doors and panels and 1-1/4 inches for pilasters.
   2. Grab-Bar Reinforcement: Provide concealed internal reinforcement for grab bars mounted on units.
   3. Tapping Reinforcement: Provide concealed reinforcement for tapping (threading) at locations where machine screws are used for attaching items to units.

D. Urinal-Screen Construction:
   1. Flat-Panel Urinal Screen: Matching panel construction.

E. Facing Sheets and Closures: Baked Enamel steel sheet of nominal thicknesses as follows:
   1. Pilasters, Braced at Both Ends: Manufacturer's standard thickness, but not less than 0.038 inch.
   2. Panels: Manufacturer's standard thickness, but not less than 0.038 inch.
   3. Doors: Manufacturer's standard thickness, but not less than 0.031 inch.
   4. Flat-Panel Urinal Screens: Thickness matching the panels.

F. Pilaster Shoes and Sleeves (Caps): Stainless-steel sheet, not less than 0.031-inch nominal thickness and 3 inches high, finished to match hardware.

G. Brackets (Fittings):
   1. Stirrup Type: Ear or U-brackets; stainless steel.

H. Baked Enamel Finish: Manufacturer's standard textured finish on exposed faces. Protect exposed surfaces from damage by application of strippable, temporary protective covering before shipment.
   1. Color: to be selected by architect from manufacturer's standard colors.

2.3 ACCESSORIES

A. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories.

1. Material: Stainless steel.
2. Hinges: Manufacturer's standard continuous, hinge that swings to a closed or partially open position.
3. Latch and Keeper: Manufacturer's standard surface-mounted latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible.
4. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories.
5. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors and entrance-screen doors.
6. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible.

B. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized steel, or other rust-resistant, protective-coated steel.

2.4 FABRICATION

A. Floor-and-Ceiling-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment at tops and bottoms of pilasters. Provide shoes and sleeves (caps) at pilasters to conceal anchorage.

B. Door Size and Swings: Unless otherwise indicated, provide 26-inch- wide, in-swinging doors for standard toilet compartments and 36-inch- wide, out-swinging doors with a minimum 32-inch- wide, clear opening for compartments designated as accessible.

PART 3 EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install unit's rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
   1. Maximum Clearances:
      a. Pilasters and Panels: 1/2 inch.

b. Panels and Walls: 1 inch.

2. Stirrup Brackets: Secure panels to walls and to pilasters with no fewer than three brackets attached at midpoint and near top and bottom of panel.
   a. Locate wall brackets so holes for wall anchors occur in masonry or tile joints.
   b. Align brackets at pilasters with brackets at walls.

B. Floor-and-Ceiling-Anchored Units: Secure pilasters to supporting construction and level, plumb, and tighten. Hang doors and adjust so doors are level and aligned with panels when doors are in closed position.

3.2 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors and doors in entrance screens to return doors to fully closed position.

END OF SECTION

SECTION 10280
TOILET ROOM ACCESSORIES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Public-use washroom accessories.
   2. Custodial accessories.

B. Related Sections:
   1. Section 09 "Tiling" for ceramic toilet and bath accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include the following:
   1. Construction details and dimensions.
   2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
   3. Material and finish descriptions.
   4. Features that will be included for Project.
   5. Manufacturer's warranty.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
   1. Identify locations using room designations indicated.
   2. Identify products using designations indicated.

C. Maintenance Data: Include maintenance manuals as specified in Division 1 for all accessories. Provide lists of replacement parts and service recommendations.

1.4 QUALITY ASSURANCE

A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.5 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.1 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. Manufacturer's Mirror Warranty: Written warranty, executed by mirror manufacturer agreeing to replace mirrors that develop visible silver spoilage defects within minimum warranty period indicated.

1. Minimum Warranty Period: 15 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 Not Used

2.2 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.

1. All mirror shelves and frames, and grab bars to be stainless steel.

B. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

2.3 PUBLIC-USE WASHROOM ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following.
   1. American Specialties, Inc.
   2. Bobrick Washroom Equipment, Inc.
   3. Bradley Corporation.

B. Grab Bar:
   1. Mounting: Flanges with exposed fasteners.
   2. Material: Stainless steel, 0.05 inch thick.
      a. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area.
   3. Outside Diameter: 1-1/2 inches.
   4. Configuration and Length: As indicated on Drawings.

2.4 TOILET ROOM ACCESSORY SCHEDULE

A. Toilet Tissue Dispensers (TP-1):
   1. Kimberly-Clark 09567 JRT 2 ply. (Paper, Kimberly-Clark 07805 Surpass JRT 2 ply.)

B. Soap Dispensers (SD-1)
   1. Kutol 9925 ZPL dispenser, easy push, soap type 7380 to be supplied by City and installed by Contractor.

C. Mirrors (MIR-X):
   1. Above Sink
   2. Bradley mirror, channel frame with shelf; model 7815.
   3. Size: as noted on drawings
   4. Full Length
   5. Bradley mirror, channel frame; model 781.
   6. Size: as noted on drawings

D. Sanitary Napkin Vendor (SNV-1):
   1. Bradley #426.

E. Sanitary Napkin Disposal (SND-1):

1. Bradley #4781-15.

F. Grab bars (GB-X):
   1. Bradley #832
   2. Size: as noted on drawings

G. Waste Receptacles
   1. By City of Milwaukee (N.I.C.)

H. Paper Towel Dispensers (PTD-1)
   1. San Jama Vision Roll Towel Dispenser T1200TBK (14" square, with paper towel roll.)

2.5 CUSTODIAL ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. American Specialties, Inc.
   2. Bobrick Washroom Equipment, Inc.
   3. Bradley Corporation.

B. Utility Shelf :
   1. Basis-of-Design Product:
   2. Description: With exposed edges turned down not less than 1/2 inch and supported by two triangular brackets welded to shelf underside.
   3. Size: as noted on drawings.
   4. Material and Finish: Not less than nominal 0.05-inch- thick stainless steel, No. 304 finish stainless steel (satin finish)

C. Mop and Broom Holder :
   1. Basis-of-Design Product:
   2. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.
   3. Length: 36 inches.
   4. Hooks: Three.
   5. Mop/Broom Holders: Four, spring-loaded, rubber hat, cam type.
   6. Material and Finish: Stainless steel, No. 4 finish (satin).
      a. Shelf: Not less than nominal 0.05-inch- thick stainless steel.
      b. Rod: Approximately 1/4-inch- diameter stainless steel.

2.6 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges.

Equip units for concealed anchorage and with corrosion-resistant backing plates.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F 446.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION

SECTION 10431
INTERIOR SIGNAGE (NOT IN CONTRACT, BY THE OWNER)

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. Panel signs.
   2. Dimensional characters (letters and numbers).
   3. Signage accessories.

B. Related Sections include the following:
   1. Division 23 Section "Mechanical Identification" for labels, tags, and nameplates for mechanical equipment.
   2. Division 26 Section "Electrical Identification" for labels, tags, and nameplates for electrical equipment.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of sign.

B. Shop Drawings: Include plans, elevations, and large-scale sections of typical members and other components. Show mounting methods, grounds, mounting heights, layout, spacing, reinforcement, accessories, and installation details.
   1. Provide message list for each sign, including large-scale details of wording, lettering, and braille layout.

C. Samples for Verification: For each type of sign, include the following Samples to verify color selected:
   1. Panel Signs: Full-size Samples of each type of sign required.
   2. Dimensional Characters: Full-size Samples of each type of dimensional character (letter and number) required. Show character style, material, finish, and method of attachment.
   3. Casting: Show representative texture, character style, spacing, finish, and method of attachment.

4. Approved samples will not be returned for installation into Project.

D. Maintenance Data: For signage cleaning and maintenance requirements to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative of signage manufacturer for installation and maintenance of units required for this Project.

B. Source Limitations: Obtain each sign type through one source from a single manufacturer.

C. Regulatory Requirements: Comply with the Americans with Disabilities Act (ADA) and with code provisions as adopted by authorities having jurisdiction.
   1. Interior Code Signage: Provide signage as required by accessibility regulations and requirements of authorities having jurisdiction. These include, but are not limited to, the following:
      a. Illuminated Exit Signs: Refer to Division 26.
      b. Stairway Identification.
      c. Signs for Accessible Spaces.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.5 PROJECT CONDITIONS

A. Field Measurements: Where sizes of signs are determined by dimensions of surfaces on which they are installed, verify dimensions by field measurement before fabrication and indicate measurements on Shop Drawings.

1.6 COORDINATION

A. For signs supported by or anchored to permanent construction, advise installers of anchorage devices about specific requirements for placement of anchorage devices and similar items to be used for attaching signs.
   1. For signs supported by or anchored to permanent construction, furnish templates for installation of anchorage devices.

B. Coordinate location of remote transformers with building construction. Ensure that transformers are accessible after completion of Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Field Verify, new signage required to match existing building standard.

2.2 PANEL SIGNS

A. General: Provide panel signs that comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.
   1. Produce smooth panel sign surfaces constructed to remain flat under installed conditions within tolerance of plus or minus 1/16 inch (1.5 mm) measured diagonally.

B. Cast-Acrylic Sheet: Manufacturer's standard and as follows:
   1. Color: As selected by Architect from manufacturer's full range.

C. Frames: Fabricate frames to profile indicated; comply with the following requirements for materials and corner conditions:
   1. Material: Acrylic plastic.
   2. Corner Condition: Square or rounded.

D. Laminated Panels: Permanently laminate face panels to backing sheets of material; use manufacturer's standard process.

E. Graphic Content and Style: Provide sign copy that complies with requirements indicated on Drawings for size, spacing, content, mounting height and location of signage.

F. Tactile and Braille Copy: Manufacturer's standard process for producing copy complying with ADA Accessibility Guidelines and ICC/ANSI A117.1. Text shall be accompanied by Grade 2 braille. Produce precisely formed characters with square cut edges free from burrs and cut marks.
   1. Panel Material: Opaque acrylic sheet.
   2. Raised-Copy Thickness: Not less than 1/32 inch (0.8 mm).

G. Applied Copy: Die-cut characters from vinyl film of nominal thickness of 3 mils (0.076 mm) with pressure-sensitive adhesive backing. Apply copy to exposed face of panel sign.
   1. Panel Material: Opaque acrylic sheet.

H. Colored Coatings for Acrylic Sheet: For copy, background and frame colors, provide Pantone Matching System (PMS) colored coatings, including inks and

paints that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and are nonfading for application intended.

2.3 PANEL SIGN TYPES

A. Room Signs:
   1. Material: Cast-acrylic sheet.
   2. Perimeter: Unframed.
   3. Copy: Tactile and braille.
   4. Character Style: Helvetica.
   5. Text: As indicated on the drawings.
   6. Message: Fixed.
   7. Sizes:
      a. Sign: As indicated on drawings.
      b. Character: Minimum 5/8-inch- (16-mm-) high characters.
   8. Colors:
      a. Frame: As selected by Architect from manufacturer's full range.
      b. Character: As selected by Architect from manufacturer's full range.
      c. Background: As selected by Architect from manufacturer's full range.

B. Symbols of Accessibility: Provide 6-inch- (150-mm-) high symbol fabricated from opaque nonreflective vinyl film, 0.0035-inch (0.089-mm) nominal thickness, with pressure-sensitive adhesive backing suitable for both exterior and interior applications.

2.4 ACCESSORIES

A. Vinyl Film: Provide opaque nonreflective vinyl film, 0.0035-inch (0.089-mm) minimum thickness, with pressure-sensitive adhesive backing suitable for both exterior and interior applications.

B. Mounting Methods: Use concealed fasteners or double-sided vinyl tape fabricated from materials that are not corrosive to sign material and mounting surface.

C. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.
   a. FINISHES, GENERAL

D. Protect mechanical finishes on exposed surfaces from damage by applying

strippable, temporary protective covering before shipping.

E. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Verify that items, including anchor inserts, and electrical power provided under other sections of Work are sized and located to accommodate signs.

C. Examine supporting members to ensure that surfaces are at elevations indicated or required to comply with authorities having jurisdiction and are free from dirt and other deleterious matter.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Locate signs and accessories where indicated, using mounting methods of types described and in compliance with manufacturer's written instructions.
   1. Install signs level, plumb, and at heights indicated, with sign surfaces free from distortion and other defects in appearance.
   2. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. At double doors, install sign on inactive leaf as indicated on drawing details. Where not indicated or possible, install signs on nearest adjacent walls. Locate to allow approach within 3 inches (75 mm) of sign without encountering protruding objects or standing within swing of door.

B. Wall-Mounted Panel Signs: Attach panel signs to wall surfaces using methods indicated below:
   1. Vinyl-Tape Mounting: Use double-sided foam tape to mount signs to smooth, nonporous surfaces. Do not use this method for vinyl-covered or

rough surfaces.

2. Shim Plate Mounting: Provide 1/8-inch- (3-mm-) thick, concealed aluminum shim plates with predrilled and countersunk holes, at locations indicated, and where other mounting methods are not practicable. Attach plate with fasteners and anchors suitable for secure attachment to substrate. Attach panel signs to plate using method specified above.
3. Mechanical Fasteners: Use nonremovable mechanical fasteners placed through predrilled holes. Attach signs with fasteners and anchors suitable for secure attachment to substrate as recommended in writing by sign manufacturer.
4. Where panel signs are scheduled or indicated to be mounted on glass, provide matching plate on opposite side of glass to conceal mounting materials.

C. Bracket-Mounted Units: Provide manufacturer's standard brackets, fittings, and hardware as appropriate for mounting signs that project at right angles from walls and ceilings. Attach brackets and fittings securely to walls and ceilings with concealed fasteners and anchoring

3.3 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Owner.

END OF SECTION

SECTION 10441
FIRE EXTINGUISHERS

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 portable, hand-carried fire extinguishers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher.

1.4 QUALITY ASSURANCE

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
   1. Provide fire extinguishers approved, listed, and labeled by FMG.

1.5 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire protection cabinets to ensure fit and function.

PART 2 - PRODUCTS

2.1 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers (FE-1):
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Badger Fire Protection; a Kidde company.
b. J. L. Industries, Inc.; a division of Activar Construction Products Group.
c. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.

B. Multipurpose Dry-Chemical Type: UL-rated 20# nominal capacity, with monoammonium phosphate-based dry chemical in manufacturer's standard enameled container.

2.2 ACCESSORIES

A. Provide wall mounted extinguisher brackets for each extinguisher

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.
   1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install fire extinguishers in locations indicated and in compliance with requirements of authorities having jurisdiction.

END OF SECTION

SECTION 10511
METAL LOCKERS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Knocked-down, painted metal, corridor lockers. Wall mounted, with bases to match existing corridor lockers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of metal locker.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal locker.

B. Shop Drawings: For metal lockers.
   1. Include plans, elevations, sections, details, and attachments to other work.
   2. Show locker trim and accessories.
   3. Include locker identification system and numbering sequence.

1.4 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for their installation.

1.6 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of recessed openings by field measurements before fabrication.

1.7 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that metal lockers can be supported and installed as indicated.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.
   1. Failures include, but are not limited to, the following:

      a)Structural failures.
      b)Faulty operation of latches and other door hardware.
   2. Damage from deliberate destruction and vandalism is excluded.
   3. Warranty Period for Knocked-Down Metal Lockers: Two years from date of Substantial Completion.
   4. Warranty Period for Welded Metal Lockers: 10 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain metal lockers and accessories from single source from single locker manufacturer.
   1. Obtain locks from single lock manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Accessibility Requirements: For lockers indicated to be accessible, comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC A117.1.

2.3 KNOCKED-DOWN CORRIDOR LOCKERS

A. Doors: One piece; fabricated from.060-inch nominal-thickness steel sheet; formed into channel shape with double bend at vertical edges and with right-angle single bend at horizontal edges.
   1. Doors less than 12 inches wide may be fabricated from 0.048-inch nominal-thickness steel sheet.
   2. Doors for box lockers less than 15 inches wide may be fabricated from 0.048-inch nominal-thickness steel sheet.
   3. Reinforcement: Manufacturer's standard reinforcing angles, channels, or stiffeners for doors more than 15 inches wide; welded to inner face of

doors.

4. Stiffeners: Manufacturer's standard full-height stiffener fabricated from 0.048-inch nominal-thickness steel sheet; welded to inner face of doors.
5. Sound-Dampening Panels: Manufacturer's standard, designed to stiffen doors and reduce sound levels when doors are closed, of die-formed metal with full perimeter flange and sound-dampening material; welded to inner face of doors.
6. Door Style: Vented panel as follows:
   a. Louvered Vents: No fewer than six louver openings at top and bottom for single-tier lockers.

B. Body: Assembled by riveting or bolting body components together. Fabricate from unperforated steel sheet with thicknesses as follows:
   1. Tops, Bottoms, and Intermediate Dividers: 0.024-inch nominal thickness, with single bend at sides.
   2. Backs and Sides: 0.024-inch nominal thickness, with full-height, double-flanged connections.
   3. Shelves: 0.024-inch nominal thickness, with double bend at front and single bend at sides and back.

C. Frames: Channel formed; fabricated from 0.060-inch nominal-thickness steel sheet; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral, full-height door strikes on vertical main frames.
   1. Cross Frames between Tiers: Channel formed and fabricated from same material as main frames; welded to vertical main frames.
   2. Frame Vents: Fabricate face frames with vents.

D. Hinges: Welded to door and attached to door frame with no fewer than two factory-installed rivets per hinge that are completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees.
   1. Hinges: Manufacturer's standard, steel, continuous or knuckle type.

E. Projecting Door Handle and Latch: Finger-lift latch control designed for use with either built-in combination locks or padlocks; positive automatic latching, chromium plated; pry and vandal resistant.
   1. Latch Hooks: Equip doors 48 inches and higher with three latch hooks and doors less than 48 inches high with two latch hooks; fabricated from 0.105-inch nominal-thickness steel sheet; welded or riveted to full-height door strikes; with resilient silencer on each latch hook.
   2. Latching Mechanism: Manufacturer's standard, rattle-free latching mechanism and moving components isolated to prevent metal-to-metal contact, and incorporating a prelocking device that allows locker door to be locked while door is open and then closed without unlocking or

damaging lock or latching mechanism.

F. Locks: Hasp for paddle locks. (locks by owner).

G. Hooks: Manufacturer's standard ball-pointed type hooks, aluminum or steel; zinc plated.

H. Materials:
   1. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B, suitable for exposed applications.
   2. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with A60 zinc-iron, alloy (galvannealed) coating designation.

I. Finish: Baked enamel or powder coat.
   1. Color: As selected by Architect from manufacturer's full range.

2.4 FABRICATION

A. Fabricate metal lockers square, rigid, without warp, and with metal faces flat and free of dents or distortion. Make exposed metal edges safe to touch and free of sharp edges and burrs.
   1. Form body panels, doors, shelves, and accessories from one-piece steel sheet unless otherwise indicated.
   2. Provide fasteners, filler plates, supports, clips, and closures as required for complete installation.

B. Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments. Factory weld frame members of each metal locker together to form a rigid, one-piece assembly.

C. Equipment: Provide each locker with an identification plate and the following equipment:
   1. Single-Tier Units: Shelf, one double-prong ceiling hook, and two single-prong wall hooks.

D. Knocked-Down Construction: Fabricate metal lockers using nuts, bolts, screws, or rivets for preassembly at plant prior to shipping.

E. Accessible Lockers: Fabricate as follows:
   1. Locate bottom shelf no lower than 15 inches above the floor.
   2. Where hooks, coat rods, or additional shelves are provided, locate no higher than 48 inches above the floor.

F. Continuous Base: Formed into channel or zee profile for stiffness, and fabricated in lengths as long as practical to enclose base and base ends of metal lockers; finished to match lockers.

2.5 ACCESSORIES

A. Fasteners: Zinc- or nickel-plated steel, slotless-type, exposed bolt heads; with self-locking nuts or lock washers for nuts on moving parts.

B. Anchors: Material, type, and size required for secure anchorage to each substrate.
   1. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls, and elsewhere as indicated, for corrosion resistance.
   2. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine walls, floors, and support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install lockers level, plumb, and true; shim as required, using concealed shims.
   1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches o.c. Using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion.
   2. Anchor single rows of metal lockers to walls near top and bottom of lockers of lockers and to floor.
   3. Anchor back-to-back metal lockers to floor.

B. Knocked-Down Lockers: Assemble with standard fasteners, with no exposed

fasteners on door faces or face frames.

C. Equipment:
   1. Attach hooks with at least two fasteners.
   2. Attach door locks on doors using security-type fasteners.

D. Trim: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.
   1. Attach recess trim to recessed metal lockers with concealed clips.
   2. Attach filler panels with concealed fasteners. Locate filler panels where indicated on Drawings.
   3. Attach sloping-top units to metal lockers, with closures at exposed ends.
   4. Attach finished end panels using fasteners only at perimeter to conceal exposed ends of nonrecessed metal lockers.

E. Freestanding Locker Benches: Place benches in locations indicated on Drawings.

3.3 ADJUSTING

A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding. Verify that integral locking devices operate properly.

3.4 PROTECTION

A. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.

B. Touch up marred finishes, or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION

SECTION 12211
HORIZONTAL LOUVER BLINDS (NOT IN CONTRACT, BY OWNER)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Horizontal louver blinds with aluminum slats.

B. Related Requirements:
   1. Section 06 "Miscellaneous Rough Carpentry" for wood blocking and grounds for mounting horizontal louver blinds and accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show fabrication and installation details for horizontal louver blinds.

C. Samples for Initial Selection: For each type and color of horizontal louver blind.
   1. Include similar Samples of accessories involving color selection.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver horizontal louver blinds in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Do not install horizontal louver blinds until construction and wet and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where horizontal louver blinds are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain horizontal louver blinds from single source from single manufacturer.

2.2 HORIZONTAL LOUVER BLINDS, ALUMINUM SLATS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Hunter Douglas Contract.
   2. Levolor Contract; a Newell Rubbermaid company.
   3. Spring Window Fashioins
   4. Approved Equal

B. Slats: Aluminum; alloy and temper recommended by producer for type of use and finish indicated; with crowned profile and radius corners.
   1. Width: 1 inch (25 mm).
   2. Thickness: 0.008 inch minimum
   3. Spacing: Manufacturer's standard.
   4. Finish: baked polyester enamal.
   5. Features:
      a. Lift-Cord Rout Holes: Minimum size required for lift cord and located near back (outside) edge of slat to maximize slat overlap and minimize light gaps between slats.

C. Headrail: Formed steel or extruded aluminum; long edges returned or rolled. Headrails fully enclose operating mechanisms on three sides.
   1. Capacity: One blind per headrail unless otherwise indicated.
   2. Ends: Manufacturer's standard.
   3. Manual Lift Mechanism:
      a. Lift-Cord Lock: Top locking; stops lift cord when blind is in fully opened or fully closed positions only; equipped with ring pull not

more than 4 inches (100 mm) long.

b. Operator: Extension of lift cord(s) through lift-cord lock mechanism to form cord pull.

4. Manual Tilt Mechanism: Enclosed worm-gear mechanism and linkage rod that adjusts ladders.
   a. Tilt: Full.
   b. Operator: Clear Thermoplastic wand

D. Lift Cords: 100% high tenacity polyester chord.

E. Mounting Brackets: With spacers and shims required for blind placement and alignment indicated.

F. Colors, Textures, Patterns, and Gloss:
   1. Slats: As selected by Architect from manufacturer's full range.
   2. Components: Provide rails, cords, ladders, and materials exposed to view matching or coordinating with slat color unless otherwise indicated.

2.3 HORIZONTAL LOUVER BLIND FABRICATION

A. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F (23 deg C):
   1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which blind is installed less 1/4 inch (6 mm) per side or 1/2 inch (13 mm) total, plus or minus 1/8 inch (3.1 mm). Length equal to head-to-sill dimension of opening in which blind is installed less 1/4 inch (6 mm), plus or minus 1/8 inch (3.1 mm).

B. Concealed Components: Noncorrodible or corrosion-resistant-coated materials.
   1. Lift-and-Tilt Mechanisms: With permanently lubricated moving parts.

C. Mounting and Intermediate Brackets: Designed for removal and reinstallation of blind without damaging blind and adjacent surfaces, for supporting blind components, and for bracket positions and blind placement indicated.

D. Installation Fasteners: No fewer than two fasteners per bracket, fabricated from metal noncorrosive to brackets and adjoining construction; type designed for securing to supporting substrate; and supporting blinds and accessories under conditions of normal use.

E. Color-Coated Finish:
   1. Metal: For components exposed to view, apply manufacturer's standard baked finish complying with manufacturer's written instructions for

surface preparation including pretreatment, application, baking, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install horizontal louver blinds level and plumb, aligned and centered on openings, and aligned with adjacent units according to manufacturer's written instructions.
   1. Locate so exterior slat edges are not closer than 1 inch (25 mm) from interior faces of glass and not closer than 1/2 inch (13 mm) from interior faces of glazing frames through full operating ranges of blinds.
   2. Install mounting and intermediate brackets to prevent deflection of headrails.
   3. Install with clearances that prevent interference with adjacent blinds, adjacent construction, and operating hardware of glazed openings, other window treatments, and similar building components and furnishings.

3.3 ADJUSTING

A. Adjust horizontal louver blinds to operate free of binding or malfunction through full operating ranges.

3.4 CLEANING AND PROTECTION

A. Clean horizontal louver blind surfaces after installation according to manufacturer's written instructions.

B. Provide final protection and maintain conditions in a manner acceptable to manufacturer and Installer and that ensures that horizontal louver blinds are without damage or deterioration at time of Substantial Completion.

C. Replace damaged horizontal louver blinds that cannot be repaired in a manner approved by Architect before time of Substantial Completion.

END OF SECTION

SECTION 12354
MANUFACTURED CASEWORK

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. Wood-faced kitchen cabinets.
   2. Plastic Laminate countertops

B. Related Requirements:
   1. Section 06 "Miscellaneous Carpentry" or wood blocking for anchoring casework.
   2. Section 09 "Non-Load-Bearing Steel Framing" for reinforcements in metal-framed partitions for anchoring casework.
   3. Section 09 "Resilient Wall Base and Accessories" for resilient base applied to plastic-laminate-faced casework.

1.3 REFERENCES

A. Kitchen Cabinet Manufacturers Association (KMCA)

B. American National Standards Institute (ANSI)

C. Hardwood Plywood & Veneer Association (HPVA)

1.4 DEFINITIONS

A. Definitions in the AWI's, AWMAC's, and WI's "Architectural Woodwork Standards" apply to the work of this Section.

B. Exposed Surfaces of Casework: Surfaces visible when doors and drawers are closed, including visible surfaces in open cabinet.

C. Semiexposed Surfaces of Casework:
   1. Surfaces visible when behind opaque doors and drawer fronts are open, including interior faces of doors and and interiors and sides of drawers.

D. Concealed Surfaces of Casework:
   1. Surfaces not usually visible after installation, including sleepers, web frames, dust panels, bottoms of drawers, and ends of cabinets installed directly against and completely concealed by walls or other cabinets.
   2. Tops of wall cabinets and utility cabinets are defined as concealed.
   3. Bottoms of wall cabinets are defined as semiexposed

1.5 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that casework can be supported and installed as indicated.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Show fabrication details, including types and locations of hardware. Show installation details, including field joints and filler panels. Indicate manufacturer's catalog numbers for casework.

C. Samples: For cabinet finishes, laminate for countertop

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer that is certified for chain of custody by an FSC-accredited certification body.

B. Product Designations: Drawings indicate size, configurations, and finish material of casework by referencing designated manufacturer's catalog numbers. Other manufacturer's casework of similar sizes, similar door and drawer configurations, similar finish materials, and complying with the Specifications may be considered. Refer to Division 1 Section Substitutions.

C. Quality Standards: Unless otherwise indicated, comply with the following standards:
   1. Cabinets: KCMA A161.1

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver casework only after painting, utility roughing-in, and similar operations that could damage, soil, or deteriorate casework have been completed in installation areas. If casework must be stored in other than

installation areas, store only in areas where environmental conditions meet requirements specified in "Project Conditions" Article.

B. Keep finished surfaces covered with polyethylene film or other protective covering during handling and installation.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install casework until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period. Maintain temperature and relative humidity during the remainder of the construction period in range recommended for Project location by the AWI's, AWMAC's, and WI's "Architectural Woodwork Standards."

B. Established Dimensions: Where casework is indicated to fit to other construction, establish dimensions for areas where woodwork is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

C. Locate concealed framing, blocking, and reinforcements that support casework by field measurements before being enclosed, and indicate measurements on Shop Drawings.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of casework that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Delamination of components or other failures of glue bond.
      b. Warping of components.
      c. Failure of operating hardware.
   2. Warranty Period: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 CASEWORK, GENERAL

A. Acceptable Manufacturers: Subject to the compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Cabinets

a. KraftMaid Cabinetry, Inc
b. American Woodmark
c. Schuler Cabinets
d. Approved Equal

2. Plastic Laminate Countertops; post formed
   1) Wilsonart
   2) Approved Equal

B. Product Designations: Drawings indicate sizes, configurations, and finish materials of manufactured cabinets by referencing designated manufacturer's standards. Other manufacturers' casework of similar sizes and door and drawer configurations, of same finish materials, and complying with the Specifications may be considered. See Section 01 "Product Requirements."

2.2 CABINET MATERIALS

A. Cabinets style:
1. Door Face: Square Raised Panel
2. Species: Red Oak

B. Exposed Materials: Comply with the following:

1. Exposed Wood Species:
   a. Unless otherwise indicated, do not use two adjacent exposed faces shall be similar that are noticeably dissimilar in color, grain, figure, and or natural character markings.
   b. Red Oak.

2. Solid Wood: Clear hardwood lumber of species indicated, free of defects, selected for compatible grain and color, kiln dried to 7 percent moisture content.

3. Plywood: Hardwood plywood complying with HPVA HP – 1 face veneer of species indicated, selected for compatible color and grain with Grade A faces and Grade C backs of same species as faces.

4. Edge band exposed edges with minimum 1/8 inch (3 mm) thick, solid-wood edging of same species as face veneer.

5. Vinyl-Faced Fiberboard: Medium-density fiberboard complying with ANSI A208.2, milled to required shapes, with a thermoformed vinyl overlay applied in a vacuum or membrane press.

6. Thermoset Decorative Overlay: Medium-density particleboard complying with ANSI A208-1, Grade M-2; with surface of thermally fused,

melamine-impregnated decorative paper complying with LMA SAT-1.

7. Provide PVC or polyester edge banding complying with LMA EDG-1 on components with exposed or semi-exposed surfaces.

C. Semi-exposed Materials: Unless otherwise noted, provide the following:

1. Plywood: Hardwood plywood complying with HPVA HP-1 with Grade C faces and backs stained to be compatible with exposed surfaces.

2. Plywood: Hardwood plywood complying with HPVA HP-1 with Grade C faces stained to be compatible with exposed surfaces and Grade 3 backs of Birch species, with clear finish.

3. Plywood: Hardwood plywood complying with HPVA HP-1 with Grade C face stained to be compatible with exposed surfaces and an embossed, natural birch vinyl film adhesively bonded to the plywood.

4. Vinyl-Faced Particleboard: Medium density particleboard complying with ANSI A208.1, Grade M-2 with an embossed, wood grain-patterned vinyl film adhesively bonded to particleboard.
   a. Provide vinyl film on both sides of shelves, dividers, and other components with two semi-exposed surfaces and semi-exposed edges.

5. Concealed Materials: Comply with the following:
   a. Plywood: Any hardwood or softwood species, with no defects affecting strength or utility.
   b. Particleboard: ANSI A208.1, Grade M-2

2.3 COUNTERTOP MATERIALS

A. High-Pressure Decorative Laminate complying NEMA LD3, post-formed.

B. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. As selected by Architect from manufacturer's full range in the following categories:
   a. Patterns, matte finish.

2.4 COLORS AND FINISHES

A. Colors, Textures, and Patterns: As selected by Architect from manufacturer's

full range for these characteristics.

2.5 CASEWORK HARDWARE AND ACCESSORIES

A. Hardware, General: Unless otherwise indicated, provide manufacturer's standard satin-finish, commercial-quality, heavy-duty hardware complying with BHMA A156.9.

B. Frameless Concealed Hinges (European Type): BHMA A156.9, Type B01602, 170 degrees of opening, self-closing. Provide two hinges for doors less than 48 inches (1220 mm) high, and provide three hinges for doors more than 48 inches (1220 mm) high.

C. Pulls: No hardware required for doors. Doors should be operable without hardware.

D. Drawer Slides: BHMA A156.9, Type B05091.
   1. Heavy Duty (Grade 1HD-100 and Grade 1HD-200): Side mounted; full-overtravel-extension type; zinc-plated, steel ball-bearing slides.
   2. Soft Closing Operation

E. Adjustable Shelf Supports: Two-pin locking metal shelf rests complying with BHMA A156.9, Type B04013.

2.6 CABINET CONSTRUCTION

A. Face Style: Reveal overlay: door and drawer faces partially cover body or face frame.

B. Face Frames: 3/4-by-1 1/2-inch (19-by-38-mm) solid wood.

C. Door and Drawer Fronts:
   1. Solid wood slab, 3/4-inch (19mm) thick.
   2. Solid wood stiles and rails, 3/4-inch (19mm), with 1/4-inch (6.4mm) thick, veneer-faced plywood center panels.

D. Exposed Cabinet Ends:
   1. 1/2-inch (12.7mm) thick, veneer-faced plywood with natural birch vinyl faced interior.

E. Cabinet Tops and Bottoms: 1/2- inch (12.7mm) thick natural birch veneer-faced plywood, supported by and secured in rabbits in end panels and front face frame.

F. Base Unit Top Rails: 3/4 by 2 3/4-inch solid wood, interlocking with end

panels, and secured under pressure with glue and with mechanical fasteners.

G. Wall-Hung Unit Top and Bottom Rails: 1/2 by 2 1/2-inch solid wood, interlocking with end panels, and secured with glue and mechanical fasteners.

H. Base Unit Back Panels: 3/8-inch vinyl-faced or veneer particleboard fastened to rear edge of end panels and to top rail.

I. Wall-Hung Unit Backs: 3/16-inch thick plywood, captured on the end panels and fastened to the top and bottom rails.

J. Front Face Frame Drawer Rails: 3/4-by-1 1/2-inch solid wood fastened into face frame.

K. Drawers: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
   1. Join subfronts, backs, and sides with glued dovetail joints.
   2. Subfronts, backs, and sides: 3/4-inch (19mm)-thick solid wood.
   3. One drawer, for / over each base cabinet door.

L. Shelves: 3/4-inch (19mm)-thick particleboard or 5/8-inch-(16mm)-thick plywood.

M. Joinery: Rabbet backs flush into end panels and secure with concealed mechanical fasteners. Connect tops and bottoms of wall cabinets and bottoms of base cabinets to ends and dividers with mechanical fasteners. Rabbet tops bottoms, and backs into end panels.

N. Factory Finishing: To the greatest extent possible, finish casework at the factory. Defer only final touch up until after installation.

2.7 PLASTIC LAMINATE - CONSTRUCTION

A. Configuration: Provide typical post-from countertops with the following front and backsplash style:
   1. Front: Post form cement to core.
   2. Backsplash: Post formed, eased curve

B. Construction:
   1. Core Material: Particleboard with continuous exterior glue & stapled
   2. Cement laminate to core.
   3. Paper Backing: Provide paper backing on underside of countertop substrate.
   4. Finished end caps

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of framing and reinforcements, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 CASEWORK INSTALLATION

A. Install casework with no variations in flushness of adjoining surfaces; use concealed shims. Where casework abuts other finished work, scribe and cut for accurate fit. Provide filler strips, scribe strips, and moldings in finish to match casework face.

B. Install casework without distortion so doors and drawers fit openings and are aligned. Complete installation of hardware and accessories as indicated.

C. Install casework and countertop level and plumb to a tolerance of 1/8-inch in 8 feet (3mm in 2.4m).

D. Fasten cabinets to adjacent units and to backing.
   1. Fasten wall cabinets through back, near top and bottom, at ends and not less than 24 inches o. c.

3.3 CLEANING

A. Repair or remove and replace defective work as directed on completion of installation.

B. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

END OF SECTION

SECTION 13125
PRE FABRICATED METAL BUILDING SYSTEMS

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: factory built, pre-assembled, all steel, noncombustible building to include the building, and any pre-installed electrical if listed. Building is to be shop fabricated and delivered to site in sections, set on contractor furnished contractor installed concrete foundation, attached together on site to form one complete building with no visible exterior split.

1. Structural-steel framing.
2. Metal roof panels.
3. Metal wall panels.
4. Doors and frames.
5. Accessories.

B. Related Sections:

1. Section 03 "Concrete"

1.3 ACTION SUBMITTALS

A. Product Data: For each type of metal building system component. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:

1. Structural-steel-framing system.
2. Metal roof panels.
3. Metal liner panels.

4. Insulation and vapor retarder facings.
5. Flashing and trim.
6. Doors.
7. Accessories.

B. Shop Drawings: For the following metal building system components. Include plans, elevations, sections, details, and attachments to other work.

1. Anchor-Bolt Plans: Submit anchor-bolt plans and templates before foundation work begins. Include location, diameter, and projection of anchor bolts required to attach metal building to foundation. Indicate column reactions at each location.
2. Structural-Framing Drawings: Show complete fabrication of primary and secondary framing; include provisions for openings. Indicate welds and bolted connections, distinguishing between shop and field applications. Include transverse cross-sections.

3. Metal Roof Panel Layout Drawings: Show layouts of metal panels including methods of support. Include details of edge conditions, joints, panel profiles, corners, anchorages, trim, flashings, closures, and special details. Distinguish between factory- and field-assembled work; show locations of exposed fasteners.

4. Accessory Drawings: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches:

   a. Flashing and trim.
   b. Gutters.
   c. Downspouts.
   d. Roof ventilators.
   e. Louvers.

C. Samples for Initial Selection: For units with factory-applied color finish.

D. Door Schedule: For doors and frames. Use same designations indicated on Drawings. Include details of reinforcement.

1. Door Hardware Schedule: Include details of fabrication and assembly of door hardware. Organize schedule into door hardware sets indicating complete designations of every item required for each door or opening.

2. Keying Schedule: Detail Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.

E. Delegated-Design Submittal: For metal building systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified erector, manufacturer, professional engineer.

B. Metal Building System Certificates: For each type of metal building system, from manufacturer.

1. Letter of Design Certification: Signed and sealed by a qualified professional engineer. Include the following:

   a. Name and location of Project.
   b. Name of manufacturer.
   c. Name of Contractor.
   d. Building dimensions including width, length, height, and roof slope.
   e. Indicate compliance with AISC standards for hot-rolled steel and AISI standards for cold-rolled steel, including edition dates of each standard.
   f. Governing building code and year of edition.
   g. Design Loads: Include dead load, roof live load, collateral loads, roof snow load, deflection, wind loads/speeds and exposure, seismic design category or effective peak velocity-related acceleration/peak acceleration, and auxiliary loads (cranes).
   h. Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing building code.
   i. Building-Use Category: Indicate category of building use and its effect on load importance factors.
   j. AISC Certification for Category MB: Include statement that metal building system and components were designed and produced in an AISC-Certified Facility by an AISC-Certified Manufacturer.

C. Warranties: Sample of special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panel finishes and door hardware to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer.

1. AISC Certification for Category MB: An AISC-Certified Manufacturer that designs and produces metal building systems and components in an AISC-Certified Facility.
2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

B. Erector Qualifications: An experienced erector who specializes in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.

C. Source Limitations: Obtain metal building system components, including primary and secondary framing and metal panel assemblies, from single source from single manufacturer.

D. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3, "Structural Welding Code - Sheet Steel."

E. Structural Steel: Comply with AISC 360, "Specification for Structural Steel Buildings," for design requirements and allowable stresses.

F. Cold-Formed Steel: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" for design requirements and allowable stresses.

G. Fire-Resistance Ratings: Where indicated, provide metal panel assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
2. Combustion Characteristics: ASTM E 136.

H. Fire-Rated Door Assemblies: Where indicated, Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

I. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to metal building systems including, but not limited to, the following:

   a. Condition of foundations and other preparatory work performed by other trades.
   b. Structural load limitations.
   c. Construction schedule. Verify availability of materials and erector's personnel, equipment, and facilities needed to make progress and avoid delays.
   d. Required tests, inspections, and certifications.
   e. Unfavorable weather and forecasted weather conditions.

2. Review methods and procedures related to metal roof panel assemblies including, but not limited to, the following:

   a. Compliance with requirements for purlin and rafter conditions, including flatness and attachment to structural members.
   b. Structural limitations of purlins and rafters during and after roofing.
   c. Flashings, special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect metal roof panels.
   d. Temporary protection requirements for metal roof panel assembly during and after installation.
   e. Roof observation and repair after metal roof panel installation.

3. Review methods and procedures related to metal wall panel assemblies including, but not limited to, the following:

   a. Compliance with requirements for support conditions, including alignment between and attachment to structural members.

b. Structural limitations of girts and columns during and after wall panel installation.
c. Flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect metal wall panels.
d. Temporary protection requirements for metal wall panel assembly during and after installation.
e. Wall observation and repair after metal wall panel installation.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, sheets, panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Protect foam-plastic insulation as follows:

1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic insulation materials to Project site before installation time.
3. Complete installation and concealment of foam-plastic materials as rapidly as possible in each area of construction.

1.8 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when weather conditions permit metal panels to be installed according to manufacturers' written instructions and warranty requirements.

B. Field Measurements:

1. Established Dimensions for Foundations: Comply with established dimensions on approved anchor-bolt plans, establishing foundation dimensions and proceeding with fabricating structural framing without field measurements. Coordinate anchor-bolt installation to ensure that actual anchorage dimensions correspond to established dimensions.
2. Established Dimensions for Metal Panels: Where field measurements cannot be made without delaying the Work, either establish framing and opening

dimensions and proceed with fabricating metal panels without field measurements, or allow for field trimming metal panels. Coordinate construction to ensure that actual building dimensions, locations of structural members, and openings correspond to established dimensions.

1.9 COORDINATION

A. Coordinate sizes and locations of concrete foundations and casting of anchor-bolt inserts into foundation walls and footings. Concrete, reinforcement, and formwork requirements are specified in Section 03 "Cast-in-Place Concrete."

B. Coordinate metal panel assemblies with rain drainage work, flashing, trim, and construction of supports and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

A. Special Warranty on Metal Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

   a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
   b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
   c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

B. Special Weathertightness Warranty for Standing-Seam Metal Roof Panels: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that leak or otherwise fail to remain weathertight within specified warranty period.

1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide or comparable product by one of the following:

1. Trachte Inc. Oregon WI, (design basis).
2. Cleary building corp. Verona WI
3. A&S Building Systems, Inc.; Division of NCI Building Systems, L.P.
4. Butler Manufacturing Company; a BlueScope Steel company.

2.2 METAL BUILDING SYSTEMS

A. Description: Provide a complete, integrated set of metal building system manufacturer's standard mutually dependent components and assemblies that form a metal building system capable of withstanding structural and other loads, thermally induced movement, and exposure to weather without failure or infiltration of water into building interior.

1. Provide premanufactured metal building system of size and with bay spacings, roof slopes, and spans indicated on drawings.

B. Primary-Frame Type:

1. Rigid Clear Span: Solid-member, structural-framing system without interior columns.

C. End-Wall Framing: Manufacturer's standard, for buildings not required to be expandable, consisting of primary frame, capable of supporting one-half of a bay design load, and load-bearing end-wall and corner columns and rafters.

D. End-Wall Framing: Engineer end walls to be expandable. Provide primary frame, capable of supporting full-bay design loads, and end-wall columns.

E. Secondary-Frame Type: Manufacturer's standard purlins and joists and partially inset-framed girts.

F. Eave Height: as indicated by nominal height on Drawings.

G. Bay Spacing: As determined by manufacturer.

H. Roof Slope: Manufacturer's standard for frame type required.

I. Roof System: Manufacturer's standard standing-seam.

J. Exterior Wall System: Manufacturer's standard tapered-rib, exposed-fastener metal wall panels.

2.3 METAL BUILDING SYSTEM PERFORMANCE

A. Delegated Design: Design metal building system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Metal building systems shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to procedures in MBMA's "Metal Building Systems Manual."

1. Design Loads: As required by MBMA's "Metal Building Systems Manual." ASCE/SEI 7.rement.
2. Deflection Limits: Design metal building system assemblies to withstand design loads with deflections no greater than the following:

    a. Purlins and Rafters: Vertical deflection of 1/240 of the span.
    b. Girts: Horizontal deflection of 1/240 of the span.
    c. Metal Roof Panels: Vertical deflection of 1/240 of the span.
    d. Design secondary-framing system to accommodate deflection of primary framing and construction tolerances, and to maintain clearances at openings.

3. Drift Limits: Engineer building structure to withstand design loads with drift limits no greater than the following:

    a. Lateral Drift: Maximum of 1/400 of the building height.

4. Metal panel assemblies shall withstand the effects of gravity loads and loads and stresses within limits and under conditions indicated according to ASTM E 1592.

C. Thermal Movements: Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing

buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

D. Air Infiltration for Metal Roof Panels: Air leakage through assembly of not more than 0.06 cfm/sq. ft. of roof area when tested according to ASTM E 1680 at negative test-pressure difference of 1.57 lbf/sq. ft.

E. Water Penetration for Metal Roof Panels: No water penetration when tested according to ASTM E 1646 at test-pressure difference of 2.86 lbf/sq. ft.

F. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for Class 90.

2.4 STRUCTURAL-STEEL FRAMING

A. Primary Framing: Manufacturer's standard primary-framing system, designed to withstand required loads and specified requirements. Primary framing includes transverse and lean-to frames; rafter, rake, and canopy beams; sidewall, intermediate, end-wall, and corner columns; and wind bracing.

1. General: Provide frames with attachment plates, bearing plates, and splice members. Factory drill for field-bolted assembly. Provide frame span and spacing indicated.

    a. Slight variations in span and spacing may be acceptable if necessary to comply with manufacturer's standard, as approved by Architect.

2. Rigid Clear-Span Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes.
3. Frame Configuration: Single gable.
4. Exterior Column Type: Uniform depth.
5. Rafter Type: Uniform depth.

B. End-Wall Framing: Manufacturer's standard primary end-wall framing fabricated for field-bolted assembly to comply with the following:

1. End-Wall and Corner Columns: I-shaped sections fabricated from structural-steel shapes; shop-welded, built-up steel plates; or C-shaped, cold-formed, structural-steel sheet.

C. Secondary Framing: Manufacturer's standard secondary framing, including purlins, girts, eave struts, flange bracing, base members, gable angles, clips, headers, jambs, and other miscellaneous structural members. Unless otherwise indicated, fabricate framing from either cold-formed, structural-steel sheet or roll-formed, metallic-coated steel sheet, prepainted with coil coating, to comply with the following:

1. Purlins: C- or Z-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes; minimum 2-1/2-inch wide flanges.

   a. Depth: As needed to comply with system performance requirements.

2. Girts: C- or Z-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes. Form ends of Z-sections with stiffening lips angled 40 to 50 degrees from flange, with minimum 2-1/2-inch wide flanges.

   a. Depth: As required to comply with system performance requirements.

3. Eave Struts: Unequal-flange, C-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes; to provide adequate backup for metal panels.
4. Flange Bracing: Minimum 2-by-2-by-1/8-inch structural-steel angles or 1-inch- diameter, cold-formed structural tubing to stiffen primary-frame flanges.
5. Sag Bracing: Minimum 1-by-1-by-1/8-inch structural-steel angles.
6. Base or Sill Angles: Minimum 3-by-2-inch zinc-coated (galvanized) steel sheet.
7. Purlin and Girt Clips: Manufacturer's standard clips fabricated from steel sheet. Provide galvanized clips where clips are connected to galvanized framing members.
8. Secondary End-Wall Framing: Manufacturer's standard sections fabricated from zinc-coated (galvanized) steel sheet.
9. Framing for Openings: Channel shapes; fabricated from cold-formed, structural-steel sheet or structural-steel shapes. Frame head and jamb of door openings and head, jamb, and sill of other openings.
10. Miscellaneous Structural Members: Manufacturer's standard sections fabricated from cold-formed, structural-steel sheet; built-up steel plates; or zinc-coated (galvanized) steel sheet; designed to withstand required loads.

D. Bracing: Provide adjustable wind bracing as follows:

1. Diaphragm Action of Metal Panels: Design metal building bracing to resist wind forces through diaphragm action of metal panels.

E. Finish: Factory primed. Apply specified primer immediately after cleaning and pretreating.

1. Apply primer to primary and secondary framing to a minimum dry film thickness of 1 mil (0.025 mm).

a. Prime secondary framing formed from uncoated steel sheet to a minimum dry film thickness of 0.5 mil (0.013 mm) on each side.

2. Prime galvanized members with specified primer after phosphoric acid pretreatment.
3. Primer: SSPC-Paint 15, Type I, red oxide.

2.5 METAL ROOF PANELS

A. Vertical-Rib, Standing-Seam Metal Roof Panels: Formed with vertical ribs at panel edges and intermediate stiffening ribs symmetrically spaced between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels.

1. Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch nominal thickness.

a. Exterior Finish: Fluoropolymer.
b. Color: As selected by Architect from manufacturer's full range.

B. Finishes:

1. Exposed Coil-Coated Finish:

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

2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

2.6 DOORS AND FRAMES

A. Swinging Personnel Doors and Frames: Metal building system manufacturer's standard doors and frames; prepared and reinforced at strike and at hinges to receive factory- and field-applied hardware according to BHMA A156 Series.

1. Steel Doors: 1-3/4 inches thick; fabricated from 0.040-inch nominal-thickness, metallic-coated steel face sheets; of seamless, hollow-metal construction; with 0.064-inch nominal-thickness, inverted metallic-coated steel channels welded to face sheets at top and bottom of door.

   a. Design: Flush panel.
   b. Core: Kraft honeycomb

2. Steel Frames: Fabricate 2-inch- (51-mm-) wide face frames from 0.064-inch (1.63-mm) nominal-thickness, metallic-coated steel sheet.

3. Fabricate concealed stiffeners, reinforcement, edge channels, and moldings from either cold- or hot-rolled steel sheet.

4. Hardware:

   a. Provide hardware for each door leaf, as follows:

      1) Hinges: BHMA A156.1. Three antifriction-bearing, standard-weight, full-mortise, stainless-steel or bronze, template-type hinges; 4-1/2 by 4-1/2 inches (114 by 114 mm), with nonremovable pin.
      2) Lockset: BHMA A156.2. Key-in-lever cylindrical type.
      3) Threshold: BHMA A156.21. Extruded aluminum.
      4) Silencers: Pneumatic rubber; three silencers on strike jambs of single door frames and two silencers on heads of double door frames.
      5) Closer: BHMA A156.4. Surface-applied, standard-duty hydraulic type.

6) Weather Stripping: Vinyl applied to head and jambs, with vinyl sweep at sill.

5. Anchors and Accessories: Manufacturer's standard units galvanized according to ASTM A 123/A 123M.
6. Fabrication: Fabricate doors and frames to be rigid; neat in appearance; and free from defects, warp, or buckle. Provide continuous welds on exposed joints; grind, dress, and make welds smooth, flush, and invisible.

B. Overhead Sectional Door – Heavy duty insulated door with Low Headroom Hardware & Electric Operator

1. 18 ga Door / 16ga Door Frame
2. Standard Door Insulation (R-4 - Polystyrene)

2.7 ACCESSORIES

A. General: Provide accessories as standard with metal building system manufacturer and as specified. Fabricate and finish accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional and structural requirements.

1. Form exposed sheet metal accessories that are without excessive oil-canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.

B. Roof Panel Accessories: Provide components required for a complete metal roof panel assembly including copings, fasciae, corner units, ridge closures, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.

C. Flashing and Trim: Formed from 0.022-inch (0.56-mm) nominal-thickness, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match adjacent metal panels.

1. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers.
2. Opening Trim: Formed from 0.022-inch (0.56-mm) nominal-thickness, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Trim head and jamb of door openings, and head, jamb, and sill of other openings.

D. Gutters: Formed from 0.022-inch (0.56-mm) nominal-thickness, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match roof fascia and rake trim. Match profile of gable trim, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch- (2438-mm-) long sections, sized according to SMACNA's "Architectural Sheet Metal Manual."

1. Gutter Supports: Fabricated from same material and finish as gutters.
2. Strainers: Bronze, copper, or aluminum wire ball type at outlets.

E. Downspouts: Formed from 0.022-inch (0.56-mm) nominal-thickness, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match metal wall panels. Fabricate in minimum 10-foot- (3-m-) long sections, complete with formed elbows and offsets.

1. Mounting Straps: Fabricated from same material and finish as gutters.

2.8 FABRICATION

A. General: Design components and field connections required for erection to permit easy assembly.

1. Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.
2. Fabricate structural framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Members shall be free of cracks, tears, and ruptures.

B. Tolerances: Comply with MBMA's "Metal Building Systems Manual" for fabrication and erection tolerances.

C. Primary Framing: Shop fabricate framing components to indicated size and section, with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.

1. Make shop connections by welding or by using high-strength bolts.
2. Join flanges to webs of built-up members by a continuous, submerged arc-welding process.
3. Brace compression flange of primary framing with steel angles or cold-formed structural tubing between frame web and purlin web or girt web, so flange

compressive strength is within allowable limits for any combination of loadings.

4. Weld clips to frames for attaching secondary framing.
5. Shop Priming: Prepare surfaces for shop priming according to SSPC-SP 2. Shop prime primary framing with specified primer after fabrication.

D. Secondary Framing: Shop fabricate framing components to indicated size and section by roll-forming or break-forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.

1. Make shop connections by welding or by using non-high-strength bolts.
2. Shop Priming: Prepare uncoated surfaces for shop priming according to SSPC-SP 2. Shop prime uncoated secondary framing with specified primer after fabrication.

E. Metal Panels: Fabricate and finish metal panels at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.

1. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of metal panel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with erector present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Before erection proceeds, survey elevations and locations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments to receive structural framing, with erector present, for compliance with requirements and metal building system manufacturer's tolerances.

C. Proceed with erection only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition.

B. Provide temporary shores, guys, braces, and other supports during erection to keep structural framing secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural framing, connections, and bracing are in place unless otherwise indicated.

3.3 ERECTION OF STRUCTURAL FRAMING

A. Erect metal building system according to manufacturer's written erection instructions and erection drawings.

B. Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer.

C. Set structural framing accurately in locations and to elevations indicated, according to AISC specifications referenced in this Section. Maintain structural stability of frame during erection.

D. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
3. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

E. Align and adjust structural framing before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.

2. Make allowances for difference between temperature at time of erection and mean temperature when structure will be completed and in service.

F. Primary Framing and End Walls: Erect framing level, plumb, rigid, secure, and true to line. Level base plates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use grout to obtain uniform bearing and to maintain a level base-line elevation. Moist-cure grout for not less than seven days after placement.

1. Make field connections using high-strength bolts installed according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for bolt type and joint type specified.

a. Joint Type: Snug tightened or pretensioned.

G. Secondary Framing: Erect framing level, plumb, rigid, secure, and true to line. Field bolt secondary framing to clips attached to primary framing.

1. Provide rake or gable purlins with tight-fitting closure channels and fasciae.
2. Locate and space wall girts to suit openings such as doors and windows.
3. Locate canopy framing as indicated.
4. Provide supplemental framing at entire perimeter of openings, including doors, windows, louvers, ventilators, and other penetrations of roof and walls.

H. Steel Joists and Joist Girders: Install joists, girders, and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Standard Specifications and Load Tables for Steel Joists and Joist Girders," joist manufacturer's written instructions, and requirements in this Section.

1. Before installation, splice joists delivered to Project site in more than one piece.
2. Space, adjust, and align joists accurately in location before permanently fastening.
3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
4. Bolt joists to supporting steel framework using carbon-steel bolts unless otherwise indicated.
5. Bolt joists to supporting steel framework using high-strength structural bolts unless otherwise indicated. Comply with RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for high-strength structural bolt installation and tightening requirements.

6. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

I. Bracing: Install bracing in roof and sidewalls where indicated on erection drawings.

1. Tighten rod and cable bracing to avoid sag.
2. Locate interior end-bay bracing only where indicated.

J. Framing for Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to structural framing.

K. Erection Tolerances: Maintain erection tolerances of structural framing within AISC 303.

3.4 METAL PANEL INSTALLATION, GENERAL

A. Examination: Examine primary and secondary framing to verify that structural-panel support members and anchorages have been installed within alignment tolerances required by manufacturer.

1. Examine roughing-in for components and systems penetrating metal panels, to verify actual locations of penetrations relative to seams before metal panel installation.

B. General: Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Field cut metal panels as required for doors, windows, and other openings. Cut openings as small as possible, neatly to size required, and without damage to adjacent metal panel finishes.

   a. Field cutting of metal panels by torch is not permitted unless approved in writing by manufacturer.

2. Install metal panels perpendicular to structural supports unless otherwise indicated.

3. Flash and seal metal panels with weather closures at perimeter of openings and similar elements. Fasten with self-tapping screws.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Locate metal panel splices over, but not attached to, structural supports with end laps in alignment.
6. Lap metal flashing over metal panels to allow moisture to run over and off the material.

C. Lap-Seam Metal Panels: Install screw fasteners using power tools with controlled torque adjusted to compress EPDM washers tightly without damage to washers, screw threads, or metal panels. Install screws in predrilled holes.

1. Arrange and nest side-lap joints so prevailing winds blow over, not into, lapped joints. Lap ribbed or fluted sheets one full rib corrugation. Apply metal panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.

D. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.

E. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal panel assemblies. Provide types of gaskets, fillers, and sealants indicated; or, if not indicated, provide types recommended by metal panel manufacturer.

1. Seal metal panel end laps with double beads of tape or sealant the full width of panel. Seal side joints where recommended by metal panel manufacturer.
2. Prepare joints and apply sealants to comply with requirements in Section 07920 "Joint Sealants."

3.5 METAL ROOF PANEL INSTALLATION

A. General: Provide metal roof panels of full length from eave to ridge unless otherwise indicated or restricted by shipping limitations.

1. Install ridge caps as metal roof panel work proceeds.
2. Flash and seal metal roof panels with weather closures at eaves and rakes. Fasten with self-tapping screws.

B. Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each standing-seam joint, at location and spacing and with fasteners recommended by manufacturer.

1. Install clips to supports with self-drilling or self-tapping fasteners.
2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
4. Seamed Joint: Crimp standing seams with manufacturer-approved motorized seamer tool so that clip, metal roof panel, and factory-applied sealant are completely engaged.
5. Rigidly fasten eave end of metal roof panels and allow ridge end free movement due to thermal expansion and contraction. Predrill panels for fasteners.
6. Provide metal closures at peaks and each side of ridge caps.

C. Metal Fascia Panels: Align bottom of metal panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws. Flash and seal metal panels with weather closures where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.

D. Metal Roof Panel Installation Tolerances: Shim and align metal roof panels within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.6 DOOR AND FRAME INSTALLATION

A. General: Install doors and frames plumb, rigid, properly aligned, and securely fastened in place according to manufacturers' written instructions. Coordinate installation with wall flashings and other components. Seal perimeter of each door frame with elastomeric sealant used for metal wall panels.

B. Personnel Doors and Frames: Install doors and frames according to SDI A250.8. Fit non-fire-rated doors accurately in their respective frames, with the following clearances:

1. Between Doors and Frames at Jambs and Head: 1/8 inch (3 mm).
2. Between Edges of Pairs of Doors: 1/8 inch (3 mm).

3. At Door Sills with Threshold: 3/8 inch (9.5 mm).
4. At Door Sills without Threshold: 3/4 inch (19.1 mm).
5. At fire-rated openings, install frames according to, and doors with clearances specified in, NFPA 80.

C. Door Hardware: Mount units at heights indicated in DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames".

1. Install surface-mounted items after finishes have been completed on substrates involved.
2. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
3. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
4. Set thresholds for exterior doors in full bed of butyl-rubber sealant complying with requirements specified in Section 07 "Joint Sealants."

3.7 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal roof panel assembly, including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
2. Install components for a complete metal wall panel assembly, including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
3. Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by manufacturer.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed 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 weather resistant.

1. Install exposed flashing and trim that is without excessive oil-canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

C. Gutters: Join sections with riveted-and-soldered or lapped-and-sealed joints. Attach gutters to eave with gutter hangers spaced as required for gutter size, but not more than 36 inches (914 mm) o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

D. Downspouts: Join sections with 1-1/2-inch (38-mm) telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch (25 mm) away from walls; locate fasteners at top and bottom and at approximately 60 inches (1524 mm) o.c. in between.

1. Provide elbows at base of downspouts to direct water away from building.
2. Tie downspouts to underground drainage system indicated.

3.8 ADJUSTING

A. Doors: After completing installation, test and adjust doors to operate easily, free of warp, twist, or distortion.

B. Door Hardware: Adjust and check each operating item of door hardware and each door to ensure proper operation and function of every unit. Replace units that cannot be adjusted to operate as intended.

3.9 CLEANING AND PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

C. Touchup Painting: After erection, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted structural framing, bearing plates, and accessories.

1. Clean and prepare surfaces by SSPC-SP 2, "Hand Tool Cleaning," or by SSPC-SP 3, "Power Tool Cleaning."
2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

D. Metal Panels: Remove temporary protective coverings and strippable films, if any, as metal panels are installed. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

1. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

E. Doors and Frames: Immediately after installation, sand rusted or damaged areas of prime coat until smooth and apply touchup of compatible air-drying primer.

1. Immediately before final inspection, remove protective wrappings from doors and frames.

F. Louvers: Clean exposed surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate until final cleaning.

1. Restore louvers damaged during installation and construction period so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

a. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

End of Section

SECTION 15010
BASIC MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Basic Mechanical and Plumbing Requirements specifically applicable to Division 15 Sections.

1.2 SCOPE OF WORK

A. The following is a general description of the HVAC and Plumbing work for this project. This work description is not all inclusive but is offered to give the Contractor a general idea of the scope of the project.

1. HVAC work includes but is not limited to the following:

   a. Remove the existing furnace and DX cooling system, sheetmetal and condensing unit. Provide three new rooftop units. Provide new ductwork throughout the facility. Provide new roof curbs to set the new units. Provide new gas piping between the existing meter and the new gas-fired equipment. Provide electric heat in the restrooms and entryways as shown on the drawings.

   b. Remove and relocate an existing gas-fired unit heater and extend the natural gas piping as shown on the drawings.

2. Plumbing work includes but is not limited to the following:

   a. Demolition work will include existing water heater and fixtures from two bathrooms and the existing mechanical room.

   b. Existing water meter will be demolished. The water service will be extended under floor to a new location in new mechanical room.

   c. Provide new fixtures and piping for two new bathrooms, mechanical room, and kitchenette.

1.3 DEFINITIONS

A. The following words or phrases have special meaning when used in the articles of this division and in any other requirements applicable to this division:

1. "Exposed to View" or "Exposed" — shall have reference to and mean that the pipes, ducts, etc., insulated or otherwise, in the completed structure are visible within any normally occupied space, room or area.

2. "In Concealed Spaces", "Concealed or "Not Exposed to View" — shall have reference to and mean that the pipes, duct, etc., insulated or otherwise are concealed and not exposed to view within furred spaces, above suspended ceilings, pipe chases, etc.
3. "Unfinished Spaces" or "Unfinished Rooms" — shall have reference to areas such as Machine Rooms, Equipment Rooms, or similar areas. Where the words "In Finished Areas" or "Finished Rooms" are used, it shall have reference to rooms or spaces, such as, Reading rooms, Offices, Public Corridors, etc.
4. "Finished Rooms or Spaces" shall refer to areas similar to offices, public corridors, and public toilet rooms.
5. "Provide" — shall be taken to mean "furnish and install" meaning to purchase and deliver to the job site and the installation thereof.
6. "Piping" — shall include, in addition to pipe all fittings, valves, hangers, and other supports, expansion compensators, anchors, and accessories related to such piping including associated insulation.
7. "Ductwork" — shall include, in addition to ducts, all fittings, transitions, dampers, hangers and other supports, fire dampers, access panels, associated insulation and accessories related to such ductwork.
8. "Contractor" in Specifications and Drawing refers to respective Contractor performing that portion of work.
9. "Invert Elevation" (I.E.) means elevation of inside bottom of pipe or duct.
10. "Mechanical Work" is work in Division 15.

NOTE: The words "Contractor shall" are implied and shall be so understood wherever the directions "furnish," "install" or "provide" are used.

1.4 SPECIAL CONDITIONS

A. Minor items and accessories or devices reasonably inferable as necessary to the complete and proper operation of any system shall be provided by the Contractor for such system whether or not they are specifically called for by the Specifications or Drawings.

B. Where work specified in other sections of the specifications connects to equipment specified in Division 15 Sections, check the required connection to such equipment.

1.5 CODES AND STANDARDS

A. The Work governed by this Division shall comply with the latest editions of the following applicable standard specifications and codes. For other standard specifications, if included by reference, see Division 1 of the Specifications.

AABC	Associated Air Balance Council
ADC	Air Diffusion Council
AIA	American Institute of Architects
AMCA	Air Moving and Conditioning Association
ANSI	American National Standards Institute
ARI	Air-Conditioning and Refrigeration Institute
ASA	Acoustical Society of America
ASE	Association of Safety Engineers
ASHRAE	American Society of Heating Refrigeration and Air Conditioning Engineers

ASME	American Society of Mechanical Engineers
ASPE	American Society of Plumbing Engineers
ASTM	American Society for Testing Materials
AWS	American Welding Society
AWWA	American Water Works Association
CAGI	Compressed Air and Gas Institute
EPA	Environmental Protection Agency
FIA	Factory Insurance Association
FM	Factory Mutual Insurance Association
HYDI	Hydronics Institute
IBC	International Building Codes
IDPH	Illinois Department of Public Health
IEEE	Institute of Electrical and Electronics Engineers
MCAA	Mechanical Contractors Association of America
NBS	National Bureau of Standards
NEC	National Electric Code
NEMA	National Electrical Manufacturers Assoc.
NFPA	National Fire Protection Association
NSC	National Safety Council
NSF	National Sanitation Foundation
OSHA	Occupational Safety and Health Act
SMACNA	Sheet Metal and Air Conditioning Contractor's Association
UL	Underwriter's Laboratories, Inc.

1.6 WORK BY CITY

A. The following work shall be by the City:

1. Testing and balancing by others under a separate contract with the City.
2. Electrical work shall be by City forces.

1.7 PROJECT/SITE CONDITIONS

A. Install Work in locations shown on Drawings, unless prevented by Project conditions.

B. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of City before proceeding.

1.8 CONTRACTOR USE OF PREMISES

A. Refer to Division 1.

B. Limit use of site and premises to allow:

1. City occupancy.
2. Use of premises by City to conduct normal activities.

    a. Tie-ins to existing systems must be done in manner so as not to interfere with City's operations. All shut downs of existing services require a three day notice minimum in writing.

C. Schedule the Work to accommodate this requirement.

D. Cooperate with City to minimize conflict and to facilitate City's operations.

E. The City will be responsible for the identification and abatement of all hazardous materials and asbestos associated with the project. Although great care will be taken to eliminate any risks, the Contractor must be aware that hazardous materials may exist on site. Therefore, the Contractor shall immediately suspend work and notify the City if asbestos or other hazardous material is suspected in the work area of the project.

1.9 WORK SEQUENCE

A. Install work in phases to accommodate City's occupancy requirements during the construction period. Coordinate mechanical schedule with other trades and other operations.

1.10 REFERENCE STANDARDS

A. Quality Assurance

1. For products or workmanship specified by association, trade, or Federal Standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
2. Conform to reference standard by date of issue current on date of Contract Documents date for receiving bids date of City-Contractor Agreement when there are no Bid dates specified.
3. Obtain copies of standards when required by Contract Documents.
4. Maintain copy of applicable standard at job site during submittals, planning and progress of the specific work, until Substantial Completion.
5. Should specified reference standards conflict with Contract Documents, request clarification from Engineer before proceeding.
6. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

B. Reference Standards and Specification Abbreviations

1. Refer to Division 1 and Division 15, Applicable Sections.

1.11 SUBMITTALS

A. Shop drawings and samples shall be submitted in compliance with the Conditions of the Contract and General Requirements.

B. Submittals shall contain outline dimensions, operating and maintenance clearances and sufficient engineering data to indicate compliance with the specifications. Each submittal shall be clearly labeled as indicated in the Conditions of the Contract and General Requirements.

C. Each piece of equipment shall be identified by the number shown in the schedules and by specification article number pertaining to the item. Shop drawings shall as a minimum be ¼" equals 1'-0" scale, and shall be newly prepared by the Contractor and not reproduced

from the Engineer's drawings. Layouts shall be made for all floor plans including all ductwork, piping, electrical distribution and other mechanical equipment. Layouts shall show clearances of piping, ducts, etc., above floor.

D. Contractor shall obtain Engineer's approval on all the work before any equipment is purchased, or any work installed. Contractor shall also secure approval of the Governmental Authorities having jurisdiction on all equipment and on the layout of the complete system.

E. The Engineer's review and approval of shop drawings is a gratuitous assistance and in no way does it relieve the Contractor from responsibility for errors or omissions which may exist on the shop drawings. Where such errors or omissions are discovered later, they must be made good by the Contractor, without any additional cost to the City, irrespective of any approval by the Engineer.

1. The Contractor shall incorporate with his shop drawings, a letter indicating all deviations from the plans and/or specifications. If in the opinion of the Engineer, the deviations are not equal, the Contractor will be required to furnish the item as specified and as indicated on the drawings.
2. Record documents shall be submitted in compliance with the requirements of the Specifications.

F. Shop Drawings Submittal Procedures:

1. Submit eight (8) copies of manufacturer's certified shop drawings to Engineer for all equipment and controls.
2. Drawings shall include detailed dimensions, capacities, gauges, arrangement and operating clearances.
3. Incomplete submittals shall not be reviewed and Contractor will be held responsible for correction of work not having final approval.
4. Engineer shall review or take other appropriate action on Contractor submittals, such as certified shop drawings, product data, samples and other data, which Contractor is required to submit, but only for limited purpose of checking for conformance with design concept and Contract Documents.
5. This review shall not include review of accuracy or completeness of details, such as quantities, dimensions, capacities, weights or gauges, fabrication processes, construction means or methods, coordination of work with other trades or construction safety precautions, all of which are the sole responsibility of Contractor.
6. Engineer's review shall be conducted with reasonable promptness while allowing sufficient time in Engineer's judgment to permit adequate review.
7. Review of specific items shall not indicate that Engineer has reviewed entire assembly of which said item is a component.
8. Engineer shall not be responsible for any deviations from Contract Documents not submitted to Engineer in writing by Contractor.
9. Engineer shall not be required to review partial submissions or those for which submissions of correlated items have not been received.
10. Review of certified drawings does not relieve Contractor of responsibility of furnishing and install all system components, as per drawings and specifications

for proper system operation with particular respect to BTU outputs, water and air flow capacities, minimum noise requirements and space limitations, nor from responsibility for errors or omissions of any sort in drawings.

11. Engineer assumes no responsibility for figured dimensions or exact quantities of materials on shop drawings.
12. Reviews by Engineer are subject to limitations of general conditions of the contract for construction.
13. Contractor shall thoroughly check all shop drawings prepared by subcontractors for materials or equipment suppliers with regard to measurements, size of members, materials and details to satisfy specifications and drawings.
14. Each drawing shall have a date of approval and signature of reviewer.
15. If Contractor's shop drawings have been submitted and reviewed by Engineer for a particular product and Engineer has stamped "rejected", "revised and resubmit" or "submit specified items" after two reviews, any further review by Engineer for that particular product will require contractor to compensate Engineer for all time spend for further review of that product a rate of one hundred dollars ($100.00) per hour.
16. Furnish approved and corrected shop drawings to all other Contractors whose work is affected.

1.12 QUALITY CONTROL

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions and workmanship to product Work of specified quality.

B. Comply fully with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Engineer before proceeding.

D. Comply with specified standards as a minimum quality for the Work except when more stringent tolerances, codes or specified requirements indicate higher standards or more precise workmanship.

E. Work to be performed by persons qualified to produce workmanship of specified quality.

F. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion or disfigurement.

G. Manufacturers' Field Services and Reports

1. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of installation, quality or workmanship, start-up of equipment, testing, adjusting and balancing of equipment and troubleshooting as applicable and to initiate instructions when necessary.
2. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3. Submit report in duplicate within ten (10) days of observation to Engineer for review.

1.13 QUALITY ASSURANCE/CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, Products, services, site conditions and workmanship to produce Work of specified quality.

B. Comply fully with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Engineer before proceeding.

D. Comply with specified standards as a minimum quality for the Work except when more stringent tolerances, codes or specified requirements indicate higher standards or more precise workmanship.

E. Work to be performed by persons qualified to produce workmanship of specified quality.

F. Secure Products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion or disfigurement.

1.14 MANUFACTURERS' FIELD SERVICES, FIELD TESTS AND REPORTS

A. When specified in individual specification Sections, Contractor shall require material or Product suppliers, Subcontractors, or manufacturers to provide qualified staff personnel to observe site conditions; testing; conditions of installation; quality of workmanship; start-up of equipment; testing, adjusting and balancing of equipment and materials; and troubleshooting as applicable B and to initiate instructions when necessary. Submit report per paragraph C below, this section.

B. Report observations and site decisions or instructions given to City, applicators or installers that are supplemental or contrary to manufacturers' written instructions.

C. Submit written report in duplicate within 10 days of observation, start-up, testing, etc. to Engineer for review.

1.15 CONTRACT CLOSEOUT

A. Final Cleaning

1. Refer to Division 1.
2. Execute final cleaning prior to final inspection.

B. Adjusting

1. Adjust operating products and equipment to ensure smooth and unhindered operation.

C. Project Record Documents

1. Refer to Division 1.

2. Record Documents and Shop Drawings: Legibly mark each item to record actual construction including:

   a. Field changes of dimension and detail.
   b. Details not on original Contract Drawings.

3. Delete Engineer's title block and seal from all documents.
4. Submit documents to Engineer with claim for final application for payment.

D. Provide Maintenance Manuals as follows:

1. HVAC Contractor shall furnish to Engineer and City for approval, prior to installation of equipment three (3) bound copies of typewritten instructions covering complete maintenance and operation of said system and a complete set of drawings marked to show any and all deviations from original layout.

2. Contractor shall verbally instruct City on care and operation of all parts of system. Engineer may be present at verbal instruction. Contractor shall make available to City, any of their subcontractors or equipment manufacturers deemed necessary.

3. At least one month before warranty period expires, Contractor shall again meet with City for a review of original maintenance manuals and operating instructions.

4. Maintenance instructions shall include manufacturer's literature on all system equipment components.

5. All maintenance instructions shall be explicit concerning time intervals for all servicing and preventive maintenance types and grades of oil and/or grease, packing materials, normal and abnormal clearance, methods of equipment adjustments and complete description of replacement parts and materials for wearing items.

6. Maintenance instructions shall be required on all equipment and systems specified.

E. Provide Record Drawings as follows:

1. Contractor shall maintain at project site for City, one (1) record copy of all Drawings, Specifications, Addenda, Change Orders and other Modifications, in good order and marked currently to record all changes made during construction and approved Shop Drawings, Project Data, and Samples.
2. Record documents shall be available to Engineer and shall be delivered to Engineer for City upon completion of work.

1.16 TRAINING OF CITY PERSONNEL

A. Instruct user agency personnel in the proper operation and maintenance of systems and equipment as provided as part of this project. Include not less than four hours of instruction, using the Operating and Maintenance Manual during this instruction. Demonstrate startup, operation and shutdown procedures for all equipment. All training shall be completed during normal working hours.

1.17 SPARE PARTS AND MAINTENANCE DATA

A. Provide products, spare parts, maintenance and materials in quantities specified in individual specification sections.

B. Deliver to project site and place in location as directed; obtain receipt prior to final payment.

1.18 WARRANTIES

A. Provide one year warranty of workmanship and materials provided under this project.

B. Provide five year warranty of workmanship and materials on all mechanical compressors provided under this project.

C. Provide notarized copies.

D. Execute and assemble documents from Subcontractors, suppliers and manufacturers.

E. Provide table of contents and assemble in 3-D side ring binder with durable cover.

F. Submit prior to final application for payment.

G. For items of Work delayed beyond date of Substantial Completion, provide updated submittal within ten days after acceptance, listing date of acceptance as start of warranty period.

1.19 REGULATORY REQUIREMENTS

A. Conform to the International Building Code and the International Mechanical Code as amended and adopted by the State of Wisconsin, Ordinances of the City of Milwaukee and NFPA 13, latest editions.

B. Obtain permits and request inspections from the City of Milwaukee Building Department and any other Authorities Having Jurisdiction (AHJ).

C. Conform to all other governing agencies and authorities.

PART 2 - PRODUCTS

2.1 MATERIAL AND EQUIPMENT

A. Refer to Division 1.

B. Products

1. Products: Means new material, machinery, components, equipment, fixtures and systems forming Work. Does not include machinery and equipment used for preparation, fabrication, conveying and erection of Work. Products may also include existing materials or components required for reuse.
2. Do not use materials and equipment removed from existing premises, except as specifically permitted by Contract Documents.
3. Provide interchangeable components of same manufacturer for similar components.

C. Transportation and Handling

1. Transport and handle products in accordance with manufacturer's instructions.
2. Promptly inspect shipment to assure that products comply with requirements, quantities are correct and products are undamaged.

2.2 STORAGE AND PROTECTION

A. Refer to Division 1.

B. Store and protect products in accordance with manufacturer's instructions, with seals and labels intact and legible. Store sensitive products in weather-tight, climate-controlled enclosures.

C. For exterior storage of fabricated products, place on sloped supports above ground.

D. Provide off-site storage and protection when site does not permit on-site storage or protection.

E. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation.

F. Store loose granular materials on solid flat surfaces in a well-drained area. Provide mixing with foreign matter.

G. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement or damage.

H. Arrange storage of products to permit access for inspection. Periodically inspect to assure products are undamaged and are maintained under specified conditions.

2.3 PRODUCT OPTIONS

A. Refer to Division 1.

B. Products Specified by Reference Standards or by Description only: Any product meeting those standards or description.

C. Products Specified by Naming One or More Manufacturers: Products of manufacturers named and meeting specifications; no options or substitutions allowed.

1. Documents have been prepared utilizing a single manufacturer as the basis of design. Contractor shall be responsible for coordinating any varying requirements (e.g. space requirements, electrical requirement) when utilizing the other acceptable manufacturers.

PART 3 - EXECUTION

3.1 SCOPE

A. Work included under Division 15, Mechanical Work, shall include all labor, services, materials and equipment and performance of all work required for installation of mechanical systems as shown on Drawings and as herein specified in following sections.

3.2 INTERPRETATION OF CONTRACT DOCUMENTS

A. Should there be discrepancy or a question of intent, refer matter to Engineer for decision before ordering any equipment or materials or before starting any related work.

B. Drawings and Specifications are to be taken together. Work specified and not shown or work shown and not specified shall be performed or furnished as though mentioned in both Specifications and Drawings. If there is discrepancy between Drawings and Specifications as to quantity or quality to be provided, the greater quantity or better quality shall be provided.

C. Minor items and accessories or devices reasonably inferable as necessary to complete and proper installation and operation of any system shall be provided by Contractor for such system whether or not specifically called for by Specifications or Drawings.

D. Engineer may change location of any equipment 5′ and any piping, ductwork, conduit, etc. 10′ in any direction without extra charge, provided such changes are made before installation.

E. Locations of items not definitely fixed by dimensions are approximate only and exact locations necessary to secure the best conditions and results shall be determined at the site and shall be subject to review and approval by Engineer.

F. Follow drawings in laying out work, check drawings of other trades to verify spaces in which work will be installed, and maintain maximum headroom and space conditions at all points.

1. Where headroom or space conditions appear inadequate, notify Engineer or City's field representative before proceeding with installation.
2. Duct and pipe rerouting and duct size changes shall be made at no additional cost to the City.

G. Furnish advance information on locations and sizes of frames, boxes, sleeves and openings needed for the work, and also furnish information and shop drawings necessary to permit installation of other work without delay.

H. Where there is evidence that parts of the Work specified in Division 15 will interfere with other work, assist in working out space conditions to make satisfactory adjustments, revise and submit coordinated shop drawings.

I. After review and without additional cost to the City, make minor modifications in the work as required by structural interferences, by interferences with work of other sections or for proper execution of the work.

J. Work installed before coordinating with other work so as to cause interference with other work shall be changed and corrected without additional cost to the City.

K. Drawings are diagrammatic in nature and are a graphic representation of requirements and shall be followed as closely as actual building construction will permit. All changes from the plans necessary to make the work conform to the building as constructed and to fit the work of other trades or to conform to rules of the Governmental Authorities having jurisdiction, NFPA, OSHA and the City's Insurance Underwriters, shall be made by the Contractor without extra cost to the City.

L. The layout of the piping, ductwork, equipment, etc., as shown on the drawings shall be checked and exact locations shall be determined by the dimensions of the equipment approved and the Contractor shall obtain approval for the revised layout before the apparatus is installed. The Contractor shall field measure or consult existing record Architectural and Structural Drawings if available for all dimensions, locations of partitions, locations and sizes of structural supports, foundations, etc.

M. Omission in the Drawings and/or Specifications of any items necessary for the proper completion or operation of the work outlined in this specification shall not relieve the Contractor from furnishing same without additional cost to the City.

N. The Equipment Shop Drawings will be furnished to the Contractor before roughing-in. Contractor shall not install any piping or ductwork for said equipment until he has received approved shop drawings for same.

3.3 PROJECT/SITE CONDITIONS

A. Each Contractor shall visit the site prior to bid submission to determine all existing conditions that may affect his work and shall make appropriate allowances for such conditions in his bid. Failure to visit the site shall not be cause for a request for additional compensation later in the project during construction.

B. Install Work in locations shown on Drawings, unless prevented by Project conditions.

C. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of City and Engineer before proceeding.

3.4 ALTERATIONS IN PRESENT BUILDING AND SYSTEMS

A. Contractor shall take particular note of the revisions and alterations to the existing systems, facilities and equipment due to the new construction as indicated on the Drawings and/or in Specification. Contractor shall remove, reroute or alter all services, ductwork, etc., as required or as indicated on the drawings.

1. The Contractor shall maintain all services in the existing building. In case, where new service connections are to be made to existing services and service interruptions can in no way be avoided, the service interruptions shall be with the minimum of inconvenience to the City and the work shall be done at such time of any day, Saturday and Sunday included, and only as directed by the City or the Engineer.

3.5 ERECTION & WORKMANSHIP

A. Contractor is to be responsible for all work fitting into place in satisfactory, neat and workmanlike manner in every particular, to approval of Engineer.

B. Unless explicitly stated to contrary, each Contractor shall furnish and install each item of equipment or material hereinafter specified, complete with all necessary fittings, supports, trim, piping, insulation, etc., as required for complete and operating installation.

C. Equipment and materials shall be installed according to manufacturer's instruction unless otherwise specifically directed by Contract Documents

D. Contractor shall provide all necessary OSHA approved rigging, scaffolding, tools, tackle, labor, etc., necessary for the complete installation of the equipment.

E. Contractor shall adapt his work to job conditions and make such changes as required and permitted by the City and Engineer such as moving his work to clear beams, joints, light fixtures, etc., adjusting risers, etc. avoiding interferences with windows and openings, etc. raising or lowering his work to permit the passing of ductwork or the work of other trades, etc., all as required or as job conditions dictate, without any additional costs to the City.

F. All appliances and equipment shall be installed and connected with best engineering practices and in accordance with the manufacturer's best instructions and recommendations.

G. Work done by Contractor at the site in the execution of this Project shall be performed only by skilled mechanics, recognized as such in their respective trades in the direct employ either of the Contractor proper or of affiliate firms which have a longstanding and continuing formal agreement with the Contractor for providing the rendered services on similar work of this type.

3.6 PROTECTION FROM INJURY

A. All pipes, fixtures, traps, equipment, and other parts of the Work shall be protected against injury by freezing or exposure to the weather during construction while stored or installed in place.

3.7 MECHANICAL AND ELECTRICAL WORK COORDINATION

A. Refer to Division 1.

B. Provide coordination for type of mechanical and electrical work required for this project for duration of work. Electrical work shall be completed by City electricians.

C. Submittals

1. Coordinate mechanical and electrical work of Divisions 15 and 16 with work of each other and of other Divisions.
2. Coordinate progress schedules, including dates for submittals and for delivery of products.
3. Coordinate location and verify size of pipes, equipment, fixtures, conduit, ducts, openings, switches, outlets, fire sprinkler heads, fire hose cabinets, etc., in progress of the Work. Architectural Drawings shall take precedence over Mechanical and Electrical Drawings.
4. Participate in progress meetings. Report on progress of work to be adjusted under coordination requirements and any required changes in schedules. Transmit minutes of meetings and reports to concerned parties.

D. Coordination of Submittals

1. Review shop drawings, product data, and sample for compliance with Contract Documents and for coordination among work of all sections of Project Manual. Transmit to Engineer.
2. Check field dimensions and clearances and relationship to available space and anchors.
3. Check compatibility with equipment and work of other sections, electrical characteristics and operational control requirements.
4. Check motor voltages and control characteristics.
5. Coordinate controls, interlocks, wiring of pneumatic switches and relays.
6. Coordinate wiring and control diagrams.
7. Review effect of any changes on work of other sections.
8. Verify and coordinate maintenance of Record Documents.

E. Coordination of Substitutions and Modifications

1. Review proposals and requests from subcontractors.
2. Verify compliance with Contract Documents and for compatibility with work and products of other sections.
3. Submit to Engineer with recommendation for action.

F. Observation of Work

1. Observe work for compliance with Contract Documents.
2. Maintain list of observed deficiencies and defects; promptly submit to Engineer.

G. Documentation

1. Observe and maintain a record of tests. Record:

    a. Specification section number, product, and name of subcontractor.
    b. Name of testing agency and name of inspector.
    c. Name of manufacturer's representative present.
    d. Date, time, and duration of tests.
    e. Type of test, and results.
    f. Retesting required.

2. Assemble background documentation for dispute and claim settlement by Engineer.
3. Submit copies of documentation to Engineer upon request.

H. Equipment Start-Up

1. Verify utilities, connections and controls are complete and equipment is in operable condition.
2. Observe start-up and adjustments; record time and date of start-up and results.
3. Observe equipment demonstrations to City; record times and additional information required for Operation and Maintenance Manuals.

I. Inspection and Acceptance of Equipment

1. Prior to inspection, verify that equipment is tested and operational, and clean.
2. Assist Engineer with inspection. Prepare list of items to be completed and corrected.

3.8 CUTTING AND PATCHING

A. Refer to Division 1.

B. Submit written request in advance of cutting or alteration which affects:

1. Structural integrity of any element of Project.
2. Integrity of weather-exposed or moisture-resistant element.
3. Efficiency, maintenance, or safety of any operational element.
4. Visual qualities of sight-exposed elements.
5. Work of City or separate contractor.

C. Include in request:

1. Effect on work of City or separate contractor.
2. Written permission of affected separate contractor.
3. All items requested in Division 1.

D. Examination

1. Inspect existing conditions prior to commencing Work, including elements subject to damage or movement during cutting and patching.
2. After uncovering existing work, inspect conditions affecting performance of work.
3. Beginning of cutting or patching means acceptance of existing conditions.

E. Preparation

1. Provide temporary supports to ensure structural integrity of the Work. Provide devices and methods to protect other portions of Project from damage.
2. Provide protection from elements for areas which may be exposed by uncovering work.
3. Maintain excavations free of water.

F. Cutting and Patching

1. Cutting and patching required to access work in existing walls, in chases, above inaccessible ceilings, below floors, etc., shall be by the Contractor who requires the access, unless shown on the bid documents otherwise or noted otherwise.
2. The Contractor shall do all cutting, or fitting of the work as required to make its several parts fit together, or to receive the work of others, as shown or reasonably implied by the drawings or specifications, or as may be directed by Buildings & Fleet Services. Holes cut in exterior walls and/or roofs shall be waterproofed.
3. The Contractor who cuts shall also be responsible for patching. Where cutting and patching is required, the Contractor shall hire individuals skilled in such work to do cutting and patching.
4. The Contractor who removes or relocates building components which leaves a remaining opening shall be responsible for patching the opening.
5. Patching includes repairing openings to match adjacent construction and painting the surface to match existing. Painting means covering the entire wall where patching is to be done to nearest break point or corner unless indicated to be done by other trades.
6. Contractor shall not endanger any work by cutting, digging or otherwise and shall not cut or alter the work of others without their consent.
7. Do not pierce beams or columns without permission of Buildings & Fleet Services and then only as directed in writing. If any ductwork, piping, conduit, etc. is required through walls or floors where no sleeve has been provided, use a core drill or saw cut to prevent damage and structural weakening.
8. Wherever any material, finish, or equipment, is damaged, the skilled trade shall accomplish the repair or replacement, in that particular work and the cost shall be charged to the party responsible for the damage. Buildings & Fleet Services reserves the right to disallow any means and/or methods that, in the opinion of Buildings & Fleet Services, are harmful to and/or not in the best interest of preserving the improvements receiving the work.

G. Performance

1. Execute work by methods to avoid damage to other Work, and which will provide appropriate surfaces to receive patching and finishing.
2. Employ original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.
3. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
4. Restore work with new products in accordance with requirements of Contract Documents.
5. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
6. At penetrations of fire-rated walls, partitions, ceiling, or floor construction, completely seal voids with fire-rated fire resistant material to full thickness of the penetrated element.

7. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

3.9 ACCESS PANELS

A. Where control valves, shut-off valves, drip traps, heating coils, dampers, pull boxes or other specialties, which require service or adjustment, are installed above inaccessible type furred ceilings or within furred walls, Contractor whose equipment is involved shall furnish and install access panels as required.

B. Access panels shall be of sufficient size to make possible servicing, adjustment, removal and replacement of concealed equipment through opening provided. Panels shall be sized as shown on drawings, or if sizes are not shown, shall be minimum of 16" x 24" in walls and 24" x 24" in ceilings.

C. Contractor shall confer with other trades with respect to access panel locations, and shall wherever practical group valves, traps, dampers, etc. in such way as to be accessible from single panel and eliminate as many access panels as possible.

D. Submit shop drawings for review before ordering panels. Where fire rating is required, furnish label doors compatible with fire rating of assembly.

3.10 SOUND CONTROL

A. Conduits shall be grouted or sealed tightly in place.

B. Piping, ductwork, etc. shall pass through sleeves. Pack sleeves tight with glass fiber or oakum and caulked on both sides with non-hardening acoustical sealant.

3.11 FIRE RATED PENETRATIONS

A. Sleeves for pipes and ducts through fire rated and fire resistive floors and walls shall be constructed of materials classified by UL to provide fire stopping equal to time rating of construction being penetrated. Use asbestos free materials that comply with applicable codes and have been tested under positive pressure in accordance with UL 1479 or ASTM E 814.

B. Install penetration seal materials in accordance with printed instructions of the UL Fire Resistance Directory and in accordance with manufacturer's instruction.

C. Seal holes or voids made be penetrations to ensure an effective smoke barrier.

D. Where floor openings without penetrating items are more than 4" in width and subject to traffic or loading, install fire stopping materials capable of supporting same loading as floor.

E. Protect materials from damage on surfaces subject to traffic.

F. Examine penetration sealed areas to ensure proper installation before concealing or enclosing areas.

G. Keep areas of work accessible until inspection by applicable code authorities.

H. Perform under this section patching and repairing of fire stopping caused by cutting or penetration by other trades.

I. Clean up spills of liquid components.

J. Neatly cut and trim materials as required.

K. Remove equipment, materials and debris, leaving area in undamaged, clean condition.

3.12 PROTECTION OF ELECTRICAL EQUIPMENT

A. Contractor shall furnish and install sheet metal drain pans beneath piping that is routed above electrical equipment and/or above the 3′ access space in front of such equipment. Electrical equipment, for the purpose of addressing drain pan requirements, shall be defined as free-standing or wall-mounted switchgear, transformers, distribution boards or motor control centers. Piping includes, but is not limited to, plumbing, fire protection, mains (not branch piping with sprinkler heads), hydronic heating or cooling, steam and condensate, and fuel systems.

1. Drain pans shall be 20 gauge galvanized sheet metal with a minimum 4″ high turned up edge. Bottom of drain pan shall slope to a single drainage point at ⅛″ per foot. A 1″ diameter clear plastic tube shall allow collected fluid to drain to the nearest open sight floor drain. Secure plastic tubing to building structure only.
2. Drain pan shall be hung from building structure with angle iron trapeze hangers (no hanger shall penetrate the drain pan). Consider drain pan to be full of water for hanger load calculations.
3. Drain pans shall include liquid detectors with alarms only if noted on the drawings.

B. Provide sprinkler heads beneath drain pan only as required by NFPA.

C. Contractor shall include provisions to adjust the local lighting layout, at no extra cost to City, in order to accommodate any detrimental effect the drain pan has on the illumination of the electrical equipment and access space

3.13 STARTING SYSTEMS

A. Coordinate schedule for start-up of various equipment and systems.

B. Notify Engineer and City two days prior to start-up of each item.

C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence or other conditions which may cause damage.

D. Verify that tests, meter readings and specified electrical characteristics agree with those required by the equipment or system manufacturer.

E. Verify wiring and support components for equipment are complete and tested.

F. Execute start-up under supervision of responsible manufacturer's representative or Contractors' personnel in accordance with manufacturers' instructions.

G. When specified in individual specification sections, require manufacturer to provide authorized representative to be present at site to inspect, check and approve equipment or system installation prior to start-up and to supervise placing equipment or system in operation.

H. Submit a written report in accordance with paragraph 1.14 previously specified that equipment or system has been properly installed and is functioning correctly.

3.14 TESTING, ADJUSTING AND BALANCING

A. The City of Milwaukee shall appoint, employ and pay for services of independent firm to perform testing, adjusting and balancing.

B. Independent firm will perform services specified in Division 1, and Section 15990.

C. Reports will be submitted by independent firm to Engineer indicating observations and results of tests and indicating compliance or non-compliance with specified requirements and with requirements of Contract Documents.

3.15 REMODELING PROJECT PROCEDURES

A. Refer to Division 1.

B. Demolition

1. Contractor shall remove existing equipment and materials pertaining to his contract as specified or as required, whether shown on Drawings or not, to prepare for new work of all contracts.
2. Where necessary, reroute piping, ducts, conduits, wiring, etc. from within walls, floors, ceilings, etc. being removed. Contractor involved with interrupted service shall be responsible for accomplishing required work whether shown on Drawings or not.
3. Cap all abandoned or terminated piping, conduit, etc. below floor, behind wall surface, above ceiling, etc. as required to be completely concealed after new work is complete.
4. In general, mechanical remodeling work is shown on Mechanical Drawings but carefully study all drawings for all contracts for "demolition" and "remodeling" work in existing building and field check to verify locations where such work is being done to determine exact extent of work required. No extra will be allowed for additional work required because of demolition or remodeling whether or not work is specifically noted, itemized or shown on Drawings.
5. Contractor shall cap or plug all pipes, valves, fittings, etc. left open after demolition if they are not to be reused.

3.16 CLEANING, FLUSHING, INSPECTING

A. General: Clean exterior surfaces of installed piping systems of superfluous materials and prepare for application of specified coatings (if any). Flush out piping systems with clean water before proceeding with required tests. Inspect each run of each system for completion of joints, supports and accessory items.

B. Sufficient flushing water shall be introduced into the mains to produce a velocity of not less that 4' per second and this flow rate shall be continued until the discharge is clean and clear and does not show evidences of silt or foreign matter when a sample is visually inspected.

C. Inspect pressure piping in accordance with procedures of ASME B31.

3.17 PIPING TESTS

A. Test pressure piping in accordance with ASME B31.

B. General: Provide temporary equipment for testing, including pump and gauges. Test piping systems before insulation is installed wherever feasible and remove control devices before testing. Test each natural section of each piping system independently, but do not use piping system valves to isolate sections where test pressure exceeds valve pressure rating. Fill each section with water and pressurize for indicated pressure and time.

1. Test each piping system at 150% of operating pressure indicated, but not less than 25 psi test pressure.
2. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds 5% of test pressure.

C. Repair piping systems sections which fail required piping test, by disassembly and re-installation, using new materials to extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics or other temporary repair methods.

D. Drain test water from piping systems after testing and repair work has been completed.

-- END OF SECTION --

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SECTION 15060
MINOR MECHANICAL DEMOLITION FOR REMODELING

1. PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Mechanical demolition.

1.2 RELATED SECTIONS

A. Section 15010 - Basic Mechanical Requirements.

B. Section 15781 – Packaged Rooftop Air Conditioning Units.

C. Section 15890 - Ductwork.

2. PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Refer to General Conditions and Division 1 and Section 15010.

B. Materials and equipment for patching and extending work: As specified in individual Sections.

3. PART 3 - EXECUTION

3.1 EXAMINATION

A. Refer to General Conditions and Division 1 and Section 15010.

B. Verify field measurements, equipment location, piping and ductwork sizes and arrangements as shown on Drawings.

C. Verify that abandoned piping, ductwork and equipment serve only abandoned facilities.

3.2 PREPARATION

A. Refer to General Conditions and Division 1 and Section 15010.

B. Disconnect mechanical systems in walls, floors and ceilings scheduled for removal.

C. Coordinate utility service shut-downs with the City and Utility Companies.

D. Provide temporary connections to maintain existing systems in service during construction.

E. Existing Mechanical Systems: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and new connections. Notify, Owner and Engineer at least 7 days before partially or completely disabling system. Minimize shut-down duration. Make temporary connections to maintain service in areas adjacent to work area.

3.3 DEMOLITION AND EXTENSION OF EXISTING MECHANICAL WORK

A. Demolish and extend existing mechanical work under provisions of General Conditions, Division 1, Section 15010 and this Section.

B. In general, mechanical remodeling work is shown on Mechanical Drawings but carefully study all drawings for all contracts for "demolition" and "remodeling" work in existing building and field check to verify locations where such work is being done to determine exact extent of work required. No extra will be allowed for additional work required because of demolition or remodeling whether or not work is specifically noted, itemized or shown on Drawings.

C. Remove existing equipment and materials pertaining to contract as specified or as required, whether shown on Drawings or not, to prepare for new work of all contracts.

D. Where necessary, reroute piping, ducts, etc. from within walls, floors, ceilings, etc. being removed. Contractor involved with interrupted service shall be responsible for accomplishing required work whether shown on Drawings or not.

E. Cap all abandoned or terminated piping, etc. below floor, behind wall surface, above ceiling, etc., as required to be completely concealed after new work is complete.

F. Cap or plug all pipes, valves, fittings, etc. left open after demolition if they are not to be reused.

G. Maintain access to existing mechanical installations which remain active. Modify installation or provide access panel as appropriate.

H. Extend existing installations using materials and methods compatible with existing mechanical installations, or as specified.

3.4 DISPOSITION OF REMOVED EQUIPMENT

A. Where existing materials or equipment are specified to be removed from service, respective Contractor shall take possession of same, coordinate with Owner where items are to be stored or remove unwanted items from site promptly, except as specified below or unless otherwise noted on Drawings.

B. All salvageable material and equipment, including but not necessarily limited to plumbing fixtures, heating units, air conditioning units, piping, valves, etc., shall be removed and maintained in as good condition as possible and turned over to Owner. However, if Owner decides any such materials are of no value to him, then they shall become property of Contractor who shall remove such discarded work from premises and dispose of same.

C. Existing equipment or systems, etc. which are specified to be replaced by new equipment, or system etc. shall not be removed from service until the new equipment, materials, systems, etc. have actually arrived at project site.

3.5 INSTALLATION

A. Install relocated materials and as indicated on drawings.

3.6 CLEANING AND REPAIR

A. Refer to General Conditions and Division 1 and Section 15010.

B. Clean and repair existing materials and equipment which remain or are to be reused.

--END OF SECTION --

SECTION 15140
SUPPORTS, ANCHORS AND SLEEVES

1. PART 1 - GENERAL

1.1 WORK INCLUDED

A. Pipe and equipment hangers, supports and associated anchors.

B. Duct hangers and supports.

C. Equipment bases and supports (including roof curbs).

D. Sleeves and seals.

E. Vertical-piping clamps.

F. Saddles and shields.

G. Miscellaneous materials.

H. Anchors.

I. Flashing and sealing equipment and pipe stacks.

1.2 RELATED WORK

A. Section 15010 - Basic Mechanical Requirements.

B. Section 15242 - Vibration Isolation.

C. Section 15250 - Thermal Insulation.

D. Section 15410 - Plumbing Piping.

E. Section 15440 - Plumbing Fixtures.

F. Section 15450 - Plumbing Equipment.

G. Section 15781 - Packaged Rooftop Air Conditioning Units.

H. Section 15860 - Centrifugal Fans.

I. Section 15890 - Ductwork.

J. Section 15910 - Ductwork Accessories.

1.3 REFERENCES

A. ANSI/ASME B31.1 - Power Piping.

B. AWS - Specifications for Qualification of Welding Procedures and Welders.

C. ASTM A36 - Steel Plates, Shapes and Bars.

D. ASTM C150 - Portland Cement.

E. ASTM C404 - Uniformly Graded Natural Sand.

F. ASTM E-814 - Fire Tests of Through-Penetration Fire Stops.

G. AWWA - American Water Works Associations.

H. BOCA - Basic/National Building Code.

I. ICBO - Uniform Building Code.

J. MSS - Manufacturers Standardization Society.

K. NRB 243 - National Research Board Report Number.

L. NFPA 13 - Standard for the Installation of Sprinkler Systems.

M. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems.

N. NFPA 101 - Code for Safety to Life from Fires in Buildings and Structures.

O. SBCCI - Standard Building Code.

P. SMACNA - HVAC Duct Construction Standards, Metal and Flexible.

Q. UL - Underwriters Laboratories.

R. UL 1479 - Firestops, Fire Tests of Through-Penetration.

S. FM - Factory Mutual.

1.4 QUALITY ASSURANCE

A. Refer to General Conditions, Division 1 and 15010.

B. UL and FM Compliance: Provide products which are UL listed and FM approved.

C. MSS Standard Compliance:

1. Provide pipe hangers and supports of which materials, design and manufacture comply with MSS SP-58.

2. Select and apply pipe hangers and supports, complying with MSS SP-69.

3. Fabricate and install pipe hangers and supports, complying with MSS SP-89.

4. Terminology used in this section is defined in MSS SP-90.

1.5 SUBMITTALS

A. Refer to General Conditions and Division 1 and Section 15010.

B. Submit product data under provisions of Section 01300.

C. Indicate hanger and support framing and attachment methods.

2. PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - PIPE HANGERS AND SUPPORTS

A. B-Line Systems, Inc.

B. Fee and Mason Manufacturing Company

C. ITT Grinnell Corporation

D. Substitutions: Under provisions of Division 1.

2.2 PIPE HANGERS AND SUPPORTS (BASED ON B-LINE SYSTEMS, INC.)

A. Pipe Hangers

1. Hangers for Uninsulated Copper Pipe Sizes ½" to 4": Carbon steel, adjustable, clevis copper plated. Fig B3104CT.

2. Hangers for Steel Pipe Sizes ½" to 4" and Cold Pipe Sizes 5" and Over: Carbon steel, adjustable, clevis. Fig. B3102.

3. Hangers for Hot Pipe Sizes 4" and Over: Adjustable steel yoke, single hanger with iron roll. Fig. B3110.

4. Hangers for Plastic Pipe ½" to 4": Carbon steel, adjustable V-bottom clevis with plastic pipe trough. Fig. B3106.

5. Multiple or Trapeze Hangers: Structural steel channels with welded pipe spacers and hanger rods; cast iron roll and stand for hot pipe sizes 4" and over. Fig. B3122.

B. Wall Supports, Brackets, Pipe Rolls, U-bolts

1. Wall Support for Single Pipes to 4": Carbon steel straight one hole J-hook plain finish painted with one coat of rust-inhibiting primer. Fig. B3190.

2. Wall Support for Pipe Sizes 4" and Over: Welded steel wall bracket plain finish. Fig. B3066.

3. U-Bolts: Carbon steel with hex nuts to support, anchor or guide cold piping on wall brackets. Fig. B3188.

C. Vertical Supports and Riser Clamps

1. Standard Riser Clamp: Two formed carbon steel straps, bolts and nuts with plain painted finish. Fig. B3373.

2. Heavy Duty Riser Clamp: Two formed carbon steel straps with plain painted finish, bolts and nuts. Fig. B3131.

3. Offset Extended Riser Clamp: Two formed carbon steel straps with legs, plain painted finish, bolts and nuts. Fig. B3148.

4. Riser clamps for uninsulated copper pipes are to be copper plated.

5. Riser clamps for glass pipes are to be plastic coated.

D. Floor Supports

1. Floor Support for Pipe Sizes to 4" and All Cold Pipe Sizes: Cast iron adjustable pipe saddle, locknut nipple, floor flange and concrete pier or steel support. Fig. B3090.

2. Floor Support for Hot Pipe Sizes 5" and Over: Adjustable cast iron roller and stand (previously specified), steel screws and concrete pier or steel support.

E. Roof Supports

1. Roof Support for Pipe Sizes to 3" IPS: Roller-bearing pipe support used to support roof mounted gas pipes, electrical conduit, etc. Design shall absorb thermal expansion and contraction of pipes thus preventing

damage to the roof membrane. Pipes rest on a polycarbonate resin roller and a polycarbonate axle situated in a polycarbonate resin base.

2. Secure pipe to roof support to prevent separation of the pipe from the support.

3. Manufacturer: MIRO Industries, Inc., Heber City, Utah.

F. Beam and Bar Joist Clamps

1. Standard Beam Clamp: Two formed carbon steel straps with plain painted finish, bolt and nut. Fig. B3050.

G. Pipe Insulation Shields

1. Shield for Piping 2" and Smaller: 16 gauge galvanized steel shield over insulation in 180 degree segments, minimum 12" long at pipe support. Fig. B3151.

2.3 ACCEPTABLE MANUFACTURERS - STRUT PIPE SUPPORTS SYSTEMS

A. B-Line Systems, Inc.

B. ITT Grinnell - Powerstrut

C. Unistrut Corporation

D. Substitutions: Under provisions of Division 1.

2.4 STRUT PIPE SUPPORT SYSTEMS (BASED ON UNISTRUT)

A. Multiple or Trapeze Hangers: Roll formed 12 gauge strip steel channel framing type trapeze hangers with green prime coat finish. Provide all necessary supporting steel rollers to keep pipe in alignment and allow for expansion. Series D-1000.

B. Tunnel Pipe Supports

1. General: Provide pipe supports, inserts, pipe rolls, etc., for support of piping in tunnel.

2. Pipe Supports: Roll formed 12 gauge strip steel channel framing system with green prime coat finish and necessary accessories. Steel channels and spacing shall be suitable for the load the stresses imposed by piping systems. Series P-1000.

3. Wall and Ceiling Inserts: Continuous galvanized steel channel type with all nuts, springs, etc. required to fasten pipe supports. Series P-3200.

2.5 DUCT HANGERS

A. Where ductwork is concealed, duct hangers shall be strips of galvanized steel or round steel rod and shall comply with SMACNA - HVAC Duct Construction Standards, Metal and Flexible.

B. Where ductwork is exposed beneath acoustical ceiling tile, contractor shall use a wire rope suspension system. Product line shall allow for single wire penetration of ceiling tile (no Y-straps). Acceptable manufacturers include Ductmate, Gripple and approved equal. Clasping and wire shall be of a consistent manufacturer and shall not be mismatched.

2.6 HANGER RODS

A. Steel Hanger Rods: Threaded both ends.

B. Duct hangers made of round steel rod are to be uncoated hot-rolled steel except where installation is in corrosive atmosphere, then, hanger rods should be electro galvanized all thread rod or hot dipped galvanized rods with threads painted after installation.

2.7 INSERTS

A. Precast Concrete with Concrete Topping or Roof Insulation: Support hangers from 4" x 4" x ¼" thick drilled steel plates set on deck over drilled holes before pouring of concrete topping or placing of roof insulation or from cinch anchors located in the precast deck.

2.8 FLASHING

A. Metal Flashing: 26 gauge galvanized steel.

B. Lead Flashing: 5 lb/sq ft sheet lead for waterproofing; one lb/sq ft sheet lead for soundproofing.

C. Caps: Steel, 22 gauge minimum; 16 gauge at fire resistant elements.

2.9 EQUIPMENT CURBS

A. Floor Mounted Equipment: Reinforced concrete pads shall be minimum 4" high and sized to match base of equipment.

B. Roof Mounted Equipment: Curbs with 16 gauge galvanized press formed steel shell and base. Continuous weld on shell seams, internally reinforcing welded as required with factory installed wood (fir) nailer. Curbs shall be minimum 3½" wide by 12" high.

2.10 SLEEVES

A. Sleeves for Pipes Through Non-fire Rated Floors: Form with 18 gauge galvanized steel.

B. Sleeves for Pipes Through Non-fire Rated Beams, Walls and Footings: Form with standard weight steel pipe.

C. Sleeves for Pipes Through Fire Rated and Fire Resistive Floors and Walls and Fireproofing: Prefabricated fire rated sleeves including seals, UL listed complying with ASTM E814. Fire penetrators manufactured by ProSet Systems.

D. Sleeves for Round Ductwork: Form with 18 gauge galvanized steel.

E. Sleeves for Rectangular Ductwork: Form with 18 gauge galvanized steel.

F. Penetration Stuffing and Damming Materials

1. Fire, Smoke and Fume Stops: Fiberglass batt insulation, mineral wool or backer block where damming is required.

2. Non-Fire Rated Penetrations: Fiberglass batt insulation or mineral wool.

G. Caulking

1. Fire, Smoke and Fume Stops

a. Cracks, voids or holes up to 4" diameter: Use putty or caulking, one-piece intumescent elastomer, non-corrosive to metal and capable of expanding 10 times when exposed to temperatures of 250F to 350F and have I.C.B.O., B.O.C.A.I. and S.B.C.C.I. (NRB243) and NFPA 101 approved ratings to three hours per ASTM E-814 (UL 1479). At contractor's option, Chase Foam CTC-PR-855 may be used, where approved by the governing agencies.

b. Opening 4" or greater: Use intumescent elastomer sealing system capable of passing 3-hour fire test in accordance with ASTM E-814 (UL 1479), consisting of wall wrap or liner, partitions and end caps capable of expanding 10 times when exposed to temperatures of 250F to 350F.

c. Materials shall be UL listed fire barrier caulk, wrap/strip, moldable putty and sheet forms.

d. Subject to compliance with requirements, provide fire barrier penetration seals by one of the following:

3M Fire Protection Products
Chase Technology Corporation
Nelson; Unit of General Signal

e. Use proper UL through-penetration firestop systems required for materials passing through sleeves.

2.11 FABRICATION

A. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

B. Design hangers without disengagement of supported pipe.

C. Provide copper plated hangers and supports for copper piping. Insulated copper pipe will not require copper plated hangers and supports.

D. Duct hangers shall comply with SMACNA - HVAC Duct Construction Standards, Metal and Flexible.

2.12 MISCELLANEOUS MATERIALS

A. Metal Framing: Provide products complying with NEMA STD ML 1.

B. Steel Plates, Shapes and Bars: Provide products complying with ASTM A 36.

C. Cement Grout: Portland cement (ASTM C 150, Type I or Type III) and clean uniformly graded, natural sand (ASTM C 404, Size No. 2). Mix at a ratio of 1.0 part cement to 3.0 parts sand, by volume, with minimum amount of water required for placement and hydration.

D. Heavy Duty Steel Trapezes: Shop fabricate from structural steel shapes selected for loads required; weld steel in accordance with AWS standards.

E. Pipe Guides: Provide factory-fabricated guides, of cast semi-steel or heavy fabricated steel, consisting of bolted two-section outer cylinder and base with two-section guiding spider bolted tight to pipe. Size guide and spiders to clear pipe and insulation (if any) and cylinder. Provide guides of length recommended by manufacturer to allow indicated travel.

F. Pipe Anchors: Shop fabricate from structural steel shapes selected for loads required; weld steel in accordance with AWS standards.

2.13 FINISH

A. Prime coat exposed steel hangers, guides, anchors and supports. Hangers, guides anchors and supports located in crawl spaces, pipe shafts and suspended ceiling spaces are not considered exposed.

3. PART 3 - EXECUTION

3.1 INSERTS

A. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

B. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4".

C. Where concrete slabs form finished ceiling, provide inserts to be flush with slab surface.

D. Where inserts are omitted, drill through concrete slab from below and provide thru-bolt with recessed square steel plate and nut flush with top of slab.

E. In remodeled areas, provide expanding concrete anchors. Holes for expanding fasteners to be drilled either by carbide bit or by teeth on fastener itself. Expansion shield to be "set" by driving it into hole and expanding it with conical plug.

3.2 PIPE HANGERS AND SUPPORTS

A. Support horizontal piping as follows:

PIPE SIZE	MAX. HANGER SPACING	HANGER DIAMETER
½" to 1¼"	6'-6"	⅜"
1½" to 2"	10'-0"	⅜"
2½" to 3"	10'-0"	½"

B. Install hangers to provide minimum ½" space between finished covering and adjacent work.

C. Place a hanger within 12" of each change in direction of piping and at each vertical drop riser to equipment.

D. Use hangers with 1½" minimum vertical adjustment.

E. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.

F. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.

G. Support riser piping independently of connected horizontal piping.

H. Pipes shall not be supported from ducts, electrical conduits or other piping.

I. Support pipes such that piping is hung free of dependence on pipe sleeves for supports.

J. Provide all auxiliary steel required for pipe supports.

K. Threaded pipe, chains, wire and perforated straps will not be accepted. Stagger and distribute hangers on parallel piping to avoid overloading of existing or new construction.

L. Roller type supports shall be used for pipes 4" and larger subject to axial movement (steam, condensate and hot water). They shall be braced so that movement occurs in roller rather than support rods.

3.3 DUCT HANGERS AND SUPPORTS

A. Duct hanging system shall be at contractor's option. Comply with SMACNA - HVAC Duct Construction Standards, Metal and Flexible and meet with approval of Engineer.

B. Vertical Ducts In Open Shafts: Provide additional galvanized structural steel members to span openings for support of ducts and angles at each floor.

C. Ducts Along Walls: Are to have supports spaced not more than 8 feet apart.

D. Provide hangers at the center of every ell or change in direction of horizontal ductwork.

E. Wire strap or perforated hangers will not be permitted.

3.4 FLASHING

A. Provide flexible flashing and metal counterflashing where piping and ductwork penetrate weather or waterproofed walls, floors and roofs.

B. Provide curbs for mechanical roof installations 12" minimum high above roofing surface. Flexible sheet flash and counterflash with sheet metal; seal watertight.

3.5 SLEEVES

A. Set sleeves in position in formwork. Provide reinforcing around sleeves. All sleeves shall be set true to line, level, plumb and position.

B. Where ducts or pipes which pass through sleeves are to be insulated, the sleeves shall be of sufficient size to permit the full specified thickness of insulation to pass through sleeves.

C. Extend sleeves through floors 1" above finished floor level. Caulk sleeves full depth and provide floor plate. Floor sleeves in kitchen, laboratories or equipment rooms over habitable spaces shall extend 2" above finished floor.

D. Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with fire stopping insulation and caulk seal air tight. Provide close fitting metal collar or escutcheon covers at both sides of penetration. All pipe penetrations shall be fire-stopped as necessary to restore the original fire rating of the floor or wall system. The annular void around the pipe shall not be filled with mineral wool, fiberglass insulation, cement, grout or similar non-rated materials that fail to expand when exposed to heat.

E. Install chrome plated steel escutcheons at finished surfaces.

F. The contractor shall not drill holes through, cut or otherwise damage any beam or column of the building's structural frame.

G. Installation of Fire, Smoke and Fume Stopping Materials:

1. Penetration shall be free of debris and dirt.

2. Dam the penetration (when required) with an acceptable material.

3. Apply material to the penetration. Use a caulking gun, putty knife or other normal trade tools per manufacturer's instructions.

4. Provide proper material thickness to assure that fire rating is equal to or greater than floor or wall pipe is penetrating.

3.6 ADJUSTING AND CLEANING

A. Hanger Adjustment: Adjust hangers so as to distribute loads equally on attachments.

B. Support Adjustment: Provide grout under supports so as to bring piping and equipment to proper level and elevations.

C. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

D. Clean sleeves with fire, smoke and fume stopping materials as follows.

1. Remove damming materials where necessary after material has cured.

2. Clean up adjacent surfaces with Xylene or other approved cleaning agent.

-- END OF SECTION --

SECTION 15170
MOTORS

1. PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Three phase electric motors.

1.2 RELATED WORK

A. Section 15010 - Basic Mechanical Requirements.

B. Section 15781 - Packaged Roof Top Air Conditioning Units.

C. Section 15860 - Centrifugal Fans

1.3 REFERENCES

A. AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.

B. AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings.

C. ANSI/IEEE 112B - Test Procedure for Polyphase Induction Motors and Generators.

D. ANSI/NEMA MG 1 - Motors and Generators.

E. ANSI/NFPA 70 - National Electrical Code, latest edition.

1.4 SUBMITTALS

A. Refer to Division 1 and Section 15010.

B. Submit shop drawings and product data under provisions of Division 1 and Section 15010.

C. Submit manufacturer's certified sound power levels in dba.

D. Submit manufacturer's installation instructions under provisions of Section 15010.

1.5 OPERATION AND MAINTENANCE DATA

A. Refer to General Conditions and Division 1.

B. Submit operation and maintenance data under provisions of Sections 15010.

C. Include assembly drawings, bearing data including replacement sizes and lubrication instructions.

1.6 QUALITY ASSURANCE

A. Refer to General Conditions, Division 1 and 15010.

1.7 REGULATORY REQUIREMENTS

A. Conform to applicable local and state electrical codes. All motors shall be UL or ETL listed and labeled and comply with NEMA standards for appropriate duty and use.

1.8 DELIVERY, STORAGE AND HANDLING

A. Refer to General Conditions and Division 1.

B. Deliver products to site under provisions of Section 01600 and 15010.

C. Store and protect products under provisions of Section 01600 and 15010.

D. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering.

1.9 WARRANTY

A. Refer to Section 15010.

2. PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Magnetek (Century)

B. Baldor

C. General Electric

D. Westinghouse

E. Lincoln Electric

F. Marathon

G. Franklin Electric

H. Reliance

I. Substitutions: Under provisions of Division 1.

2.2 GENERAL CONSTRUCTION AND REQUIREMENTS

A. Electrical Service: Refer to Division 16 for required electrical characteristics.

B. Motors: Each motor shall be rated in accordance with NEMA Standards to carry its full nameplate load continuously with minimum service factor of 1.15 in accordance with listed data. Motors shall be of the general purpose NEMA Type B, with open drip-proof (ODP) or totally enclosed fan-cooled (TEFC) type enclosures and certified for a temperature rise of 40C.

C. NEMA Class B insulation certified at 90C temperature rise, shall be used in areas with a potential ambient temperature up to 40C. NEMA Type Class F, insulation certified for a 115C temperature rise, shall be used in areas with an ambient temperature above 40C and up to 60C. All ratings from sea level to 3300 ft. altitude.

D. Duty rating of motors shall be continuous duty and/or intermittent duty to fit the application. Motors shall be capable of not less than six (6) starts in a twenty-four (24) hour period.

E. Motors not installed in horizontal position shall be provided with suitable ball-bearings.

F. Where motor horsepowers are specified in connection with equipment drive, they are to be considered as minimum manufacturer's starting torque requirements with the characteristic power curve of the given equipment and in no case with the power nameplate rating of the motor furnished.

G. Do not take advantage of service factors in selection of motors.

H. Motors of windings for voltage other than specified but with nameplate ratings corresponding to specification requirements are not acceptable.

I. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, Service Factor, Power Factor.

J. Electrical Connection: Conduit connection boxes, threaded for conduit. For fractional horsepower motors where connection is made directly, provide conduit connection in end frame.

K. All motors and accessories shall comply in all respects with NEMA standards.

L. Coordinate the NEMA type of each motor with the torque and inertia load of the equipment served and the inrush characteristics of the motor with the starter

selection, so that all items furnished constitute a properly related package. No motor shall operate in the service factor range, defined as a brake horsepower at 15% over the nameplate rating.

M. All motors located in ducted air streams or subject to outside air elements shall be totally enclosed fan cooled; others shall be open drip-proof design. Motors 1 hp or larger shall have encapsulated stator windings of the epoxy or silicone type.

N. Fan motors shall be capable of accelerating their respective fans from nine revolutions per minute to design or synchronous revolutions per minute within a maximum of ten seconds.

O. Motors ½ hp and larger shall operate on 480 or 208 volt, three-phase, 60 Hertz, alternating current, except as otherwise noted. Motors ⅓ hp and smaller shall operate on 120 volt, single-phase, 60 Hertz, alternating current, except as otherwise noted.

P. Premium Efficiency Motors: Provide energy efficient motors, size 1 hp and larger, unless otherwise noted, with efficiencies in accordance with data listed in the schedules. Scheduled efficiencies are based on the 9/5/90 proposed NEMA Standard.

2.3 THREE PHASE POWER - SQUIRREL CAGE MOTORS

A. Starting Torque: NEMA design B characteristics.

B. Starting Current: Not to exceed six times full load current.

C. Stall Conditions: 20 seconds cold stall, 12 seconds hot stall.

D. Power Output, Locked Rotor Torque, Breakdown or Pullout Torque: NEMA Design B characteristics.

E. Design, Construction, Testing and Performance: Conform to ANSI/NEMA MG 1 for Design B motors.

F. Insulation System: NEMA Class B or better.

G. Testing Procedure: In accordance with ANSI/IEEE 112, Test Method B. Load test motors to determine freedom from electrical or mechanical defects and compliance with performance data.

H. Motor Frames: NEMA standard T-frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.

I. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum AFBMA 9, L-10 life

of 20,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension.

J. Nominal Efficiency: Meet or exceed values in Schedules at full load and rated voltage when tested in accordance with ANSI/IEEE 112.

K. Nominal Power Factor: Meet or exceed values in Schedules at full load and rated voltage when tested in accordance with ANSI/IEEE 112B.

3. PART 3 - EXECUTION

3.1 APPLICATION

A. Motors drawing less than 250 Watts and intended for intermittent service may be germane to equipment manufacturer and need not conform to these specifications.

B. Motors intended for use with variable frequency drives shall be rated for inverter duty.

3.2 NEMA ODP/TEFC MOTOR SERVICE FACTORS

HP	3600 RPM	1800 RPM	1200 RPM	900 RPM
⅙ - ⅓	1.35	1.35	1.35	1.35
½	1.25	1.25	1.25	1.15
¾	1.25	1.25	1.15	1.15
1	1.25	1.15	1.15	1.15
1½-150	1.15	1.15	1.15	1.15

3.3 PERFORMANCE SCHEDULE: THREE PHASE - PREMIUM EFFICIENCY, OPEN, DRIP-PROOF

HP	RPM (Syn)	NEMA Frame	Percent Efficiency	Guaranteed Minimum Percent Power Factor
1	1800	143T	85.5	84
1½	1800	145T	86.5	85
2	1800	145T	86.5	85
3	1800	182T	89.5	86
5	1800	184T	89.5	88
7½	1800	213T	91.0	82
10	1800	215T	91.7	82

15	1800	254T	93.0	86
20	1800	256T	93.0	86

3.4 **PERFORMANCE SCHEDULE: THREE PHASE - PREMIUM EFFICIENCY, TOTALLY ENCLOSED, FAN COOLED**

HP	RPM (Syn)	NEMA Frame	Percent Efficiency	Guaranteed Minimum Percent Power Factor
1½	1200	182T	86.5	70
2	1200	184T	86.5	68
3	1200	213T	89.5	63
5	1200	215T	89.5	66
7½	1200	254T	91.7	74
10	1200	256T	91.7	75.0
15	1200	284T	92.4	72.0
20	1200	286T	93.0	76.0

-- END OF SECTION --

SECTION 15190
MECHANICAL IDENTIFICATION

1. PART 1 - GENERAL

1.1 WORK INCLUDED

A. Identification of mechanical products installed under Division 15.

1.2 RELATED WORK

A. Section 15010 - Basic Mechanical Requirements.

B. Section 15250 - Thermal Insulation.

C. Section 15410 - Plumbing Piping.

D. Section 15430 - Plumbing Specialties.

E. Section 15450 - Plumbing Equipment.

F. Section 15505 - Fuel Gas Piping.

G. Section 15781 - Packaged Rooftop Air Conditioning Units.

H. Section 15860 - Centrifugal Fans.

I. Section 15890 - Ductwork.

J. Section 15910 - Ductwork Accessories.

1.3 REFERENCES

A. ANSI/ASME A13.1 - Scheme for the Identification of Piping Systems.

1.4 SUBMITTALS

A. Refer to General Conditions and Division 1.

B. Submit shop drawings product data under provisions of Section 01300 and 15010.

C. Submit list of wording, symbols, letter size and color coding for mechanical identification.

D. Submit valve chart and schedule, including valve tag number, location, function and valve manufacturer's name and model number.

E. Submit manufacturer's installation instructions under provisions of Division 1 and Section 15010.

2. PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Brimar Industries

B. Seton Nameplate

C. W. H. Brady

D. Substitutions: Under provisions of Division 1 .

2.2 MATERIALS

A. Color: Unless specified otherwise, conform with ANSI/ASME A13.1.

B. Plastic Nameplates: Laminated three-layer plastic with engraved black letters on light contrasting background color.

C. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1½" diameter with smooth edges. Use ½" text size for numbering and ¼" text size for system identification.

D. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and fluid being conveyed.

1. Lettering to be 1-1/4" wide on piping 4" and under.

2. Lettering to be 2" wide on piping over 4".

E. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

3. PART 3 - EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces for stencil painting.

3.2 INSTALLATION

A. Plastic Nameplates: Install with corrosive-resistant mechanical fasteners, or adhesive.

B. Plastic Tags: Install with corrosive-resistant chain.

C. Stencil Markers: Black or white for best contrast, wherever continuous color coded paint of piping is provided.

D. Plastic Pipe Markers: Install in accordance with manufacturer's instructions.

E. Plastic Tape Pipe Markers: Install complete around pipe in accordance with manufacturer's instructions.

F. Equipment: Identify rooftop units, domestic, water heater, fans and heat transfer equipment with plastic nameplates.

G. Controls: Identify control panels and major control components outside panels with plastic nameplates.

H. Piping: Identify piping, concealed or exposed, with plastic pipe markers. Identify service, flow direction and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and "T", at each side of penetration of structure or enclosure and at each obstruction.

I. Ductwork:

1. Identify ductwork with stenciled painting. Identify as to air handling unit number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure and at each obstruction.

2. Access Doors: Provide stenciled signs on each access door in ductwork and housings, indicating purpose of access (to what equipment) and other maintenance and operating instructions and appropriate safety and procedural information.

J. All items used for identification shall be installed to match existing throughout building.

-- END OF SECTION --

SECTION 15242
VIBRATION ISOLATION

1. PART 1 - GENERAL

1.1 WORK INCLUDED

A. Vibration isolation.

1.2 REFERENCES

A. ASHRAE Handbooks.

1.3 QUALITY ASSURANCE

A. Refer to Section 15010.

B. Comply with product data under provisions of Division 1 and Section 15010.

C. Maintain ASHRAE criteria for average noise criteria curves for all equipment at full load condition.

D. All mechanical equipment is to be isolated from the building structure by means of noise and vibration isolators.

E. All piping to be isolated according to this Section of the Specifications shall freely pass through walls and floors without rigid connections to building structures. Penetration points shall be sleeved or otherwise formed to allow passage of piping and maintain a minimum of ¾" and maximum of 1¼" clearance around the outside surfaces. This clearance space shall be tightly packed to conform with Section 15140.

F. The isolation materials manufacturer will be responsible for the proper selection of spring rates to accomplish the specified minimum static deflections for all spring and pad type isolators based on the weight distribution of equipment to be isolated.

G. All outdoor equipment is to be provided with galvanized isolators and cadmium spring elements.

1.4 SUBMITTALS

A. Refer to Division 1 and Section 15010.

B. Submit product data under provisions of Section 15010.

C. Indicate vibration isolator locations, with static and dynamic load of each, on shop drawings and described on product data.

D. Furnish a complete set of final Shop Drawings of all mechanical equipment to receive vibration isolation devices to the vibration isolation materials manufacturer. These Drawings will be the basis upon which the selection of vibration isolators and design of supplementary bases will be completed. The Shop Drawings to be furnished shall include operating weight of the equipment to be isolated and the distribution of weight to the support points.

E. Furnish a complete layout of piping to be isolated, including vertical risers, showing size or weight and support points of the piping system to the vibration isolation materials manufacturer for selection and layout of isolation hangers.

F. Submit scale drawings of hangers showing swing capability of 30 degree arc.

G. Submit manufacturer's installation instructions under provisions of Division 1 and Section 15010.

1.5 CERTIFICATES

A. Refer to Division 1 and Section 15010.

B. Submit manufacturer's certificate under provisions of Section 15010 that isolators are properly installed and properly adjusted to meet or exceed specified requirements.

2. PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - BASES AND VIBRATION ISOLATORS

A. Mason Industries

B. Peabody Noise Control

C. Vibro-Acoustics

D. Vibration Mountings & Controls

2.2 VIBRATION ISOLATOR SELECTION

A. Noise and vibration isolator types, minimum operating static deflections and supplemental bases shall be provided for individual mechanical equipment units according to selection criteria delineated in Schedule incorporated as part of this specification.

B. Isolator types are scheduled to establish minimum standards. At the Contractor's option, labor saving accessories can be an integral part of isolators

supplied to provide initial lift of equipment to operating height, hold piping at fixed elevations during installation and initial system filling operations and similar installation advantages, provided isolators supplied incorporate and specified isolator type and do not degrade the noise and vibration isolation of equipment mounted.

2.3 BASES

A. Option J - Base:

1. Factory fabricated roof mounted equipment support curbs.

2.4 VIBRATION ISOLATORS

A. Option H - Hangers:

1. Vibration hangers with steel hanger box, steel spring and double deflection neoprene element in series. Spring diameter and hanger box lower hole to be large enough to permit hanger rod to swing through 30 degree arc before contacting box. Spring diameter to be no less than 0.8 of spring operating height with minimum additional travel to 50% of rated deflection before going solid. Type 30N manufactured by Mason Industries.

B. Option I - Hangers:

1. Vibration hangers to be same as described for Option H above but pre-compressed to deflection rate to keep piping or equipment at fixed elevation during installation. Hangers to have deflection scale and release mechanism to free spring after installation is complete and hanger is subjected to full load with deflection clearly indicated on scale. Type PC30N manufactured by Mason Industries.

2.5 FABRICATION

A. Provide pairs of neoprene side snubbers or restraining springs where side torque or thrust may develop.

B. Color code spring mounts.

C. Select springs to operate at ⅔ maximum compression strain, with ¼" ribbed neoprene pads.

3. PART 3 - EXECUTION

3.1 INSTALLATION

A. Install vibration isolators for motor driven equipment.

B. Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end.

C. On completion of installation of all isolation materials and before start up of isolated equipment all debris shall be cleared from areas surrounding and from beneath all isolated equipment, leaving equipment free to move on the isolation supports.

D. No rigid connections between equipment and building structure shall be made that degrade the noise and vibration isolation system herein specified. Electrical conduit connections to isolated equipment shall be looped to allow free motion of isolated equipment.

3.2 INSPECTION

A. The Contractor shall consult with the local representative of the materials manufacturer, prior to installing any devices, in order to obtain guidance for this project's specific installation requirements.

B. The local representative of the materials manufacturer shall conduct periodic inspections of the installation of materials herein specified and shall report in writing to the Contractor any deviations from good installation practice observed.

C. On completion of installation of all noise and vibration isolation devices herein specified, the local representative of the materials manufacturer shall inspect the completed system and report in writing any installation errors, improperly selected isolation devices, or other fault in the system that could affect the performance of the system.

3.3 SCHEDULE

	Basement or Slab on Grade			Upper Floors		
ISOLATED EQUIPMENT	Inertia Base Option	Vibration Isolator Option	Min Static Deflec	Base Option	Isolator Option	Min Static Deflec
Roof Top Equipment						
Roof Top Units with Internal Isolation	--	--	--	J	--	--

-- END OF SECTION --

SECTION 15250
THERMAL INSULATION

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Products furnished and installed under this section:

1. Insulation.
2. Protective coverings.
3. Accessories.
4. Repairs to all existing insulation cut or damaged by work performed under this Contract.

B. Products furnished but not installed under this section: None.

C. Products installed but not furnished under this section: None.

D. Services provided:

1. Design - None.
2. Training - None.
3. Obtain permits - None.

1.2 DEFINITIONS

A. Piping Insulation: Thermal insulation applied to prevent heat transmission to or from a piping system (temperature range of -100F to +1500F).

B. Ductwork Insulation: Thermal insulation applied to prevent heat transmission to or from a duct system (temperature range of -100F to +1500F).

C. Jacket: Protective covering over insulation; may be factory applied such as "all service jacket" or field applied to provide additional protection; of such materials as canvas, polyvinyl chloride (PVC), aluminum or stainless steel.

D. Vapor Retarder Jacket: Insulation jacket material which impedes the transmission of water vapor.

E. Insert: Spacer placed between the equipment support system and the equipment to allow for the space required for insulation.

F. Insulation Shield: Buffer material placed between the equipment support system and the insulation to prevent the insulation material from crushing.

1.3 CODES AND STANDARDS

A. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

B. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate).

C. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot Plate Apparatus.

D. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.

E. ASTM C449/C449M - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.

F. ASTM C518 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

G. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.

H. ASTM C547 - Standard Specification for Mineral Fiber Preformed Pipe Insulation.

I. ASTM C449 - Mineral Fiber Hydraulic-setting Thermal Insulating and Finishing Cement.

J. ASTM C553 - Mineral Fiber Blanket and Felt Insulation (Industrial Type).

K. ASTM C612 - Mineral Fiber Block and Board Thermal Insulation.

L. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

M. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

N. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.

O. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

P. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.

Q. Midwest Insulation Contractors Association (MICA) - Commercial and Industrial Insulation Standards.

R. North American Insulation Manufacturers Association (NAIMA) National Insulation Standards.

S. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

T. National Insulation and Abatement Contractors Association (NIACA) - Guide to Insulation Product Specifications.

U. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

V. NFPA-90A - Installation of Air Conditioning and Ventilation Systems.

W. NFPA-90B - Warm Air Heating and Air-Conditioning Systems.

X. ASHRAE Standard 90.1-1989 Energy Efficient Design of New Buildings Except New Low-Rise Residential Buildings.

1.4 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience.

B. Installer: Company specializing in performing the work of this section with minimum five years documented experience.

C. Products: Flame spread/smoke developed rating of 25/50 in accordance with ASTM E84 or NFPA 255 or UL 723.

D. No insulation product shall support or promote mold or fungus growth.

1.5 SUBMITTALS

A. Submit under provisions of Section 15010.

B. Product Data: Provide a schedule, listing each type of insulation, thickness, density, type of protective covering, etc., and the work and service to which each type of insulation is to be applied. The schedule shall be submitted in quantities consistent with that required in the Conditions of the Contract. No insulation shall be purchased or installed until the schedule is reviewed by the Engineer.

C. Manufacturer's Installation Instructions: Indicate specific installation instructions per the manufacturers of the various products and indicate how the system (combination of products) will be assembled. Highlight critical environmental factors such as drying time, etc., as well as any variations between the manufacturer's installation instructions and the specified installation instructions along with a reason for the difference.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver products to site under provisions of Section 15010.

B. Deliver products to site in containers with manufacturer's stamp or label affixed showing fire hazard indexes of products.

C. Protect products against dirt, water, chemical and mechanical damage before, during and after installation. Do not install damaged or wet insulation; remove from project site. Damage to products prior to final acceptance of the Work shall be repaired or replaced at no additional cost to Owner.

D. Where existing insulation has been removed or disturbed, due to new connections and/or alterations, repair and replace existing insulation using materials that match existing, except where existing insulation includes asbestos material.

E. Existing insulation containing asbestos materials (or thought to contain asbestos materials) must be removed by Owner, either totally or in part, in strict accordance with OSHA Regulations utilizing OSHA approved Contractors. Repair and/or replacement of existing insulation containing asbestos shall be with new products as specified herein.

F. Maintain ambient conditions required by the manufacturer of each product.

1.7 SPARE PARTS

A. Six rolls of tape to be used for sealing penetrations in vapor retarder jackets.

1.8 WARRANTY

A. One year warranty on products and complete installation commencing at the time of Substantial Completion.

1.9 MAINTENANCE

Not Applicable

PART 2 - PRODUCTS

2.1 INSULATION

A. Acceptable Manufacturers:

1. Johns Manville
2. Owens-Corning
3. Knauf
4. Armstrong
5. Certainteed Corp.
6. Rock Wool Manufacturing

B. Type GFP: *Glass fiber pipe* insulation; ANSI/ASTM C547, rigid molded, for use to 850F; thermal conductivity ('k' value) of 0.23 (Btu)/(hr ft^2 EF) at 75F mean temperature, k=0.29 at 200F, k=0.43 at 400F; noncombustible factory-applied white kraft paper bonded to aluminum foil and reinforced with glass fibers (ASJ) (vapor permeability shall not exceed .02 perms) that has a self-sealing longitudinal lap which provides positive closure without the use of tools, staples, adhesives, ties or tape at ambient temperatures between 25F and 110F shall be provided as a vapor retarder.

C. Type GFFB: *Glass fiber flexible blanket* insulation; ASTM C553; for use to 250F; 'k' value of .28 at 75F mean temperature; commercial grade; ¾ lb/cu ft minimum density; noncombustible factory-applied foil-scrim kraft (FSK) jacket (vapor permeability shall not exceed .02 perms).

D. Type FEP: *Flexible elastomeric plastic* insulation; ANSI/ASTM C534; 'k' value of 0.27 at 75F mean temperature.

2.2 PIPE ACCESSORIES

A. Acceptable Manufacturers:

1. Foster
2. Minnesota Mining
3. Chicago Mastic

B. Insulating Cement: ANSI/ASTM C195; hydraulic setting mineral wool; compatible with the insulation and protective coverings.

C. Finishing Cement: ASTM C449; compatible with the insulation/fitting covers/jackets.

D. Adhesives and Tapes: Compatible with insulation and protective coverings.

2.3 DUCT/EQUIPMENT ACCESSORIES

A. Acceptable Manufacturers:

1. Foster
2. Minnesota Mining
3. Chicago Mastic

B. Adhesives: Waterproof fire-retardant type.

C. Lagging Adhesive: Fire resistive to ASTM E84 or NFPA 255 or UL 723.

D. Joint Tape: Glass fiber cloth, open mesh.

E. Bedding Compounds: Non-shrinking, permanently flexible, compatible with insulation.

F. Vapor Retarder Coating: Non-flammable, fire resistant, polymeric resin, compatible with insulation.

G. Insulating Cement: ANSI/ASTM C195, hydraulic setting mineral wool.

H. Impale Anchors: Galvanized steel, 12 gauge, self-adhesive pad.

I. Tie Wire: Annealed steel, 16 gauge.

J. Wire Mesh: Corrosive-resistant metal; hexagonal pattern.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Install products only after piping, ductwork and equipment have been tested and approved.

B. Verify that surfaces are clean and dry with any and all foreign material removed.

C. Provide drop cloths or other means of protecting all equipment from drops, spattering, etc. which may be caused by the application of insulating products.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's and NAIMA instructions.

B. Whenever insulated pipes or ducts pass through sleeves or openings, the full specified thickness of the insulation shall pass through the sleeve or opening, except for sleeves located in fire rated partitions or floors. Space between pipe and sleeve located in fire rated partition or floor shall be sealed.

C. Contractor shall note that all adhesives shall be applied as specified, in continuous bands for complete coverage. The "spot" application of adhesives is not permitted.

D. Neatly finish insulation at supports, protrusions and interruptions.

E. Contractor shall coordinate with support and firestopping requirements as noted elsewhere in the Contract Documents.

3.3 APPLICATION (PIPING)

A. Schedule

INSULATION	OPERATING TYPE	OPERATING TEMP (F)
Domestic Hot Water System		
Domestic Hot Water Supply	GFP	
Domestic Hot Water Recirculating	GFP	
Domestic Cold Water System		
Domestic Cold Water	GFP	
Roof Drains and Storm Water	GFP	

B. Insulation thickness shall be as follows:

Fluid Design Operating Temperature Range, F	Nominal Pipe Diameter (in.)				
	1" and less	1½" and less	2" to 4"	5" & 6"	8" & up
100-200	1.5	1.5	2.0	2.0	2.0
40-60	1.5	1.5	1.5	1.5	1.5
Up to 39	1.5	1.5	2.0	2.0	2.0

1. Use maximum fluid temperature for those systems where fluid temperature is above ambient temperature, minimum fluid temperature for those systems where fluid temperature is below ambient temperature.
2. EXCEPTION: Insulation thickness for roof drains and storm water shall be 1".

C. Indoor, Concealed Pipe

1. End joints shall be sealed with minimum 3" wide factory finished vapor retarder strips applied with adhesive.
2. All fittings, valves, strainers, etc. in piping 3" and larger and all flanges in any size pipe shall be insulated with fabricated mitered or molded segments of fiberglass pipe insulation equal in thickness to the adjoining pipe insulation. Segments shall be firmly butted and securely wired in place with 16 gauge soft annealed copper clad wire wraps. Apply a ¼" thick coat of insulation manufacturer's insulating cement over insulation and finish with a glass cloth jacket or a spiral wrap of stretchable glass tape between two coats of Foster No. 30-36 after cement is dry.
3. All fittings, valves, strainers, etc. in piping 2½" and smaller shall be insulated with the insulation manufacturer's insulating cement applied in several layers to the equal thickness of adjoining pipe insulation and finished with a glass cloth jacket or a spiral wrap of stretchable glass tape between two coats of Foster No. 30-36.
4. Ends of pipe insulation shall be sealed off with fire resistive mastic, Foster 60-30, at all flanges, valves and fittings and at intervals of not more than 21 feet on continuous runs of pipe.
5. Insulation on all strainers shall have removable cover for cleaning.
6. Insulate all piping within air handling units.

D. Indoor, Exposed Pipe

1. For pipe exposed in mechanical equipment rooms or in finished spaces, insulate pipe, fittings, joints and valves the same as for concealed applications.
2. Locate insulation and cover seams in least visible locations on exposed piping systems.

E. Where multiple layers of pipe insulation are required, all longitudinal and circumferential joints shall be staggered.

F. Insulate all horizontal storm water piping as well as all vertical piping between roof drain body and the first length of vertical piping to first 90 degree elbow down. Insulate roof drain body and seal to roof slab.

3.4 APPLICATION (DUCTWORK)

A. Flexible ductwork insulation (Type GFFB) (1½" thick) shall be applied to all concealed (above ceiling, within shafts, etc.) supply ductwork.

1. Insulation shall be wrapped around and secured to ducts by means of the butt joint method of application along the duct length (longitudinal seam) and the butt joint method of application along the duct perimeter at the joints (longitudinal seam). Overlapping flap shall be at least 2" wide.
2. All edges of insulation shall be butted snugly together. Provide 4" wide tape on ducts at all joints, seams, edges, breaks, mechanical pin penetrations, etc.
3. Insulation shall be further secured to the bottom of horizontal ductwork or to all four sides of a vertical duct with approved type welded mechanical pins. These pins shall be applied on 12" centers to all surfaces of ductwork as follows:

Horizontal Duct Width	Vertical Duct Dimensions	Minimum Rows of Pins
Up to 11"	Up to 11"	No pins required
12" to 23"	12" to 23"	One
24" to 35"	24" to 35"	Two
36" to 47"	36" to 47"	Three
48" to 59"	48" to 59"	Four
60" to 71"	60" to 71"	Five
72" to 83"	72" to 83"	Six
84" to 95"	84" to 95"	Seven

4. Contractor shall install all insulation without sag.
5. All round ductwork shall be insulated same as specified above except no pins are required.

3.5 ADJUSTING

Not Applicable

3.6 CLEANING

A. All empty cartons, containers, etc. which have contained insulating materials shall be removed from the site and premises by the Contractor as soon as possible after their contents have been removed.

END OF SECTION

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SECTION 15410
PLUMBING PIPING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Pipe and pipe fittings.

B. Valves.

C. Sanitary sewer piping system.

D. Domestic water piping system.

E. Storm water piping system.

1.2 REFERENCES

A. ANSI A112.1/ASSE 1001 - Vacuum Breakers, Anti-Siphon.

B. ANSI/ASME B16.3 - Malleable Iron Threaded Fittings Class 150 and 300.

C. ANSI/ASME B16.4 - Cast Iron Threaded Fittings Class 125 and 250.

D. ANSI/ASME B16.5 - Steel Pipe Flanges and Flanged Fittings.

E. ANSI/ASME B16.12 - Cast Iron Threaded Drainage Fittings.

F. ANSI/ASME B16.15 - Cast Bronze Threaded Fittings.

G. ANSI/ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.

H. ANSI/ASME B16.22 - Wrought Copper and Bronze Soldered Joint Pressure Fittings.

I. ANSI/ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings – Type L.

J. ANSI/ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - TYPE L.

K. ANSI/ASME Sec. 9 - Welding and Brazing Qualifications.

L. ANSI/ASTM B32 - Solder Metal.

M. ANSI/AWS D1.1 - Structural Welding Code.

N. ANSI/AWWA C105 - Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquids.

O. ANSI/AWWA C111 - Rubber-Gasket Joints for Ductile Iron and Gray-Iron Pressure Pipe and Fittings.

P. ASSE 1011 - Vacuum Breakers, Hose Connection.

Q. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.

R. ASTM A74 - Cast Iron Soil Pipe and Fittings.

S. ASTM A158 - High Silicon Cast Iron Pipe and Fittings.

T. ASTM B88 - Seamless Copper Water Tube.

U. ASTM B306 - Copper Drainage Tube (TYPE L).

V. ASTM C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

W. AWS A5.8 - Brazing Filler Metal.

X. AWWA C601 - Standard Methods for the Examination of Water and Waste Water.

Y. CISPI 301 - Cast Iron Soil Pipe and Fittings for Hubless Cast Iron Sanitary Systems.

1.3 QUALITY ASSURANCE

A. Refer to General Conditions.

B. Comply with product data under provisions of Division 1.

C. Pipe: Each length of pipe shall be legibly identified at mill by paint, stenciling or raised symbols identifying manufacturer and class type or schedule of pipe. Copper pipe shall be identified at 3 foot intervals.

D. Fittings: To be identified by the manufacturer by permanently attached tags, imprints, or other approved means, indicating the class of wall thickness and material.

E. Valves: Manufacturer's name and pressure rating marked on valve body.

F. All grooved products shall be of one manufacturer.

1.4 SUBMITTALS

A. Submit product data under provisions of Division 1 and Section 15010.

B. Include data on pipe materials, pipe fittings, valves and accessories.

1.5 DELIVERY, STORAGE AND HANDLING

A. Refer to General Conditions.

B. Deliver products to site under provisions of Division 1.

C. Store and protect products under provisions of General Conditions.

D. Deliver and store valves in shipping containers with labeling in place.

PART 2 - PRODUCTS

2.1 SANITARY SEWER AND VENT PIPING, BURIED WITHIN 5 FEET OF BUILDING EXCAVATION LINE

A. Cast Iron Pipe: ASTM A74 service weight. Fittings: Cast iron. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets or molten lead (1" deep) and oakum.

2.2 SANITARY SEWER AND VENT PIPING, ABOVE GRADE (LESS THAN 2")

A. Copper Pipe: ASTM B306, Type L. Fittings: ANSI/ASME B16.23, cast alloy, or ANSI/ASME B16.29, wrought copper. Joints: ANSI/ASTM B32, solder.

2.3 SANITARY SEWER AND VENT PIPING, ABOVE GRADE (2" AND LARGER)

A. Cast Iron Pipe: CISPI 301, hubless, service weight. Fittings: Cast iron. Joints: CISPI 310-04, Neoprene gaskets and stainless steel clamp-and-shield assemblies for vertical pipe. Provide ASTM C1540 heavy duty clamp and shield assemblies for horizontal pipe.

2.4 WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING EXCAVATION LINE

A. Type K copper water tube, O (annealed) temper, ASTM B88; with cast copper pressure fittings, ANSI B16.18; wrought copper pressure fittings, ANSI B16.22; lead free (<.2%) solder, ASTM B32; flux, ASTM B813; or cast copper flared pressure fittings, ANSI B16.26.

2.5 WATER PIPING, ABOVE GRADE

A. Type L copper water tube, H (drawn) temper, ASTM B88; wrought copper pressure fittings, ANSI B16.22; lead free (<.2%) solder, ASTM B32; flux, ASTM B813; copper phosporous brazing alloy, AWS A5.8 BCuP. Copper mechanical grooved fittings and couplings on roll grooved pipe may be used in lieu of soldered fittings. Mechanically formed brazed tee connections may be used in lieu of specified tee fittings for branch takeoffs up to one-half (1/2) the diameter of the main.

2.6 STORM WATER PIPING, ABOVE GRADE

A. Hubless cast iron soil pipe and fittings, ASTM A888; with no-hub couplings, CISPI 301, CISPI 310, ASTM A74. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Pipe Institute. Cast iron piping and fittings shall be of A B & I Foundry, Charlotte Pipe and Foundry, or Tyler Pipe manufacturers.

2.7 ACCEPTABLE MANUFACTURERS – NO-HUB COUPLINGS

A. Ananco

B. Husky

C. Clamp-All

D. Mission

2.8 FLANGES, UNIONS AND COUPLINGS

A. Pipe Size 2" and Under: ANSI/ASME B16.3 150 psig malleable iron unions for threaded ferrous piping; ANSI/ASME B16.15 bronze unions for copper pipe, soldered joints.

B. Unions Above 150 psig: 300 psig malleable iron, brass to iron seat ground joint air tested unions.

C. Pipe Size Over 2": ANSI/ASME B16.5 150 psig forged steel slip-on flanges for ferrous piping; ANSI/ASME B16.24 bronze flanges for copper piping; neoprene gaskets for gas service; $\frac{1}{16}$" thick preformed neoprene.

D. Dielectric Connections:

1. Flanged or union type: Gaskets to conform to manufacturer's recommendations for the intended service, rated at minimum temperature of 200F (or higher as dictated by service) for continuous duty.
2. Union type: Galvanized or plated steel-threaded end; copper- solder end; water impervious isolation barrier.
3. Fittings provided shall meet ANSI B16.8 and be capable of isolating stray electrical currents up to 600 volts minimum.
4. Waterway fitting type: carbon steel or ductile iron, zinc electroplated, grooved, plain or threaded end, water impervious isolation barrier.

5. Acceptable Manufacturers: B&K Industries, Inc.; Eclipse, Inc.; EPCO Sales Inc.; Capital Manufacturing Company, Division of Harsco Corporation; Watts Regulator Company.

2.9 ACCEPTABLE MANUFACTURERS - BALL VALVES

A. Apollo

B. Hammond

C. Milwaukee

D. Viega

E. Nibco

F. Substitutions: Under provisions of General Conditions.

2.10 BALL VALVES

A. Up to 2": 600 psi WOG, bronze or brass two-piece body, chrome plated brass full port ball, teflon seats and stuffing box ring, lever handle and balancing stops, threaded or soldered ends. Model BA-450/450S manufactured by Milwaukee or Viega press-fit ball valve with "SC" feature.

B. Ball valves mounted in insulated pipes shall have extended stems to clear pipe covering.

2.11 ACCEPTABLE MANUFACTURERS - SWING CHECK VALVES

A. Crane

B. Hammond

C. Stockham

D. Milwaukee

E. Substitutions: Under provisions of General Conditions.

2.12 SWING CHECK VALVES

A. Up to 3": Bronze 22 degree swing disc, solder ends, 125 lb. Model 509 manufactured by Milwaukee.

2.13 ACCEPTABLE MANUFACTURERS - RELIEF VALVES

A. CASH (A.W.) Valve Manufacturing Corporation

B. Watts Regulator Company

C. Zurn Industries, Inc.; Wilkins-Regulator Division

D. Substitutions: General Conditions.

2.14 RELIEF VALVES

A. Pressure Relief Valves: Bronze body, teflon seat, steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labeled.

B. Combined Pressure-Temperature Relief Valves: Bronze body, test lever, thermostat, complying with ANSI Z21.22 listing requirements for temperature discharge capacity. Provide temperature relief at 210F (99C) and pressure relief at 150 psi.

2.15 ACCEPTABLE MANUFACTURERS - BALANCE COCKS

A. Hammond Valve Corporation

B. Milwaukee Valve Company, Inc.

C. Spirax Sarco

D. Substitutions: General Conditions.

2.16 BALANCE COCKS

A. Soldered Ends 1" and Smaller: Class 125, bronze body, bronze plug, screw driver operated, straight pattern. Fig. 308 manufactured by Hammond.

2.17 ACCEPTABLE MANUFACTURERS - DRAIN VALVES

A. Hammond

B. Nibco

C. Substitutions: General Conditions

2.18 DRAIN VALVES

A. Class 125: bronze body, screw-in bonnet, rising stem, threaded male inlet composition disc, ¾" hose outlet. Fig. 64 manufactured by Nibco.

PART 3 - EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel or groove plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges, grooved joint couplings or unions.

D. Field test all piping before start-up of systems.

3.2 INSTALLATION

A. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

B. Route piping in orderly manner plumb and parallel to building structure and maintain gradient.

C. Group piping whenever practical at common elevations. Space piping to permit applying full insulation and servicing of valves.

D. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

E. Provide clearance for installation of insulation and access to valves and fittings.

F. Provide access where valves and fittings are not exposed.

G. Slope water piping and arrange to drain at low points.

H. Provide sleeves when penetrating floors and walls. Refer to Section 15140.

I. Where pipe support members are welded to structural building framing, scrape, brush clean and apply one coat of zinc rich primer to welding.

J. Prepare pipe, fittings, supports and accessories not prefinished, ready for finish painting.

K. Establish invert elevations, slopes for drainage to ¼" per foot (2%) minimum for piping 3" and smaller and 1/8" per foot (1%) for piping 4" and larger, unless otherwise noted on drawings. Minimum slope for piping from low consumption water closets (1.6 gal./flush) shall be 2%.

L. Install frost-proof vent caps on each vent pipe passing through roof and elsewhere where indicated. Maintain 1" clearance between vent pipe and roof substrate.

M. Flashing Flanges: Install flashing flange and clamping device with each stack and cleanout passing through water proof membrane.

N. Vent Flashing Sleeves: Install on stacks passing through roof, secure over stack flashing in accordance with manufacturer's instructions.

O. Install valves with stems upright or horizontal, not inverted.

P. In general, all piping, ductwork and similar items shall be installed concealed from view above ceiling, in partitions, shafts, chases, unless otherwise indicated.

Q. Where pipes are in partitions, furred out spaces and chases, obtain information as to their exact location and size and install work so as to be entirely concealed in allotted space. If conflicts arise making this impossible, obtain instructions from Architect/Engineer before proceeding with work.

R. Furnish advance information on locations and sizes of frames, boxes, sleeves and openings needed for work and also furnish information and shop drawings necessary to permit installation of other work without delay.

S. Where there is evidence that parts of Mechanical Work will interfere with other work, assist in working out space conditions and/or structure, make necessary adjustments to accommodate work.

T. Mechanical Work installed before coordinating with other work so as to cause interference with other work to be changed to correct such condition without additional cost to Owner.

U. Appliances and equipment to be installed and connected with best engineering practices and in accordance with manufacturer's instructions and recommendations. Piping, valves, connections and other like items recommended by manufacturer or as required for proper operation to be provided without additional cost to Owner.

V. In no case will any pipe, conduit or duct be installed where it is supported on or suspended from another pipe, conduit or duct.

W. Follow manufacturers' directions in installation and operation of all equipment and materials.

X. Accessibility:

1. Install Mechanical work to permit removal (without damage to other parts) of coils, heat exchangers, pumps, fan shafts and wheels, belt guards, sheaves and drives and other parts requiring periodic replacement or maintenance.
2. Arrange pipes and equipment to permit ready access to valves, cocks, traps, starters, motors, dampers, control components and to clear the openings of swinging and overhead doors and of access panels.

Y. Copper Press Fit Joints: Pipe shall be certified for use with the Copper Press-Fit system. Pipe shall be square cut, ±0.030", properly deburred and cleaned. Pipe ends shall be marked at the required location, using a manufacturer-supplied gauge, to ensure full insertion into the coupling or fitting during assembly.

3.3 APPLICATION

A. Install unions or grooved joint couplings downstream of valves and at equipment or apparatus connections.

B. Install brass male adapters or grooved joint copper couplings on each side of valves in copper piped system. Sweat solder adapters to pipe.

C. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

3.4 SERVICE CONNECTIONS

A. Provide new water service complete with water meter with by-pass valves.

3.5 EQUIPMENT CONNECTIONS

A. Piping Runouts to Fixtures: Provide soil and waste piping runouts to plumbing fixtures and drains, with approved trap, of sizes indicated; but in no case smaller than required by local Plumbing Code. Provide hot and cold water piping runouts to fixtures of sizes indicated, but in no case smaller than required by local Plumbing Code.

B. Locate soil and waste piping runouts as close as possible to bottom of floor slab supporting fixtures or drains.

C. Mechanical Equipment Connections: Connect hot and cold water piping system to mechanical equipment as indicated and comply with equipment manufacturers' installation instructions. Provide shutoff valve and union for each connection, provide drain valve on drain connection.

3.6 FIELD TESTS

A. Furnish all labor, material, instruments, supplies and services and bear all costs for the accomplishment of tests herein specified. Correct all defects appearing during test and repeat test until no defects are found leave the equipment clean and ready for use.

B. Tests of piping systems shall be conducted before connections to equipment are made and before piping is covered, buried or otherwise concealed.

C. Perform all tests other than herein specified which may be required by legal authorities or by agencies to whose requirements this work is to conform.

D. Furnish all necessary testing apparatus, make all temporary connections and perform all testing operations required, at no additional cost to Owner.

E. Inform Architect's/Engineer's/Owner's representative 48 hours prior to when work is ready for test.

F. Each system found to have leaks shall be subjected to further test once faulty joints have been repaired or replaced.

G. Selected welded joints shall be subjected to a hammer test (on a spot-check basis) while under pressure. For additional test requirements, see welding specification.

H. Domestic water systems and equipment vents shall be tested hydrostatically for minimum of four hours at 1½ times design pressure for that system, or 100 psig minimum, whichever is greater, unless otherwise specified.

I. Storm, soil, waste and vent piping shall be tested with water for minimum of 24 hours at 10 feet head.

J. Test pressures shall be increased if necessary to comply with applicable codes.

3.7 DISINFECTION OF DOMESTIC WATER SYSTEM

A. The method to be followed shall be that prescribed by the health authority having jurisdiction or, in the absence of a prescribed method, the procedure described in either AWWA C651 or AWWA C652, or as described in this section. This requirement shall apply to "on site" or "in plant" fabrication of a system or to a modular portion of a system.

B. The pipe system shall be flushed with clean, potable water until dirty water does not appear at the points of outlet.

C. The system or part thereof shall be filled with a water/chlorine solution containing at least 50 parts per million (50 mg/L) of chlorine, and the system or part thereof shall be valved off and allowed to stand for 24 hours; or the system or part thereof shall be filled with a water/chlorine solution containing at least 200 parts per million (200 mg/L) of chlorine and allowed to stand for three hours.

D. Following the required standing time, the system shall be flushed with clean potable water until the chlorine is purged from the system.

E. The procedure shall be repeated where shown by a bacteriological examination that contamination remains present in the system.

END OF SECTION

SECTION 15430
PLUMBING SPECIALTIES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Roof and floor drains.

B. Cleanouts.

C. Water hammer arrestors.

D. Hose bibbs hydrants.

1.2 REFERENCES

A. ANSI/ASSE 1011 - Hose Connection Vacuum Breakers.

B. ANSI/ASSE 1019 - Wall Hydrants, Frost Proof Automatic Draining Anti-Backflow Types.

C. ANSI A112.21.1 - Floor Drains.

D. ANSI A112.21.2 - Roof Drains.

E. ANSI A112.26.1 - Water Hammer Arresters.

F. PDI WH-201 Water Hammer Arresters.

1.3 QUALITY ASSURANCE

A. Refer to Division 1.

B. Manufacturer: For each product specified, provide components by same manufacturer throughout.

1.4 SUBMITTALS

A. Refer to Division 1.

B. Include component sizes, rough-in requirements, service sizes and finishes.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - ROOF DRAINS

A. Jay R. Smith

B. Josam

C. Wade

D. Zurn

E. Substitutions: Under provisions of Division 1.

F.

2.2 ROOF DRAINS

A. RD-1: 4" min. bottom outlet roof drain, enameled cast iron body with flashing collar and gravel stop, cast iron dome strainer, adjustable extension, underdeck clamp, 15" diameter. Zurn ZC-100-C-EA

2.3 ACCEPTABLE MANUFACTURERS - FLOOR DRAINS

A. Jay R. Smith

B. Josam

C. Wade

D. Zurn

E. Substitutions: Under provisions of Division 1.

2.4 FLOOR DRAINS

A. FD-1: 3" min. enameled cast iron two piece body with double drainage flange, weep holes, reversible clamping adjustable collar, adjustable 6"x6" min. square or round polished nickel-bronze strainer with threaded collar, bottom outlet. Zurn ZN-415-S or B. Provide with the addition of the trap guard diaphragm called out below.

B. Trap Guards

1. Manufacturer: ProSet Systems Trap Guard or approved equal.
2. Flexible elastomeric PVC construction diaphragm trap guard for installation in new and existing floor drains, hub drains, and trench drains. Trap guard to prevent trap evaporation and waste backflow. Size as applicable to the drain outlet size, up to 4" size.

2.5 ACCEPTABLE MANUFACTURERS - CLEANOUTS

A. Jay R. Smith

B. Josam

C. Wade

D. Zurn

E. Substitutions: Under provisions of Division 1.

2.6 CLEANOUTS

A. INTERIOR CONCRETE FLOOR AREAS: Enameled cast iron body with round or square adjustable scoriated polished nickel bronze cover, tapered threaded ABS closure plug. Zurn ZN-1400- / ZN-1400-T.

B. INTERIOR CERAMIC TILE FLOOR AREAS: Enameled cast iron body with square adjustable scoriated nickel bronze cover, tapered threaded ABS closure plug. Zurn ZN-1400-T.

C. INTERIOR VINYL TILE FLOOR AREAS: Enameled cast iron body with round adjustable scoriated nickel bronze cover, tapered threaded ABS closure plug. Zurn ZN-1400.

D. INTERIOR CARPETED FLOOR AREAS: Enameled cast iron body with round adjustable scoriated nickel bronze cover and secured carpet marker, tapered threaded ABS closure plug. Zurn Z-1400-CM.

E. INTERIOR FINISHED WALL AREAS: Line type cleanout tee with tapered threaded ABS cleanout plug, round polished stainless steel access cover secured with machine screw. Zurn Z-1446 (Note: Screw shall not pass completely through the ABS plug, trim screw as necessary)

F. INTERIOR EXPOSED VERTICAL STACKS: Line type cleanout tee with tapered threaded ABS closure plug. Zurn Z-1445.

G. INTERIOR HORIZONTAL LINES: Cast iron hub with tapped ferrule and tapered threaded ABS or PVC closure plug, or no-hub coupling and blind plug.

2.7 WATER HAMMER ARRESTORS

A. ANSI A112.26.1; sized in accordance with PDI WH-201, precharged suitable for operation in temperature range -100F to 300F and maximum 250 psig working pressure; Series 5000 manufactured by Jay R. Smith.

2.8 ACCEPTABLE MANUFACTURERS - HOSE BIBBS/HYDRANTS

A. Woodford

B. Josam

C. Zurn

D. Substitutions: Under provisions of Division 1.

2.9 HOSE BIBBS/HYDRANTS

A. Freezeless Wall Hydrants ANSI/ASSE 1019: Exposed type, automatic draining with vacuum breaker-backflow preventer, ¾" hose thread nozzle, one-piece valve plunger to control both flow and drain functions, hardened stainless steel operating stem, chrome finish on brass casting. Loose tee key to be furnished with each hydrant. Wall thickness to be as per drawings. Model 65 manufactured by Woodford.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate cutting of roof and floor construction to receive drains to required invert elevations.

3.2 INSTALLATION AND APPLICATION

A. Install specialties in accordance with manufacturer's instructions to permit intended performance.

B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.

C. Install water hammer arrestors at top of all water risers and branch lines supplying fixtures served by flush valves and at equipment connections where quick closing or solenoid valves are used, such as washing machines, water closets, etc.

D. Install water hammer arrestors complete with accessible isolation valve. Install access doors where water hammer arrestors are not exposed to view.

E. Install each floor drain, with deep seal trap unless noted otherwise on drawings.

END OF SECTION

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SECTION 15440
PLUMBING FIXTURES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Water closets

B. Urinals.

C. Lavatories.

D. Sinks.

E. Mop basins.

F. Electric water coolers.

1.2 REFERENCES

A. ANSI A112.6.1 - Supports for Off-the-Floor Plumbing Fixtures for Public Use.

B. ANSI A112.18.1 - Finished and Rough Brass Plumbing Fixture Fittings.

C. ANSI A112.19.1 - Enameled Cast Iron Plumbing Fixtures.

D. ANSI A112.19.2 - Vitreous China Plumbing Fixtures.

E. ANSI A112.19.4 - Porcelain Enameled Formed Steel Plumbing Fixtures.

F. ANSI A112.19.5 - Trim for Water-Closet Bowls, Tanks and Urinals.

G. ARI 1010 - Drinking Fountains and Self-Contained Mechanically Refrigerated Drinking Water Coolers.

H. ANSI A117.1 - Requirements for the Physically Challenged.

I. Americans with Disabilities Act Guidelines.

1.3 QUALITY ASSURANCE

A. Refer to Division 1.

B. Fixtures: By same manufacturer for each product specified throughout.

C. Trim: By same manufacturer for each product specified throughout.

1.4 SUBMITTALS

A. Refer to Division 1.

B. Product Data: Submit manufacturer's technical product data, including rated capacities of selected model clearly indicated, furnished specialties and accessories; and installation instructions. Include fixtures, sizes, utility sizes, trim and finishes.

1.5 OPERATION AND MAINTENANCE DATA

A. Refer to Division 1.

B. Maintenance Data: Submit maintenance data for each type of plumbing fixture and accessory; including troubleshooting maintenance guide. Include this data, product data and shop drawings in maintenance manual.

C. Include fixture trim exploded view and replacement parts lists.

1.6 DELIVERY, STORAGE AND HANDLING

A. Refer to Division 1.

B. Deliver plumbing fixtures individually wrapped in factory-fabricated containers.

C. Handle plumbing fixtures carefully to prevent breakage, chipping and scoring fixture finish. Do not install damaged plumbing fixtures; replace and return damaged units to equipment manufacturer.

1.7 WARRANTY

A. Refer to Division 1.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - FIXTURES

A. Water closets, urinals, lavatories, sinks (vitreous china/enameled cast iron).

1. American Standard
2. Crane
3. Eljer
4. Kohler
5. Substitutions: Refer to Division 1.

B. Sinks, lavatories (stainless steel).

1. Elkay
2. Just
3. Acorn
4. Bradley
5. Substitutions: Refer to Division 1.

2.2 ACCEPTABLE MANUFACTURERS – LAVATORY FAUCETS

A. Sloan Optima – no substations.

2.3 ACCEPTABLE MANUFACTURERS - KITCHEN SINK FAUCETS AND DRAINS

A. American Standard

B. Crane

C. Eljer

D. Kohler

E. Moen

F. Chicago Faucets

G. Speakman

H. Symmons

I. Delta

J. Substitutions: Refer to Division 1.

2.4 ACCEPTABLE MANUFACTURERS - P-TRAPS

A. McGuire

B. Frost

C. Sanitary-Dash

D. Engineered Brass Company

E. Substitutions: Refer to Division 1.

2.5 ACCEPTABLE MANUFACTURERS - STOP AND SUPPLY FITTINGS

A. Chicago Faucets

B. T&S Brass

C. McGuire

D. Engineered Brass Company

E. Substitutions: Refer to Division 1.

2.6 ACCEPTABLE MANUFACTURERS - FLUSH VALVES

A. Sloan Valve Company

B. Delany Company

C. Zurn Industries, Inc.; Hydromechanics Division

D. Substitutions: Refer to Division 1.

2.7 ACCEPTABLE MANUFACTURERS - WATER CLOSET SEATS

A. Beneke Corporation

B. Bemis Manufacturing Company

C. Church

D. Olsonite Corporation; Olsonite Seats

E. Substitutions: Refer to Division 1.

2.8 ACCEPTABLE MANUFACTURERS - FIXTURE CARRIERS

A. Zurn Industries, Inc.; Hydromechanics Division

B. Jay R. Smith

C. Josam Manufacturing Company

D. Wade

E. Substitutions: Refer to Division 1.

2.9 ACCEPTABLE MANUFACTURERS - MIXING VALVES (THERMOSTATIC)

A. Symmons

B. ITT Lawler

C. Leonard

D. Powers

E. Wilkins

F. Substitutions: Refer to Division 1.

2.10 ACCEPTABLE MANUFACTURERS - MOP BASINS

A. Fiat Products

B. Stern-Williams Company, Inc.

C. Creative Industries Terrazzo Products Inc.

D. Substitutions: Refer to Division 1.

2.11 ACCEPTABLE MANUFACTURERS - ELECTRIC WATER COOLERS

A. Elkay

B. Halsey Taylor

C. Haws

D. Oasis

E. Sunroc

F. White - Westinghouse

G. Substitutions: Refer to Division 1.

2.12 WATER CLOSET (WC-1)

A. Floor mount bottom outlet white vitreous china siphon jet close coupled tank water closet with elongated bowl, 2-1/4" passageway, 14-1/2" rim height, insulating tank liner and 1.6 gallon flush.

1. Fixture: Kohler Wellworth K-3422-U.
2. Seat: Olsonite No 95.
3. Supply & Stop: Chicago Faucet Co. No. 995-CP w/ 1/2" closet riser.

2.13 WATER CLOSET (WC-2)

A. Floor mount bottom outlet white vitreous china siphon jet close coupled tank type water closet with elongated bowl, 2-1/4" passageway, 16-1/2" barrier free height, insulating tank liner and 1.6 gallon flush. ADA compliable.

1. Fixture: Kohler Highline K-3427-U.
2. Seat: Bemis 1655-SS/C white solid plastic open front seat.
3. Supply & Stop: Chicago Faucet Co. No. 995-CP w/ 1/2" closet riser.

2.14 URINAL (UR-1)

A. Floor mount white vitreous china washout urinal with 3/4" top inlet spud, 2" outlet spud, removable stainless steel beehive strainer. Electronic sensor operated flush valve 1 gallon per flush or less.

1. Fixture: Kohler Branham K-4920-T.
2. Flush Valve: Sloan Optima 180-1.0 ES-S with EL-154 transfomer.

2.15 LAVATORY (L-1) FOR PUBLIC TOILET ROOMS

A. Wall mount white vitreous china lavatory drilled for concealed arm carrier with 4" on center faucet openings. Faucet electronic sensor activated.

1. Fixture: Kohler Greenwich K-2032.
2. Faucet: Sloan Optima ETF-80A 2P gooseneck box mount transformer.
   Drain: Kohler K-7715 perforated strainer and 1-1/4" tailpiece.
3.

4. Trap: 1-1/4"x1-1/2" 17 ga. cast brass trap and tubular wall bend. With C.O. plug.
5. Supplies & Stops: Chicago Faucet No. 1006CP.
6. Mixing Valve: Wilkins ZW3870T
7. Carrier: Smith floor mounted concealed arm carrier adjusted for 31" height rim ht.

2.16 SINK (S-1)

A. Counter mounted 18 ga type 302 stainless steel single compartment sink with 3 faucet openings 4" on center.

1. Fixture: Elkay DLR-1722.
2. Faucet: Delta 2172-LHP/RP with H25 stainless steel handles.
3. Drain: Elkay LK-335
4. Trap: 1-1/2"x1-1/2" 17 ga. cast brass trap and tubular wall bend, With C.O. plug.
5. Supplies & Stops: Chicago Faucet No. 993-CP w/ 1/2" riser, length as necessary.

2.17 MOP BASIN (MB-1)

A. Floor mounted molded polyester resin and stone mop basin, 24"x24"x10" H, with 3" drain, stainless steel strainer and vinyl bumper guards.

1. Fixture: Fiat MSB-2424.
2. Faucet: Chicago Faucet No.897RCF with Watts 8BC vacuum breaker. With #369 handles.
3. Hose: Fiat 832-AA.
4. Mop Hanger: Fiat 889-CC
5. Stops: (Integral with faucet)

2.18 ELECTRIC WATER COOLER (EWC-1)

A. Dual level, wall mounted, barrier free and standard height, stainless steel finish water cooler/drink fountain station with front pushbar operators. Single recessed steel mounting box with refrigeration system and stainless steel removable front grille for access. Rated for 8.0GPH at 80 degree inlet water at 90 degree ambient temperature and 50 degree outlet water., 1/5 HP compressor, 380 watt, 120/60/1. Mount so upper unit spout is at 40" above floor.

B. Fixture: Oasis P8ACSL

C. Supply Fittings: Chrome plated No. 376-LK loose key stop manufactured by Chicago Faucets.

PART 3 - EXECUTION

3.1 INSPECTION

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation. Special attention shall be given to cabinet recessed openings for foot valve faucets. Coordinate these openings with Millwork Contractor by providing exact dimensions for proper mounting.

B. Verify adjacent construction is ready to receive rough-in work of this Section.

C. Examine floors and substrates and conditions under which fixture work is to be accomplished. Correct any incorrect locations of piping and other unsatisfactory conditions for installation of plumbing fixtures. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to installer.

D. Inspect fixtures and accessories that are to be removed and relocated. Damaged or blemished items shall be brought to Engineer's attention before reinstalling.

3.2 INSTALLATION

A. Install each fixture with trap, easily removable for servicing and cleaning.

B. Provide chrome plated rigid or flexible supplies to fixtures with loose key stops reducers and escutcheons.

C. Piping exposed to view shall be chrome plated.

D. Install components level and plumb.

E. Seal fixtures to wall and floor surfaces with sealant, color to match fixture.

F. Protect installed fixtures from damage during remainder of construction period.

3.3 ADJUSTING AND CLEANING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise or overflow.

B. At completion clean plumbing fixtures and equipment.

C. Adjust or replace washers to prevent leaks at faucets and stops.

D. Solidly attach water closets to floor with lag screws. Lead flashing is not intended hold fixture in place.

3.4 FIELD QUALITY CONTROL

A. Upon completion of installation of plumbing fixtures and after units are water pressurized, test fixtures to demonstrate capability and compliance with requirements. When possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units and proceed with retesting.

B. Inspect each installed unit for damage to finish. If feasible, restore and match finish to original at site; otherwise, remove fixture and replace with new unit. Feasibility and match to be judged by Engineer. Remove cracked or dented units and replace with new units.

3.5 FIELD INSPECTION AND REPORT

A. Provide report, in accordance with Section 15010, prepared by manufacturer's representative, stating that systems installed and services provided under this Section are in accordance with manufacturer's recommendations and are properly operating.

END OF SECTION

SECTION 15450
PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Water heaters.

B. Pumps.

1.2 REFERENCES

A. ANSI/NFPA 30 Flammable and Combustible Liquids Code.

B. ANSI/NFPA 54 - National Fuel Gas Code.

C. ANSI/NFPA 70 - National Electrical Code.

D. UL - Underwriters Laboratories Inc.

1.3 QUALITY ASSURANCE

A. Refer to General Conditions.

B. Ensure products and installation of specified products are in conformance with recommendations and requirements of the following organizations:

1. American Gas Association (AGA).
2. Underwriters Laboratories (UL).

1.4 REGULATORY REQUIREMENTS

A. Conform to Wisconsin Code requirements for water heaters.

1.5 SUBMITTALS

A. Refer to General Conditions.

B. Include dimension drawings of water heaters indicating components and connections to other equipment and piping.

1.6 OPERATION AND MAINTENANCE DATA

A. Refer to General Conditions.

1.7 DELIVERY, STORAGE AND HANDLING

A. Refer to General Conditions.

B. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.8 WARRANTY

A. Refer to General Conditions.

PART 2 - GENERAL

2.1 ACCEPTABLE MANUFACTURERS - WATER HEATERS

A. American Water Heaters

B. Bock

C. Lochinvar

D. P.V.I. Industries

E. Rheem

F. Ruud

G. A.O. Smith

H. State

I. Substitutions: Under provisions of General Conditions.

2.2 HIGH EFFICIENCY COMMERCIAL GAS FIRED WATER HEATER

A. Type: Gas fired sealed combustion condensing commercial storage water heater, minimum 92% thermal efficiency. Design to be Energy Star Certified with 3 year tank warranty and 1 year parts warranty.

B. Tank: Steel glass lined tank rated for 150 psig complete with multiple removable magnesium anode rods or single impressed current anode rod, submerged combustion chamber, 4" tank access hand hole, foam insulation, painted steel jacket, brass drain valve and temperature and pressure relief valve.

C. Burner: Top mounted down fired premix low NOx power burner.

D. Controls: 120 volt, 1 phase, 60 Hz electronic controls, intermittent spark or hot surface ignition, operating thermostat with 110°-180°F adjustable temperature control, energy cutoff with manual reset, blower pressure switch, gas valve and pressure regulator.

E. Vent: 3" or 4" PVC, CPVC or ABS combustion air intake and flue gas outlet with DWV solvent weld fittings.

PART 3 - EXECUTION

3.1 WATER HEATER INSTALLATION

A. Install water heaters in accordance with manufacturer's instructions.

B. Refer to Section 15410, Part 3 for disinfection procedures.

C. Coordinate with plumbing piping and related fuel piping & electrical work to achieve operating system.

D. Place units on concrete housekeeping pads, orient so controls and devices needing service and maintenance have adequate access.

E. Extend relief valve discharge line to floor drain or as shown on drawings.

END OF SECTION

SECTION 15505
FUEL GAS PIPING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Pipe and pipe fittings.

B. Valves and gas cocks.

C. Natural gas piping system.

1.2 REFERENCES

A. ANSI/A21.52 - Ductile-Iron Pipe, Centrifugally Cast, in Metal Molds or Sand-Lined Molds for Gas.

B. ANSI/ASME B16.3 - Malleable Iron Threaded Fittings Class 150 NS 300.

C. ANSI/ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings - DWV.

D. ANSI/ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.

E. ANSI/ASME Sec. 9 - Welding and Brazing Qualifications.

F. ANSI/ASTM B32 - Solder Metal.

G. ANSI/AWS D1.1 - Structural Welding Code.

H. ANSI/AWWA C105 - Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquids.

I. ANSI/AWWA C110 - Ductile - Iron and Gray - Iron Fittings 3 in. through 48 in., for Water and Other Liquids.

J. ANSI/AWWA C111 - Rubber-Gasket Joints for Ductile Iron and Gray-Iron Pressure Pipe and Fittings.

K. ANSI/AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.

L. ANSI Z21.69 - Connectors for Movable Gas Appliances.

M. ASME - Boiler and Pressure Vessel Code.

N. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.

O. ASTM A234 - Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.

P. ASTM A377-79 - Gray Iron and Ductile Iron Pressure Pipe.

Q. ASTM B88 - Seamless Copper Water Tube.

R. ASTM D1785 - Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80 and 120.

S. ASTM D2241 - Poly (Vinyl Chloride) (PVC) Plastic Pipe (SDR-PR).

T. ASTM D2513 - Thermoplastic Gas Pressure Pipe, Tubing and Fittings.

U. ASTM D2466 - Poly (Vinyl Chloride) (PVC) Plastic Piping Fittings. Schedule 40.

V. ASTM D2517 - Reinforced Epoxy Resin Gas Pressure Pipe and Fittings.

W. ASTM D2683 - Socket-Type Polyethylene Fillings for Outside Diameter-Controlled Polyethylene Pipe.

X. ASTM D2855 - Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.

Y. AGA - American Gas Association Laboratories.

Z. EPA - Environmental Protection Agency.

AA. AWS A5.8 - Brazing Filler Metal.

BB. UL - Underwriters Laboratories.

1.3 QUALITY ASSURANCE

A. Refer to Division 1 and Section 15010.

B. Comply with product data under provisions of Section 15010.

C. Pipe: Each length of pipe shall be legibly identified at mill by paint, stenciling or raised symbols identifying manufacturer and class type or schedule of pipe.

D. Fittings: To be identified by the manufacturer by permanently attached tags, imprints or other approved means, indicating the class of wall thickness and material.

E. Valves and Gas Cocks: Manufacturer's name and pressure rating marked on valve body.

1.4 SUBMITTALS

A. Refer to Division 1 and Section 15010.

B. Submit product data under provisions of Section 15010.

1.5 DELIVERY, STORAGE AND HANDLING

A. Refer to Division 1 and Section 15010.

B. Deliver products to site under provisions of Section 15010.

C. Store and protect products under provisions of Section 15010.

D. Deliver and store valves in shipping containers with labeling in place.

PART 2 - PRODUCTS

2.1 NATURAL GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53, Schedule 40 black. Fittings: ANSI/ASME B16.3, malleable iron, or ASTM A234, forged steel welding type. Joints: Screwed for pipe 2" and under; ANSI/AWS D1.1, welded, for pipe over 2".

B. Flexible Gas Hose Connectors: UL listed stainless steel hose and braided cover with carbon steel fittings. Up to 2½" pipe size provide male threaded ends.

2.2 FLANGES, UNIONS AND COUPLINGS

A. Pipe Size 2" and Under: ANSI/ASME B16.3 150 psig malleable iron unions for threaded ferrous piping; ANSI/ASME B16.15 bronze unions for copper pipe, soldered joints.

B. Pipe Size Over 2": ANSI/ASME B16.5 150 psig forged steel slip-on flanges for ferrous piping; ANSI/ASME B16.24 bronze flanges for copper piping; neoprene gaskets for gas service; 1/16" thick preformed neoprene.

C. Flanges to match those on valves and equipment.

D. Flange Bolts: ASTM A-193.

E. Dielectric Connections:

1. Flanged or union type: Gaskets to conform to manufacturer's recommendations for the intended service, rated at minimum temperature of 200F (or higher as dictated by service) for continuous duty.
2. Union type: Galvanized or plated steel-threaded end; copper -- solder end; water impervious isolation barrier.
3. Fittings provided shall meet ANSI B16.8 and be capable of isolating stray electrical currents up to 600 volts minimum.
4. Acceptable Manufacturers: B&K Industries, Inc., Eclipse, Inc., EPCO Sales Inc., Capital Manufacturing Company; Division of Harsco Corporation, Watts Regulator Company.

2.3 ACCEPTABLE MANUFACTURERS - SQUARE HEAD GAS COCKS (UP TO 2")

A. Crane

B. McDonald

C. Walworth

D. Substitutions: Under provisions of Division 1 and Section 15010.

2.4 SQUARE HEAD GAS COCKS (UP TO 2")

A. 125 psi bronze body, square head with check, bronze plug, non-lubricated, threaded ends, with one wrench operator for every ten plug cocks. Fig. 254 manufactured by Crane.

PART 3 - EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Field test all piping before start-up of equipment.

3.2 INSTALLATION

A. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

B. Route piping in orderly manner, plumb and parallel to building and maintain gradient.

C. Install piping to conserve building space and not interfere with use of space and other work.

D. Group piping whenever practical at common elevations. Space piping to permit paint and servicing of valves and cocks.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 15121.

F. Provide clearance for access to valves and fittings.

G. Provide sleeves when penetrating floors and walls. Refer to Section 15140.

H. Seal pipe and sleeve penetration to achieve fire resistance equivalent to fire separation required. Refer to Section 15140.

I. Where pipe support members are welded to structural building framing, scrape, brush clean and apply one coat of zinc rich primer to welding.

J. Install valves or cocks with stems upright or horizontal, not inverted.

K. Install all gas piping in compliance with all local codes and local gas utility company.

3.3 APPLICATION

A. Install unions downstream of valves and cocks.

B. Install minimum shutoff cock 6" long dirt leg and union at gas fired equipment or apparatus connection.

C. Install cocks for shutoff and to isolate equipment, part of systems, or vertical risers.

3.4 FIELD TESTS

A. Furnish all labor material, instruments, supplies and services and bear all costs for the accomplishment of tests herein specified. Correct all defects appearing under test and repeat the tests until no defects are disclosed; leave the equipment clean and ready for use.

B. Tests of piping systems shall be conducted before connections to equipment are made and before piping is covered, buried or otherwise concealed.

C. Perform all tests other than herein specified which may be required by legal authorities or by agencies to whose requirements this work is to conform.

D. Furnish all necessary testing apparatus, make all temporary connections and perform all testing operations required, at no additional cost to the Owner.

E. No work shall be painted, backfilled or concealed until authorized by Owner's representatives.

F. Inform Owner's representative 48 hours prior to when work is ready for test.

G. Systems found to have leaks shall be subjected to further tests when faulty joints have been repaired or replaced.

H. Fuel gas piping shall be pneumatically tested with air or inert gas for minimum of 24 hours at 50 psig.

I. Test pressures shall be increased if necessary to comply with applicable codes.

3.5 SERVICE CONNECTIONS

A. Reuse existing gas service downstream of existing gas meter. Gas service distribution piping to have initial minimum pressure of 7" w.g. at the meter. Provide regulators on each line serving gravity type appliances, sized in accordance with equipment.

END OF SECTION

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SECTION 15781
PACKAGED ROOF TOP AIR CONDITIONING UNITS

1. PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Packaged roof top unit.

B. Unit controls.

C. Remote panel.

D. Roof mounting frame and base.

E. Maintenance service.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Section 16180 - Equipment Wiring Systems: Installation and wiring of thermostats and other controls components.

1.3 RELATED SECTIONS

A. Section 15010 - Basic Mechanical Requirements.

B. Section 15140 - Supports, Anchors and Sleeves.

C. Section 15170 - Motors: Evaporator and condenser fan motors.

D. Section 15242 - Vibration Isolation.

E. Section 15250 - Thermal Insulation.

F. Section 15985 - Sequence of Operation.

G. Division 16 - Electrical for supply to units, exterior power disconnect, wiring of thermostats and other control components.

1.4 REFERENCES

A. ANSI/NFPA 90A - Installation of Air Conditioning and Ventilation Systems.

B. AHRI 210 - Unitary Air-Conditioning Equipment.

C. ANSI/AHRI Standard 270 - Sound Rating of Outdoor Unitary Equipment.

D. ANSI/AHRI Standard 340/360, Performance Rating of Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment.

1.5 QUALITY ASSURANCE

A. Unit meets ASHRAE 90.1--2004 minimum efficiency requirements.

B. Units shall be Energy Star certified.

C. Unit shall be rated in accordance with AHRI Standards 210 and 360.

D. Unit shall be designed to conform to ASHRAE 15, latest edition.

1.6 SUBMITTALS

A. Refer to Division 1 and Section 15010.

B. Submit product data under provisions of Division 1 and Section 15010.

C. Submit product data for manufactured products and assemblies required for this project.

D. Indicate electrical service and duct connections on product data.

E. Submit manufacturer's installation instructions under provisions of Division 1 and Section 15010.

1.7 OPERATION AND MAINTENANCE DATA

A. Refer to Division 1 and Section 15010.

B. Submit operation and maintenance data under provisions of Division 1 and Section 15010.

C. Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data and parts listing.

1.8 DELIVERY, STORAGE AND HANDLING

A. Refer to Division 1 and Section 15010.

B. Deliver products to site under provisions of Division 1 and Section 15010.

C. Store and protect products under provisions of Division 1 and Section 15010.

D. Protect units from physical damage by storing off site until roof mounting frames or curb adapters are in place, ready for immediate installation of units.

1.9 WARRANTY

A. Refer to Section 15010.

B. Warranty: Include coverage of refrigeration compressors and heat exchangers.

1.10 MAINTENANCE SERVICE

A. Furnish complete service and maintenance of packaged roof top units for one year from Date of Substantial Completion.

B. Provide maintenance service with a two month interval as maximum time period between calls. Provide 24-hour emergency service on breakdowns and malfunctions.

C. Include maintenance items as outlined in manufacturer's operating and maintenance data, including minimum of six filter replacements, minimum of one fan belt replacement and controls check-out, adjustments and recalibrations.

D. Submit copy of service call work order or report and include description of work performed.

1.11 EXTRA MATERIALS

A. Provide two sets of filters under provisions of Section 15010.

2. PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Carrier

B. Trane

C. Johnson Controls

D. McQuay

E. Substitutions: Under provisions of Division 1 and Section 15010.

2.2 MANUFACTURED UNITS

A. Provide roof-mounted units having gas burner and electric refrigeration.

B. Unit shall be self-contained, packaged, factory assembled and prewired, consisting of cabinet and frame, supply fan, fan, heat exchanger and burner,

controls, air filters, phase loss protection, refrigerant cooling coil and compressor, condenser coil and condenser fan.

2.3 FABRICATION

A. Cabinet: Galvanized steel with baked enamel finish, access doors or removable access panels with quick fastening locking door handle type. Provide hinged access doors for the filter, evaporator, supply fan, compressor and control sections. Structural members shall be minimum 18 gauge, with access doors or removable panels of minimum 20 gauge.

B. Insulation: 1" thick foil faced glass fiber on surfaces where conditioned air is handled. Protect edges from erosion.

C. Heat Exchangers: Stainless steel, of welded construction.

D. Supply Fan: Forward curved centrifugal type, resiliently mounted with V-belt drive, adjustable variable pitch motor pulley, and rubber isolated hinge mounted motor. Isolate complete fan assembly. Motors shall be of the premium efficient type as specified in section 15170.

E. Air Filters: 2" thick disposable pleated filters. Provide two sets. The media shall be non-woven cotton fabric and shall have a minimum efficiency of 25% (MERV8) with minimum arrestance of 90%.

F. Roof Mounting Frame: 14" high galvanized steel, channel frame with gaskets, nailer strips.

2.4 BURNER

A. Gas Burner: Induced draft type burner with adjustable combustion air supply, pressure regulator, gas valves, manual shut-off, intermittent spark or glow coil ignition, flame sensing device and automatic 100% shut-off pilot. Gas pressure regulator shall be sized for 7" w.c. gas pressure. Provide gas pressure regulator with weatherproof cover and vent to atmosphere.

B. Gas Burner Safety Controls: Energize ignition, limit time for establishment of flame, prevent opening of gas valve until pilot flame is proven, stop gas flow on ignition failure, energize blower motor and, after air flow proven and slight delay, allow gas valve to open. Provide a multi-stage burner.

C. High Limit Control: Temperature sensor with fixed stop at maximum permissible setting; de-energize burner on excessive bonnet temperature and energize burner when temperature drops to lower safe value.

D. Supply Fan Control: Temperature sensor sensing bonnet temperatures and independent of burner controls, or adjustable time delay relays with switch for continuous fan operation.

2.5 EVAPORATOR COIL

A. Provide copper or aluminum tube aluminum fin coil assembly with galvanized drain pan and connection.

B. Provide capillary tubes or thermostatic expansion valves for units of 6 tons capacity and less.

2.6 COMPRESSOR

A. Provide hermetic, scroll type compressor(s), 3600 rev/min maximum, resiliently mounted with positive lubrication, crankcase heater, high and low pressure safety controls, motor overload protection, suction and discharge service valves and gauge ports and filter drier.

B. Five minute timed off circuit shall delay compressor start.

C. Outdoor thermostat shall energize compressor above 57F ambient.

D. Provide single step capacity cooling control by cycling the compressor.

2.7 CONDENSER

A. Provide copper or aluminum tube aluminum fin coil assembly with subcooling rows.

B. Provide direct drive propeller fans, resiliently mounted with fan guard, motor overload protection, wired to operate with compressor.

C. Provide refrigerant pressure switches to cycle condenser fans.

2.8 PHASE LOSS PROTECTION

A. Provide electrical phase protection for all motors and compressors.

B. Protection shall be automatic reset type and shall perform automatic unit shutdown when an electrical phase loss, phase imbalance, or phase reversal is detected.

C. Provide an LED indicator to signify "on" and "fault" statuses.

2.9 SUPPLY/RETURN/RELIEF CASING

A. Dampers: Provide outside, return and relief dampers with damper operator and control package to automatically vary outside air quantity. Outside air damper shall fail to closed position. Relief dampers may be gravity balanced.

B. Gaskets: Provide tight fitting dampers with edge gaskets, maximum leakage 5% at 2" pressure differential.

C. Damper Operator: 24 volt with gear train sealed in oil.

D. Mixed Air Controls: Maintain selected supply air temperature and return dampers to minimum position on call for heating and when ambient air enthalpy exceeds return air enthalpy.

2.10 OPERATING CONTROLS

A. Unit shall come complete with its own BACnet MS/TP compatible microprocessor control package including contactors for compressors, evaporator and condenser fans and modulating control of mixed air dampers for economizer control. Refer to Section 15985, Sequence of Operation.

B. Unit shall have a human interface panel with clear English LCD display and keypad for scheduling, monitoring, setting, editing and controlling unit.

C. Unit shall be complete with self contained low voltage control circuit protected by a resettable circuit breaker on the 24-volt transformer side.

D. Unit shall incorporate a solid-state compressor protector which provides anti-cycle reset capability should any of the following standard safety devices trip and shut off compressor.

1. Compressor over temperature, over current.

2. Loss-of-charge/low-pressure switch.

3. Freeze-protection thermostat, evaporator coil.

4. High pressure switch.

5. Automatic reset motor thermal overload protector.

6. High-temperature limit switches for the heating section.

E. The RTU DDC system shall include output relay contacts for connection to a future DDC Building Management System. These contacts shall open on a failure of the unit's supply fan, or cooling system.

F. Provide manual reset supply and return air smoke detectors that will shut down the unit is smoke is detected.

2.11 REMOTE PANEL

A. A future remote panel is anticipated for network communication with the RTU's.

B. The units shall be capable of future communication with the City's control network. For that purpose, an unused conduit shall be extended between each RTU and the mechanical room for future communication.

2.12 ELECTRICAL

A. Provide disconnect means per electrical Specification 16410 – "SAFETY AND DISCONNECT SWITCHES/ENCLOSED CIRCUIT BREAKERS"

2.13 PERFORMANCE

A. Rated cooling capacity is based on 95F condenser ambient air.

B. Rated heating capacity is based on -10 DB outdoor air temperature.

C. Supply and return air is corrected to 692 feet altitude.

3. PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that roof is ready to receive work and opening dimensions are as indicated on shop drawings.

B. Verify that proper power supply is available.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Mount units on factory built roof mounting frame providing watertight enclosure to protect ductwork and utility services. Install roof mounting frame level.

3.3 MANUFACTURER'S FIELD SERVICES

A. Provide initial start-up and shut-down during first year of operation, including routine servicing and check.

3.4 FIELD INSPECTION AND REPORT

A. Provide report, in accordance with Section 15010, prepared by manufacturer's representative, stating that systems installed and services provided under this Section are in accordance with manufacturer's recommendations and are properly operating.

3.5 SCHEDULE

A. Refer to schedule on drawings.

-- END OF SECTION --

SECTION 15820
ELECTRIC SPACE HEATING UNITS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Electric baseboard convectors.

B. Electric wall heaters.

1.2 SUBMITTALS

A. Submit under provisions of Division 1 and Section 15010.

B. Product Data: Provide dimensions, performance data and color selection chart. Clearly indicate all trim, accessories and options being furnished.

C. Submit manufacturer's installation instructions.

1.3 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division 1 and Section 15010.

B. Operation Data: Include instructions for safe operating procedures.

1.4 COORDINATION

A. Coordinate exact mounting locations of all heaters and thermostats with Owner, Engineer and other services before commencement of work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Berko

B. Chromalox

C. Indeeco

D. Markel

E. Qmark

2.2 ELECTRIC BASEBOARD CONVECTORS

A. Description: Commercial grade electric baseboard heater for wall mounting at floor level with fin tube elements and thermal overload protection with automatic reset.

B. Heating Elements: Nickel chromium heating element wire, embedded in magnesium oxide, and enclosed in a metal sheath. Aluminum fins shall be pressure bonded to the sheath. Elements shall be installed side-by-side to uniformly warm the incoming air. They shall be center anchored and float freely on each end in nylon bushings.

C. Disconnect shall be integral to heater.

D. Electric convectors shall have an integral thermostat.

E. Enclosure: Galvanized steel cabinet with bottom inlet, top outlet with extruded aluminum grille and 18 ga front cover brackets corrosion-resisting primer and baked enamel finish. Color shall be determined during submittal review.

F. Over Temperature Protection: An automatic reset thermal overheat protector shall run the length of the heater turning the unit off in the event an overheating situation should occur. The protector shall automatically reset after the unit has cooled down.

G. Refer to schedules for Input Voltage, Output Wattage and length for each device.

H. Basis of Design: Berko model BKOC.

2.3 ELECTRIC WALL HEATERS

A. Description: Electric wall heaters for recessed mounting with fin tube elements and thermal overload protection with automatic reset.

B. Heating Elements: The heating element shall be of the non-glowing design consisting of a special resistance wire enclosed in a steel sheath to which steel plate fins are copper brazed.

C. Fan and Motor: Fan shall be five-bladed aluminum. Fan motor shall be totally enclosed. Fan control shall be of bi-metallic, snap-action type and shall activate fan after heating element reaches operating temperature. The fan shall continue to operate after the thermostat is satisfied and until the heating element is cool.

D. Thermostat: The tamper-proof thermostat shall be of the bi-metallic snap-action type with enclosed contacts. It shall be completely concealed behind the front cover to become tamper proof. A thermal cutout shall be built into the system to shut off the heater in the event of overheating.

E. Disconnect: A double-pole, single throw disconnect switch shall be mounted on the back box for positive disconnect of power supply. It will be completely concealed behind the front grille panel.

F. Construction: The back box shall be designed for duty as a recessed rough-in box in either masonry or frame installations, and is also used with the surface mounting frame in surface mounting installations. The back box shall be 20-gauge galvanized steel and shall contain knockouts through which power leads are brought.

G. Front Panel: The front panel shall be of the bar grille type and shall be constructed of 16-gauge cold-rolled steel, welded into a uniform grille to direct the warmed air toward the floor. The front grille shall be surrounded by a decorative satin-finish aluminum "picture" frame.

H. Refer to schedules for Input Voltage, Output Wattage for each device.

I. Basis of Design: Berko model FRC.

PART 3 - EXECUTION (BY ELECTRICAL CONTRACTOR)

3.1 EXAMINATION

A. Verify that field conditions are acceptable and ready to receive Work.

B. Verify that required utilities are available, in proper location and ready for use.

3.2 3.2. INSTALLATION

A. Provide all conduit, wiring, outlets, fittings, etc., required for a complete operating installation of heating equipment specified herein and shown on the Drawings.

B. Install in accordance with manufacturer's instructions.

C. Locate each unit in position indicated.

D. Install unit with sufficient clearance from adjacent construction, piping, ductwork and other obstructions to allow access for service and maintenance.

3.3 FIELD QUALITY CONTROL

A. Verify operation of each electric heating unit by measuring input voltage and current simultaneously after period of ten minutes of continuous operation.

3.4 DEMONSTRATION

A. Demonstrate location of circuit breakers and switches serving electric heating branch circuits and location and setting procedures for thermostats and other heating controls.

END OF SECTION

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SECTION 15860
CENTRIFUGAL FANS

1. PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Centrifugal fans.

B. Motors and drives.

C. Accessories.

1.2 RELATED SECTIONS

A. Section 15010 - Basic Mechanical Requirements.

B. Section 15140 - Supports, Anchors and Sleeves.

C. Section 15170 - Motors.

D. Section 15242 - Vibration Isolation.

E. Section 15290 - Ductwork Insulation.

F. Section 15781 - Packaged Rooftop Air Conditioning Units.

G. Section 16010 - Basic Electrical Requirements.

1.3 REFERENCES

A. AMCA 99 - Standards Handbook.

B. AMCA 210 - Laboratory Methods of Testing Fans for Rating Purposes.

C. AMCA 300 - Test Code for Sound Rating Air Moving Devices.

D. AMCA 301 - Method of Calculating Fan Sound Ratings from Laboratory Test Data.

E. ANSI/AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.

F. ANSI/AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings.

G. SMACNA - HVAC Duct Construction Standard, Metal and Flexible.

1.4 QUALITY ASSURANCE

A. Refer to General Conditions, Division 1 and Section 15010.

B. Comply with product data under provisions of Section 15010.

C. Performance Ratings: Conform to AMCA 210.

D. Sound Ratings: AMCA 301, tested to AMCA 300.

E. Fabrication: Conform to AMCA 99.

1.5 SUBMITTALS

A. Refer to General Conditions, Division 1 and Section 15010.

B. Submit shop drawings and product data under provisions of Section 01300.

C. Provide product data on centrifugal fans and accessories as required for the work.

D. Provide fan curves with specified operating point clearly plotted.

E. Submit sound power levels for both fan inlet and outlet at rated capacity.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data under provisions of Section 15010.

B. Include instructions for lubrication, motor and drive replacement, spare parts list and wiring diagrams.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and protect products under provisions of General Conditions, Division 1 and Section 15010.

B. Protect motors, shafts and bearings from weather and construction dust.

2. PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Greenheck

B. Carnes

C. Cook

D. Trane

E. Twin City Fan

F. Substitutions: Under provisions of General Conditions and Division 1.

2.2 GENERAL

A. Downblast fan with aluminum housing, non-overloading type centrifugal wheel, inlet cone, factory mounted and wired motor and disconnect switch, and bird screen.

B. Fan manufacturer will provide disconnect switches and thermal overload protection for fans specified herein.

C. Fans used shall not decrease motor size, increase noise level, or increase tip speed by more than 10%, or increase inlet air velocity by more than 20%, from specified criteria. Fans shall be capable of accommodating static pressure variations of ±10%.

D. Each fan shall bear a permanently affixed manufacturer's engraved metal nameplate containing the model number and individual serial number.

E. Statically and dynamically balance fans to eliminate vibration or noise transmission to occupied areas.

F. Model and manufacturer as scheduled on drawings.

2.3 WHEEL AND INLET

A. Backward curved: Aluminum construction with inlet flange, backplate, shallow blades with inlet and tip curved backward in direction of air flow, mechanically secured to flange and backplate; steel hub swaged to backplate and keyed to shaft with set screw.

2.4 HOUSING

A. Heavy gauge spun aluminum, adequately braced, designed to minimize turbulence with spun inlet bell and shaped cut-off.

B. Provide housing with a hinged bell for inspection of drive and fan wheel.

2.5 MOTORS AND DRIVES

A. Motors: As indicated, in compliance with Section 15170.

B. Bearings: Bearings to be grease lubricated, self-aligning ball bearing type with grease seal and external grease fitting. Bearings shall be selected for a minimum life (L-10) of 100,000 hours at maximum speed and horsepower per fan class.

C. Shafts: Hot rolled steel, ground and polished, with key-way, protectively coated with lubricating oil.

D. V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, keyed. Variable and adjustable pitch sheaves for motors 15 hp and under, selected so required rpm is obtained with sheaves set at mid-position. Fixed sheave for 20 hp and over, matched belts and drive rated as recommended by manufacturer or minimum 1.5 times nameplate rating of the motor.

E. Disconnect switch: Provide NEMA-1 electrical shutoff disconnect wired from the fan motor to a junction box within the motor compartment.

F. Roof Mounting Frame: 14" high galvanized steel, channel frame with gaskets and nailer strips.

3. PART 3 - EXECUTION

3.1 INSTALLATION

A. Do not operate fans for any purpose until ductwork is clean, filters are in place, bearings lubricated and fan has been test run under observation.

B. Install flexible connections specified in Section 15910 between fan inlet and distribution ductwork. Ensure metal bands of connectors are parallel with minimum 1" flex between ductwork and fan while running.

C. Provide fixed sheaves required for final air balance.

D. Provide safety screen where inlet or outlet is exposed.

E. Provide backdraft damper on inlet of exhaust fans and as indicated. Provide access door for inspection of backdraft damper.

3.2 FIELD INSPECTION AND REPORT

A. Provide report, in accordance with Section 15010, prepared by manufacturer's representative, stating that systems installed and services provided under this Section are in accordance with manufacturer=s recommendations and are properly operating.

3.3 FAN SCHEDULE

A. Refer to schedule on drawings.

-- END OF SECTION --

SECTION 15890
METAL AND FLEXIBLE DUCT

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Duct and duct-associated materials and procedure in this section include:

1. Sheet metal materials
2. Single-wall rectangular ducts and fittings
3. Single-wall round ducts and fittings
4. Flexible ducts
5. Sealants and gaskets
6. Hangers and supports

B. Products/material specified under other Divisions but installed under this section:

1. Duct-mounted smoke detectors

1.2 DEFINITIONS

A. Duct Size: Duct sizes indicated herein or on associated drawings shall be the inside clear dimensions of actual air path for both unlined and lined ducts.

B. Pressure Class: A "SMACNA - HVAC Duct Construction Standards, Metal and Flexible" pressure classification system designating static pressure values (in inches w.g.) equal to the maximum operating pressure to which the ductwork can safely be subjected.

1.3 CODES AND STANDARDS

A. ASTM A 36/A 36M-97a: Specification for Carbon Structural Steel

B. ASTM A 366/A 366M-97: Specification for Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality

C. ASTM A 480/A 480M-98a: Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip

D. ASTM A 653/A 653M-99a: Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

E. ASTM B 209-96: Specification for Aluminum and Aluminum-Alloy Sheet and Plate

F. ASTM C 411-97: Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation

G. ASTM C 534-94: Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form

H. ASTM C 916-85 (Reapproved 1996): Specification for Adhesives for Duct Thermal Insulation

I. ASTM C 920-98: Specification for Elastomeric Joint Sealants

J. ASTM C 1071-98: Specification for Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material)

K. ASTM E 84-00a: Test Method for Surface Burning Characteristics of Building Materials

L. NFPA 90A-99: Installation of Air Conditioning and Ventilating Systems (ANSI)

M. NFPA 90B-99: Installation of Warm Air Heating and Air Conditioning Systems (ANSI)

N. NFPA 96-98: Ventilation Control and Fire Protection of Commercial Cooking Operations (ANSI)

O. NAIMA AH124-98: Fibrous Glass Duct Liner Standard

P. SMACNA: Duct Cleanliness for New Construction, 2000

Q. SMACNA: HVAC Air Duct Leakage Test Manual, 1985

R. SMACNA: HVAC Duct Construction Standards-Metal and Flexible, 1995 (excluding all amendments and proposed revisions).

S. UL 181-96 (Rev. 98): Factory-Made Air Ducts and Air Connectors

T. UL 723-96 (Rev. 98): Test for Surface Burning Characteristics of Building Materials

1.4 QUALITY ASSURANCE

A. Construct ductwork to NFPA 90A standards.

B. Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall, at a minimum, comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," excluding all amendments and proposed revisions, and performance requirements and design criteria indicated.

1. All further references to conformance with the requirements of SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" shall always mean with the exclusion of all amendments and proposed revisions.
2. Where the requirements of this specification exceed the requirements of the SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," the specifications shall govern.

C. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.

D. Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1.5 SUBMITTALS

A. Product Data: Submit for each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets: submit manufacturer's data sheets including performance data, pressure ratings, surface burning characteristic and installation instruction.

B. Duct Testing Submittals and Reports:

1. Submit duct pressure testing plan with duct shop drawings, including list of ducts to be tested and duct testing schedule.
2. Submit documentation of duct performance testing and submit performance testing result reports within two weeks of testing.

3. Contractor shall be responsible for any corrective action required due to a failed duct leakage test.

C. Manufacturer's Installation Instruction: Submit manufacturer's installation instructions for all manufactured ductwork.

D. Field record drawings:

1. During the construction process, the Contractor shall maintain a set of drawings showing the exact routing and location of duct systems being installed. The drawings shall be updated neatly by hand on a daily basis and account for routing modifications made in the field. Contractor shall use these drawings as a basis for generating the project as-built drawings.

E. As-built drawings:

1. Upon completion of project, Contractor shall furnish as-built drawings showing in scale the exact routing and locations of all newly installed ductwork systems. Submit in both hard-copy and electronic AutoCAD format.

1.6 DELIVERY, STORAGE AND HANDLING

A. Protect new duct interiors from moisture, construction debris and dust, and other foreign materials. If inside of new duct becomes dirty, Contractor shall clean duct per Duct Cleaning specifications.

B. Comply with SMACNA's "Duct Cleanliness for New Construction Guidelines."

1.7 WARRANTY

A. One year warranty on products and complete installation commencing at the time of Substantial Completion.

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

1. Galvanized Sheet Steel: Comply with ASTM A 653. Lock forming quality with G-90 galvanized coating designation (not less than 1.25 oz. of zinc on each side of each square foot of sheet).
2. Paint Grip Steel; mill-phosphatized "Paintgrip" or "Zincgrip" finish suitable for field painting.
3. Minimum ducts gauges shall be in accordance with the following table. This table shall be used in conjunction with SMACNA table for application of appropriate reinforcement in accordance with proper pressure class.

(1) Galvanized steel - rectangular duct:

Maximum Duct Dimension (in.)	Minimum Duct Gauge	Comments
Up to 10	26	pressure class 2" w.g.
Up to 10	24	pressure class greater than 2" w.g.
12 through 29	24	
30 through 53	22	

(2) Galvanized steel - round duct:

Maximum Duct Dimension (in.)	Minimum Duct Gauge	
Up to 10	26	pressure class 2" w.g.
Up to 10	24	pressure class greater than 2" w.g.
11 thru 17	24	

2.2 SINGLE WALL RECTANGULAR DUCTS AND FITTINGS (SHOP AND FACTORY FABRICATED)

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

1. Lindab Inc.
2. McGill AirFlow LLC.
3. SEMCO Incorporated.
4. Shop fabricated duct is acceptable for ducts with a pressures class rating of 6" w.g. or less provided compliance with the requirements herein are met.

B. General Fabrication Requirements:

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
2. Comply with SMACNA's "Industrial Duct Construction Standards" where indicated.

C. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" except as otherwise noted.

1. No duct shall be constructed to less than 2" w.g.

D. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," except at otherwise noted:

1. Button Punch Snap Lock is not acceptable.

E. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 2, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," except as otherwise noted.

2.3 SINGLE-WALL ROUND DUCTS AND FITTINGS (FACTORY AND SHOP-FABRICATED)

A. Acceptable Manufacturers:

1. Lindab Inc.
2. McGill AirFlow LLC.
3. SEMCO Incorporated.
4. Shop fabricated ducts are acceptable for all positive pressure ducts and negative pressure ducts with ratings of -1" w.g. to -4" w.g.

B. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. All round ducts must utilize spiral lock seam except:

a. Ducts up to and including 12" diameter with a positive pressure class of 2" w.g. and less may utilize longitudinal lock seam construction.

C. SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," for static-pressure class, applicable sealing requirements, and materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse joints in ducts larger than 60" in diameter shall be flanged.

D. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Seams - Round Duct and Fittings," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricate round ducts larger than 48" in diameter with butt-welded longitudinal seams.

E. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.4 FLEXIBLE DUCTS

A. Acceptable Manufacturers:

1. Buckley Associates, Inc.
2. Flexmaster USA
3. McGill AirFlow LLC.
4. Thermaflex

B. Quality Assurance:

1. Factory fabricated UL listed under UL-181 as Class 1 duct, meeting requirements of NFPA 90A with a flame spread rating of 25 or less and smoke development rating of 50 or less, unless otherwise noted.
2. Only factory-insulated flexible duct is acceptable. No field-insulated flexible duct is allowed.

C. Flexible Duct Connectors:

1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a quick-release worm-gear action, to suit duct size. Nylon or other non-metallic draw bands are not acceptable.

2.5 SEALANT AND GASKETS

A. Acceptable Manufactures for Duct Sealant:

1. Hardcast
2. United McGill
3. Ductmate

B. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

C. Duct Sealant:

1. Water-based non hardening, water resistant, mold and mildew resistant sealant classified compounded specifically for sealing joints and seams in ductwork.
   a. Maximum Static-Pressure Class: 10" w.g., positive and negative.
   b. Service: Indoor or outdoor.
   c. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets for specific applications.
2. Duct tapes are not allowed.

D. Flanged Joint Sealant: Comply with ASTM C 920. General: Single-component, acid-curing, silicone, electrometric. Type S, Grade NS, Class 25, Use O.

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

1. Gaskets used in chemical, laboratory, or process exhaust duct systems shall be suitable for exposure to substances in the air stream. Contractor shall verify the compatibility with Engineer prior to installation.

2.6 HANGERS AND SUPPORTS

A. Hanger Rods for Dry or Non-corrosive Environments: Cadmium-plated steel rods and nuts.

B. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

C. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

D. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

E. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.1 APPLICATION

A. Install duct with duct material for pressure class as per the following table:

Duct System and Location	Material	Pressure Class
Constant volume supply: all duct	Galvanized steel (G90)	+3"
Exhaust system with no air terminal units: all duct	Galvanized steel (G90)	-2"
Air relief and transfer	Galvanized steel (G90)	+2"

3.2 INSTALLATION

A. General

1. Drawing plans; schematics, and diagrams indicate general location and arrangement of duct system. Where interferences develop in field, offset or reroute ductwork as required for clearing such interference.
2. Contactor shall modify specified duct sizes as required to fit. Modified duct size shall have cross-sectional area and pressure drop equivalent to that of the specified duct size.
3. All ducts shall be airtight and free from pulsation and vibration at normal operating conditions.
4. Contractor shall submit sheet metal shop drawings to the Test and Balance Contractor for review, and provide any additional volume dampers that the Test and Balancing Contractor needs to perform final balancing.
5. Install round ducts in maximum practical lengths.
6. Install ducts with fewest possible joints.
7. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
8. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
9. Install ducts with a minimum clearance of 1", plus allowance for insulation thickness.
10. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
11. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

12. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1½".
13. Where ducts pass through fire and smoke rated interior partitions and exterior walls, install fire, smoke, and/or combination fire/smoke dampers. Contractor shall obtain a copy of architectural drawings showing the fire and smoke rated partitions and exterior walls at the time of bid and provide the appropriate damper (at all ducts penetrating fire and smoke rated partitions and walls whether shown on mechanical plans or not). Comply with requirements in Division 15 Section "Duct Accessories" for fire and smoke dampers.
14. Provide openings in ducts where required to accommodate thermometers and controllers. Provide pitot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ducts, install insulation material inside a metal ring.
15. Install duct-mounted smoke detectors.
16. Where ducts of different metals meet, joint shall use a gasket, seal or compound to prevent the two different metals from coming in contact.
17. Galvanized surfaces altered or damaged (including the damage due to welding) shall be painted with a galvanized paint.
18. All exposed and uninsulated ductwork shall be painted. For paint grip steel ducts, place identification stickers in side ducts off of the surface to be painted.
19. Gaskets shall not protrude into airstream.
20. Elbows:
    a. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Elbows."
        (1) For supply duct:
            (a) Use Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
            (b) If space does not allow the use of a Radius Type RE1, provide a square-throated elbow with turning vanes. Turning vanes shall comply with the requirements of Division 15 Section "Duct Accessories".
        (2) For return and exhaust duct:
            (a) Use Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
            (b) If space does not allow the use of a Radius Type RE1, provide a square throated elbow with vanes. Turning vanes shall comply with the requirements of Division15 Section "Duct Accessories."

b. Round Duct, excluding laboratory (fume handling) exhaust duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-3, "Round Duct Elbows."

(1) Use minimum 1.5 radius-to-diameter ratio.

(a) 12" and Smaller in Diameter: Stamped (pleated not acceptable)

(b) 14" and Larger in Diameter: Standing seam or welded five-piece 90 degree turning elbows (three-piece elbows not acceptable for 90 degree elbow).

(c) 45 degree elbows shall meet the requirements for 90 degree elbows and shall be die stamped up to 12" and three piece construction of sized greater than 12".

21. Branch Configurations:

a. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-6, "Branch Connections."

(1) Rectangular main to rectangular branch: 45-degree entry.

(2) Rectangular main to round branch: Bellmouth connection; spin in connections are allowed only on supply duct downstream of air terminal units and return ducts upstream of air terminal units.

(3) No straight tap, butt flange or cinch lock is allowed

b. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees."

(1) Provide 45-degree lateral tap; conical taps are allowed only on supply duct downstream of air terminal units and return ducts upstream of air terminal units.

(2) Saddle taps are permitted only for new connection in existing duct.

(3) No 90 degree taps are allowed.

22. Offsets and transitions: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-7, "Offsets and Transitions."

a. Transitions:

(1) Increase duct sizes gradually, not exceeding 15 degrees on each side for a concentric transition or 30 degrees on one each side for an eccentric transition.

(2) Decrease duct sized not exceeding 22.5 degrees on each side for a concentric transition or 45 degrees on one side for an eccentric transition.

b. Offsets:

(1) Provide smooth radius offset with the radius equal to the duct dimension.

(2) Mitered offset Type 2 is acceptable provided the offset angle no greater that 15 degrees.

23. Easements for obstructions:

a. Provide easements where ductwork conflicts with piping and structure.

b. Where easements exceed 10% duct area, split into two ducts maintaining original duct area.

24. Seam and joint sealing:

a. For all new ducts, all transverse joints, longitudinal seams and connections shall be sealed in conformance with SMACNA Class A sealing requirements as defined in the 1995 SMACNA HVAC Duct Construction Standards - Metal and Flexible, Second Edition.

25. Hangers and supports: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."

a. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

(1) Where practical, install concrete inserts before pouring concrete.

b. Support ducts using traverse steel and threaded rods or 1" wide straps of 16 gauge galvanized steel. Wire or perforated straps of any kind are not acceptable.

c. No hangers and supports shall be attached to ducts with sheet metal screws that penetrate any part of ducts.

d. Round duct shall be suspended on prefabricated circular single loop or two-piece bands completely encircling ducts.

e. Hanger Spacing: Except where requirements herein exceed, comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct,"

(1) Provide duct supports at a maximum of 6 foot intervals, within 24" of each elbow, and within 24" of each branch intersection.

(2) Provide vertical ducts supports at a maximum of 10 foot intervals.

f. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

26. Flexible Duct:

a. Aluminum Laminate or Acoustic CPE Flexible Duct (Insulated or Noninsulated):

(1) Connect diffusers to low pressure ducts with a maximum of five feet of flexible duct.

(2) Each connection shall be a single piece of flexible duct. No splicing is allowed.

(3) Support flexible duct at a maximum of 2 feet on center, with no portion lying on suspended ceiling system or other horizontal surface.

(4) Flexible ducts shall not pass through any partition, wall, floor or ceiling.

(5) Connect fabric type flexible ducts to diffuser collars or duct with stainless steel draw bands with quick release. Position draw bands behind collar beads if applicable. Connection shall be airtight; seal if required for airtight connection.

b. Corrugated Metal Flexible Duct Installation:

(1) Do not use Corrugated Metal Flexible Duct to change direction.

(2) Connect Corrugated Metal Flexible Duct with sealant and clamps; connection shall be airtight.

c. For all insulated flexible ducts, pull back insulation and connect internal duct to collar with stainless steel draw band. Then pull insulation and vapor barrier jacket over liner connection and secure with a second draw band. Tape insulation end with three wraps of compatible vapor barrier tape to seal insulation.

d. For termination of flexible duct at externally insulated duct, secure flexible duct jacket to duct insulation with three wraps of compatible vapor barrier tape.

-- END OF SECTION --

SECTION 15910
DUCTWORK ACCESSORIES

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Accessories addressed in this section include:

1. Manual volume dampers
2. Duct access doors
3. Flexible connectors
4. Duct access doors

1.2 DEFINITIONS

Not Applicable

1.3 CODES AND STANDARDS

A. AMCA 500 - Test Methods for Louvers, Dampers and Shutters.

B. AMCA 511 - Certified Ratings Program for Air Control Devices.

C. NFPA 90A - Installation of Air Conditioning and Ventilating Systems, 2002

D. SMACNA - HVAC Duct Construction Standards-Metal and Flexible, 1995

1.4 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."

B. Ductwork specialties shall be designed and manufactured to conform to the same pressure class as the duct in which they are located, unless otherwise indicated to exceed.

1.5 SUBMITTALS

A. Product Data: Provide manufacturer's literature and illustrations for all components indicating materials, construction, quantities, size, dimensions and configuration.

B. Submit a request for substitution if not providing the listed Acceptable Manufacturers for any given product.

C. Shop Drawings: Provide details of equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection for all products.

D. Submit operation and maintenance data under provisions of Section 15010.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver products to site under provisions of Section 01600.

B. Deliver products to site in containers with manufacturer's and UL stamp affixed.

C. Protect products against dirt, water, chemical and mechanical damage before, during and after installation. Damage to products prior to final acceptance of the Work shall be repaired or replaced at no additional cost to the City.

1.7 WARRANTY

A. Provide one year warranty.

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards – Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, except where otherwise indicated to exceed the requirements of the Standard.

B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G90 coating designation. For uninsulated ducts with surfaces exposed to view, provide paint grip steel; mill-phosphatized "Paintgrip" or "Zincgrip" finish suitable for field painting.

C. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

D. Tie Rods: Galvanized steel, ¼" minimum diameter for tie rod lengths of 36" or less; 3/8" minimum diameter for tie rod lengths longer than 36".

2.2 MANUAL VOLUME DAMPERS

A. Acceptable Manufacturers:

1. Air Balance, Inc.
2. Nailor Industries, Inc.
3. Ruskin Company
4. Vent Products Company, Inc.

B. Quality Assurance:

1. Include leakage, pressure drop, and maximum pressure data with submittals.
2. Damper pressure drop ratings shall be based on tests and procedures performed in accordance with AMCA500.
3. Field or shop fabricated manual volume dampers are not acceptable.

C. Standard Manual Volume Damper:

1. Factory fabricated, rectangular or round damper with required hardware and accessories. Single-blade or multiple-opposed-blade design, with linkage outside airstream, and suitable for horizontal or vertical applications.

2. Performance data:

   a. Capacity: Demonstrate damper capacity to withstand HVAC system operating conditions.

      (1) Closed position: Maximum pressure of 3" w.g.
      (2) Open position: Maximum air velocity of 1,500 fpm.

   b. Pressure drop:

      (1) Rectangular dampers: Maximum 0.10" w.g. at 1,500 fpm across a 24" x 24" damper.
      (2) Round dampers: Maximum 0.02" w.g. at 1,500 fpm across a 20" diameter round damper.

3. Rectangular Damper Construction:

   a. Frame: Hat-shaped, galvanized sheet steel channels, minimum 16 gauge (0.064" thick), with mitered and welded corners; frames with flanges where required for attaching to walls and flangeless frames for installing in ducts.
   b. Blades: Minimum 16 gauge (0.064" thick), galvanized steel. For ducts 10" in height and less, single blade dampers are acceptable. For ducts over 10" in height, provide multiple blades of 8" maximum width.
   c. Basis of Design: Ruskin Company Model: MD35.

4. Round Damper Construction:

   a. Frame: Minimum 0.036" thick galvanized steel with flanges where indicated for attaching to walls.
   b. Blades: Minimum 20 gauge (0.040" thick) galvanized steel, maximum 16" diameter.
   c. Basis of Design: Ruskin Company Model MDRS25.

D. Jackshaft: 1" diameter, galvanized-steel pipe rotating within 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 in multiple-damper assembly.

E. Damper Hardware:

   1. Hand-Operated Damper Regulator:

      a. For all manual dampers provide a locking type hand quadrant operator with lever handle, position indicator and lock nut for all dampers.
      b. Provide a minimum of a 2" hand-quadrant stand-off elevated platform where damper is located in insulated ducts.

2.3 TURNING VANES

A. Acceptable Manufacturers:

1. Aero/Dyne Industries
2. Ductmate Industries, Inc.
3. Carlisle Harcast, Inc

B. Quality Assurance:

1. Comply with SMACNA's "HVAC Duct Construction Standards – Metal and Flexible" for vanes and vane runners or provide Aero/Dyne HEP vanes. Vane runners shall automatically align vanes.
2. Vanes shall be factory fabricated on common base rail. Field fabricated vanes are not acceptable.

C. Construction:

1. 2" or 4½" double-vane, curved blades of galvanized sheet steel set ¾" on center; support with bars perpendicular to blades set a maximum of 2" on center; and set into vane runners suitable for duct mounting.
2. Minimum 24 gauge vanes for ducts less than 30" wide.
3. Minimum 22 gauge vanes for ducts 30" wide and greater.

2.4 FLEXIBLE CONNECTORS

A. Acceptable Manufacturers:

1. Duro Dyne Corp.
2. Ventfabrics, Inc.

B. General Description: Flame-retardant or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.

C. Metal-Edged Connectors: Factory fabricated with a fabric strip minimum 4" wide attached to two strips of 2¾" wide, 24 gauge (0.028" thick), galvanized sheet steel or 0.032" thick aluminum sheets. Select metal compatible with ducts.

D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz/sq yd.
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: -40F to +200F.

2.5 DUCT ACCESS DOORS

A. Acceptable Manufacturers:

1. Air Balance, Inc.
2. FlexmasterUSA
3. Greenheck
4. McGill AirFlow Corporation
5. Nailor Industries, Inc.

B. Access Door Construction:

1. General: Fabricate doors airtight and suitable for duct pressure class.
2. Doors shall be rectangular, close-fitting doors of galvanized steel with sealing gaskets, edge protection and quick fastening locking devices suitable for duct pressure class. Access doors with sheet metal screw fasteners are not acceptable.
3. Access doors located in insulated ductwork shall be double wall with insulation fill. Provide a minimum thickness of 1½" insulation fill or thicker insulation as necessary to match the insulation thickness on duct in which the access door is located.
4. Provide number of hinges and locks as follows:

   a. Up to 18" square: Two hinges and two sash locks.

PART 3 - EXECUTION

3.1 APPLICATION AND INSTALLATION

A. General

1. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards – Metal and Flexible" except where otherwise noted to exceed the requirements of this Standard.
2. Provide duct accessories of materials suited to duct materials; use galvanized steel accessories in galvanized-steel, paint grip steel accessories in paint grip steel ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
3. Install accessories in accordance with manufacturer's instructions.

B. Manual Volume Dampers

1. Utilize standard volume dampers for:

   a. supply airflow balancing downstream of terminal units,
   b. return and exhaust airflow balancing applications further than 30 feet from the return or exhaust fan.

2. Provide manual volume dampers for balancing at all points on supply, return and exhaust systems where branch ducts are taken from larger ducts and at duct or flexible take-offs to supply and return diffusers or registers.
3. Install at a minimum of two duct widths from branch takeoff.
4. When installing volume dampers in ducts with liner; avoid damage to and erosion of duct liner.
5. When installing volume dampers in insulated duct, install regulator with elevated platform such that damper is accessible and adjustable without imparting damage to the insulation.
6. Close duct penetrations for damper components to seal duct consistent with pressure class.
7. Provide remote operated volume control dampers regulator(s) for inaccessible volume dampers.

C. Flexible Connectors

1. Install flexible connectors immediately adjacent to equipment in ducts associated with fans and motorized equipment supported by vibration isolators. Installed width shall be not less than 4".
2. For fans developing static pressures of 5" w.g. and higher, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

D. Duct Access Doors

1. Review locations prior to fabrication.
2. Provide duct access doors sufficient for required inspecting, adjusting and maintenance but not less than the dimension shown below (the duct dimension given is that in which the access door is to be located):

   a. For duct dimension up to 12": 8"x8"
   b. For duct dimension 14 " to 21": 12"x12"

E. Instrument Test Holes

1. Provide duct test holes where indicated and required for testing and balancing purposes.
2. Provide only factory fabricated instrument test holes in ductwork with a pressure rating greater than 2" or less than -2".
3. Install visible above insulation.

3.2 TESTING, INSPECTIONS AND ADJUSTING

A. Manual Volume Dampers

1. Operate manual control dampers to verify full range of movement is possible. Correct any situation in which dampers cannot travel their full range of movement.
2. Adjust final positioning of manual-volume dampers as specified in Section 15990, "Testing, Adjusting, and Balancing."
3. Operate remote manual volume damper operators to verify full range of movement of operator and damper.

B. Turning Vanes

1. Inspect turning vanes for proper and secure installation.

C. Duct Access Doors

1. Inspect locations of access doors and verify that purpose of access door can be performed.

-- END OF SECTION --

SECTION 15936
AIR INLETS AND OUTLETS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Products covered in this section include:

1. General use diffusers, registers and grilles

a. Plenum slot diffuser
b. Supply grille or register
c. Return and exhaust grille or register
d. Door transfer air grille
e. Duct-mounted supply register for spiral duct

1.2 DEFINITIONS

A. Diffusers: Elements arranged to deflect air through a large angle and to create local high-ratio mixing; typically located in ceilings.

B. Grilles: Louvered or perforated coverings for openings in air passages, which can be located in sidewalls, ceilings, or floors.

C. Registers: Combination grille and damper assemblies over air openings.

1.3 CODES AND STANDARDS (USE LATEST EDITIONS)

A. Air Movement & Control Association International, Inc. (AMCA)

1. AMCA 511 - Certified Ratings Program for Air Control Devices

B. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

1. SMACNA - HVAC Duct Construction Standards-Metal and Flexible

1.4 QUALITY ASSURANCE

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

B. Louver ratings shall be based on tests and procedures performed in accordance with AMCA 511. Louvers shall be provided with an AMCA Certified Rating Seal for air performance and water penetration.

1.5 SUBMITTALS

A. Product Data: For each type of product provide the following product data:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.

B. For Diffuser Registers and Grilles:

1. Provide a diffuser, register, and grille schedule indicating drawing designation, room location, quantity, model number, size, material and color, accessories furnished.

C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Ceiling suspension assembly members
2. Method of attaching hangers to building structure
3. Size and location of access doors for inaccessible (plaster) ceilings
4. Ceiling-mounted items including but not limited to lighting fixtures, diffusers, registers, grilles, speakers, sprinklers, access panels, smoke detectors, special moldings, duct access panels

PART 2 - PRODUCTS

2.1 GENERAL USE DIFFUSERS, REGISTERS AND GRILLES

A. Acceptable Manufacturers

1. Krueger
2. Nailor Industries, Inc.
3. Price Industries
4. Titus

B. General

1. Diffuser color shall be standard white unless indicated otherwise.
2. Unless otherwise noted diffusers, registers and grilles shall be fabricated of heavy gauge steel except in locations defined below:
   a. Devices used in areas subject to moisture (locker and shower rooms) shall be heavy gauge extruded aluminum.
   b. Devices located in stainless steel duct shall be stainless steel.
3. Contractor to provide type of frame compatible with the ceiling type including but not limited to T-Bar, spline or plaster ceiling.
4. Refer to drawing schedule for opposed blade damper requirements in supply diffusers. If damper is required by the drawing schedule, provide radial opposed blade damper operable from diffuser face.

C. Plenum Slot Diffuser

1. Plenum slot diffusers of lengths, number of slots, inlet opening sizes and widths as noted on the schedule.
2. Fabricated of minimum 24 gauge galvanized steel with 3/4" or 1" slots as shown on drawings.
3. The face of the diffuser shall have a double metal thickness, rigid hemmed edge and minimum 1-1/8" neck for duct connection.
4. Each slot in supply applications shall be provided with two element pattern adjustment as well as air volume control. The pattern controllers in lengths 36" to 60" shall have a center divider with two independently adjustable pattern controllers in each slot. Adjustments shall be accessible from the face of the diffuser.
5. Return models shall have no pattern controllers.
6. Plenums shall be furnished without interior factory insulation.

7. Basis of Design: Model TBD-30 for supply and TBR-30 for return

D. Supply Grille or Register

1. Grilles shall be double deflection of sizes shown on the drawings.
2. The deflection blades shall be parallel to short dimension. Blades shall be spaced 3/4" and shall have friction pivots on both sides. Plastic blade pivots are not acceptable.
3. Registers assembly shall have integral opposed blade damper operable from face with screwdriver.
4. Border shall be 1-1/4" with countersunk screw holes.
5. Basis of Design: Titus Model 300

E. Return and Exhaust Grille or Register

1. Grilles shall have fixed deflection blades with 3/4" spacing and shall be of sizes shown on the drawings. Blades shall be parallel to long direction.
2. Registers assembly shall have integral opposed blade damper operable from face with screwdriver.
3. Border shall be 1-1/4" with countersunk screw holes.
4. Basis of Design: Titus Model 350.

F. Ceiling or Wall Transfer Air Grilles

1. Return registers shall have fixed deflection blades with 3/4" spacing and shall be of sizes shown on the drawings. Blades shall be parallel to long direction.
2. Border shall be 1-1/4" with countersunk screw holes.
3. Basis of Design: Titus Model 350.

G. Ceiling Egg Crate Transfer Grilles:

1. Fixed grilles of ½" x ½" x ½" louvers as manufactured by Titus.
2. Fabricate core of aluminum with factory white finish.

H. Door Transfer Air Grille

1. Inverted V blades with deflection angle of 77 degrees for sight proof design
2. 20 gauge steel frame with 1-1/4" border and countersunk screw holes. Corners shall be welded. Provide frame on both sides to give finished appearance on both sides of door.
3. Factory prime coat finish.
4. Basis of Design: Titus Model T-700 (steel) or CT-700 (aluminum).

I. Duct-Mounted Supply Register for Spiral Duct

1. Registers shall be double deflection, of sizes shown on the drawings, curved to match the specified outside diameter of the ductwork. Supply grilles shall be constructed with radius end caps and foam gaskets for a tight seal to the duct diameter.
2. The deflection blades shall be parallel to long dimension. Blades shall be constructed of heavy duty extruded aluminum and shall be spaced ¾-inch apart. Blades shall extend completely through the side frame on each side to ensure stability throughout the complete cfm operating range of the grille. Blades shall be individually adjustable without loosening or rattling and shall be securely held in place.

3. Registers shall have integral opposed blade damper operable from face with screwdriver.
4. Border shall be 1-3/8" with countersunk screw holes.
5. Basis of Design: Titus Model S300FL

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install items level and plumb.

B. Clean/repair damaged surfaces in accordance with manufacturer's instructions.

C. Additional requirements for all diffusers, registers and grilles:

1. Check location of ceiling mounted diffusers, registers and grilles and make necessary adjustments in position to conform to architectural reflected ceiling plans. Where architectural features or other items conflict with installation, notify Architect/Engineer for a determination of final location.
2. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers. Seal all seams in accordance with ductwork construction requirements.
3. Provide balancing dampers on every duct take-off to each diffusers, register or grille regardless of whether dampers are specified as part of the diffuser, or grille and register assembly.
4. Frames for diffusers, grilles and registers located in plaster walls or ceilings shall be set prior to plastering.
5. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION

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SECTION 15985
SEQUENCE OF OPERATION

1. PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This section includes a written sequence of operation for all HVAC equipment. Included are the following topics:

1. Scope
2. Related Work
3. Packaged Rooftop Air Conditioning Units – RTU-1, RTU-2 and RTU-3

1.2 RELATED WORK

A. Section 15010 – Basic Mechanical Requirements.

B. Section 15871 – Packaged Rooftop Air Conditioning Units.

1.3 SUBMITTALS

A. Refer to General Conditions and Division 1.

B. Submit shop drawings and product data under provisions of Division 1 and 15010.

1.4 OPERATION AND MAINTENANCE DATA

A. Refer to General Conditions and Division 1.

B. Submit operation and maintenance data under provisions of Sections 15010.

1.5 QUALITY ASSURANCE

A. Refer to General Conditions, Division 1 and 15010.

1.6 DELIVERY, STORAGE AND HANDLING

A. Refer to General Conditions and Division 1.

B. Deliver products to site under provisions of Division 1 and 15010.

C. Store and protect products under provisions of Division 1 and 15010.

1.7 WARRANTY

A. Refer to Section 15010.

B. Store and protect products under provisions of Division 1 and 15010.

2. PART 2 - PRODUCTS

A. Not Used.

3. PART 3 - SEQUENCE OF OPERATION

3.1 GENERAL

A. The mechanical contractor is responsible for providing controls.

B. The mechanical contractor shall install the damper actuators, low limit thermostats, etc. furnished by the rooftop unit manufacturer.

C. The rooftop unit manufacturer shall furnish the damper actuators, low limit thermostats and local loop controls.

D. The rooftop unit manufacturer shall provide transmitters, digital controller and related wiring. Any loose devices shall be installed by the mechanical contractor.

3.2 PACKAGED ROOFTOP AIR CONDITIONING UNITS RTU-1, RTU-2 AND RTU-3

A. All sequences described below shall be controlled from the RTU DDC controller unless otherwise noted. All setpoints shall be operator adjustable.

B. Packaged air conditioning unit shall have a microprocessor-based controller that shall monitor and control the RTU in a stand-alone mode. The RTU control panel shall have a human interface panel with a clear English LCD display and keypad for scheduling, monitoring, setting, editing and controlling.

C. The RTU shall perform the following control strategies, provide the points listed on the point list and provide the specified monitoring and diagnostics.

D. Occupied Mode.

1. RTU shall run continuously during occupied mode. The outside air and return dampers shall modulate to the minimum outside air position. DX cooling, gas heat, and economizer operation shall be enabled. Minimum on/off timing of the mechanical cooling shall be used to prevent rapid cycling.

2. If all hardwired safety interlocks allow operation, the supply fan shall start.

3. The RTU shall be controlled from the integral DDC controller to maintain the space air temperature setpoint of 72°F (adjustable). Upon proof of supply fan operation, the stages of gas heat, return and outdoor air dampers, and the stages of DX cooling shall be controlled in sequence to maintain the space setpoint. At no time shall the gas heat be operating when the return and outdoor air dampers are economizing or the DX cooling is operating. Whenever the space temperature is above the setpoint, the following shall occur in sequence: The stages of gas heat shall shut down. When heating is completely off and the economizer sequence is enabled, the economizer outside air damper and return air dampers will be modulated together in sequence to maintain space temperature setpoint. When the outside air economizer damper is completely open, or the economizer sequence is not enabled, the stages of DX cooling shall be controlled to maintain the space temperature

setpoint. When the space temperature is below setpoint the reverse shall occur. DX cooling control shall be locked out below 50° F (adj.) outside air temperature.

4. Economizer Operation - The air handling unit shall be capable of economizer operation given the following conditions.

   a. When the outside air enthalpy is less than the return air enthalpy, the stages of gas heating, the economizer outside air and return dampers shall be controlled to maintain the space temperature setpoint.
   b. When the space temperature setpoint cannot be satisfied from outside air cooling, control the stages of DX cooling compressors to maintain the space temperature setpoint.
   c. RTU economizer switchover shall be by enthalpy comparison. When the outside air enthalpy is greater than the return air enthalpy, the outside air damper shall be closed to the minimum position and the return air and relief air dampers shall be open. The stages of DX cooling compressors shall be controlled to maintain the space temperature setpoint.

E. Unoccupied Mode.

1. When scheduled to the unoccupied mode the RTU shall shut down. If the room temperature drops below the unoccupied heating setpoint of 60F, the RTU shall start and the stages of gas heat shall be controlled to maintain the heating setpoint. The RTU outside air damper shall be fully closed and the return damper shall be fully open during unoccupied operation. Mechanical cooling and economizer operation shall be locked out. When the zone is above the unoccupied heating shutdown setpoint of 65F, the RTU shall shut off.

F. Morning Warm-up

1. Morning warm-up mode shall be initialized 1 hour (adjustable) before the switch from unoccupied to occupied mode if the zone temperature is below the heating setpoint. If the zone temperature is above the heating setpoint the unit shall remain in unoccupied mode.

2. During morning warm-up mode the outside air damper shall be fully closed, the return damper shall be fully open, and the stage of gas heat shall be controlled to maintain the heating setpoint. Mechanical cooling and economizer operation shall be locked out. When zone is above the heating setpoint the unit shall be switch to occupied mode.

G. Alarms

1. Dirty Filter Alarm: An alarm shall be created at the RTU and available via BACnet for future remote alarming and notification. The unit shall continue to operate as normal.

2. Fan Failure Alarm: An alarm shall be created at the RTU and available via BACnet for future remote alarming and notification. The start signal to the unit shall be maintained.

3. Low DAT Alarm: An alarm shall be created at the RTU and available via BACnet for future remote alarming and notification. A hardwired interlock shall shut down the RTU. Alarm shall require manual reset.

4. Room Temperature Alarm: If zone temperature is more than 3F from its setpoint (during occupied operation) an alarm shall be available via BACnet for future remote alarming and notification. The unit shall continue to operate as normal.

5. Smoke Alarm: Integral smoke detector shall shut down the RTU and create an alarm available via BACnet for future remote alarming and notification. Alarm shall require manual reset.

6. Phase Loss, Imbalance, or Reversal Alarm: An alarm shall be created at the RTU and available via BACnet for future remote alarming and notification. A hardwired interlock shall shut down the RTU. Alarm shall automatically reset upon phase correction.

H. The following are the control fail-safe conditions upon failure of the RTU integral controller or loss of control power.

1. The supply air fan shall fail OFF and the powered exhaust fan shall fail OFF.

2. The DX cooling stages shall fail OFF.

3. The gas heating stages shall fail OFF.

4. The outside air dampers shall close.

5. The return air damper shall open.

Any hardwired safeties shall override the specified fail-safe positions indicated above.

I. The Point List for the RTU's are as follows:

Point Type	General Description
Digital Outputs (DO)	Supply Fan Start/Stop
	Gas Heat Stage 1 Command
	DX Cooling Stage 1 Command
Digital Inputs (DI)	Supply Fan Status (via current switch)
	Freezestat Status
	Gas Heat Stage 1 Status
	DX Cooling Stage 1 Status
	Phase Loss
Analog Outputs (AO)	Economizer Outside Air Damper
	Return Air Damper
Analog Inputs (AI)	Outside Air Temperature
	Return Air Temperature
	Mixed Air Temperature
	Discharge Air Temperature
	Filter Differential Pressure
	Space Temperature

-- END OF SECTION --

SECTION 15990
TESTING, ADJUSTING AND BALANCING

(NOT IN CONTRACT, UNDER CONTRACT BY CITY OF MILWAUKEE)

1. PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Testing, adjustment and balancing of air systems.

B. Measurement of final operating condition of HVAC systems.

1.2 RELATED SECTIONS

A. Section 15010 - Basic Mechanical Requirements

B. Section 15781 - Packaged Roof Top Air Conditioning Units.

C. Section 15860 - Centrifugal Fans.

D. Section 15890 - Ductwork.

E. Section 15910 - Ductwork Accessories.

1.3 REFERENCES

A. AABC - National Standards for Field Measurement and Instrumentation, Total System Balance.

B. ASHRAE - 1995 HVAC Applications Handbook: Chapter 34, Testing, Adjusting and Balancing.

C. NEBB - Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems.

D. TABB - International Standards for Environmental Systems Balance.

1.4 SUBMITTALS

A. Submit name of adjusting and balancing agency for approval within 30 days after award of Contract.

B. Submit test reports as a submittal under provisions of Section 15010.

C. Submit test reports under provisions of Section 15010.

D. Prior to commencing work, submit draft reports indicating adjusting, balancing and equipment data required.

E. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Engineer and for inclusion in operating and maintenance manuals.

F. Provide reports in soft cover, letter size, three-ring binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.

G. Include detailed procedures, agenda, sample report forms prior to commencing system balance.

1.5 REPORT FORMS

A. Submit reports on AABC National Standards for Total System Balance or NEBB forms.

B. Forms shall include the following information:

1. Title Page:
   - a. Company name
   - b. Company address
   - c. Company telephone number
   - d. Project name
   - e. Project location
   - f. Project Engineer
   - g. Project Contractor
2. Instrument List:
   - a. Instrument
   - b. Manufacturer
   - c. Model
   - d. Serial number
   - e. Range
   - f. Calibration date
3. Air Moving Equipment:
   - a. Location
   - b. Manufacturer
   - c. Model
   - d. Air flow, specified and actual
   - e. Return air flow, specified and actual
   - f. Outside air flow, specified and actual
   - g. Total static pressure (total external), specified and actual
   - h. Inlet pressure

i. Discharge pressure
j. Fan RPM

4. Return Air/Outside Air/Relief Air Data:

a. Identification/location
b. Design air flow
c. Actual air flow
d. Design return air flow
e. Actual return air flow
f. Design outside air flow
g. Actual outside air flow
h. Return air temperature
i. Outside air temperature
j. Required mixed air temperature
k. Actual mixed air temperature
l. Design outside/return air/relief air ratio
m. Actual outside/return air/relief air ratio

5. Electric Motors:

a. Manufacturer
b. HP/BHP
c. Phase, voltage, amperage; nameplate, actual, no load.
d. RPM
e. Service factor
f. Starter size, rating, heater elements

6. V-Belt Drive:

a. Identification/location
b. Required driven RPM
c. Driven sheave, diameter and RPM
d. Belt, size and quantity
e. Motor sheave, diameter and RPM
f. Center to center distance, maximum, minimum, and actual

7. Duct Traverse:

a. System zone/branch
b. Duct size
c. Area
d. Design velocity
e. Design air flow
f. Test velocity
g. Test air flow
h. Duct static pressure
i. Air temperature
j. Air correction factor

8. Air Distribution Test Sheet:
   a. Room number/location
   b. Area factor
   c. Design velocity
   d. Design air flow
   e. Test (final) velocity
   f. Test (final) air flow
   g. Percent of design air flow
9. Cooling Coil Data:
   a. Identification/number
   b. Location
   c. Service
   d. Manufacturer
   e. Air flow, design and actual
   f. Entering air DB temperature, design and actual
   g. Entering air WB temperature, design and actual
   h. Leaving air DB temperature, design and actual
   i. Leaving air WB temperature, design and actual
   j. Air pressure drop, design and actual
10. Heating Coil Data:
   a. Identification/number
   b. Location
   c. Service
   d. Manufacturer
   e. Air flow, design and actual
   f. Entering air temperature, design and actual
   g. Leaving air temperature, design and actual
   h. Air pressure drop, design and actual

1.6 PROJECT RECORD DOCUMENTS

A. Submit record documents under provisions of Section 15010.

B. Accurately record actual locations of balancing valves and rough setting.

1.7 QUALITY ASSURANCE

A. Agency shall be company specializing in the adjusting and balancing of systems specified in this Section with minimum three years documented experience. Perform Work under supervision of AABC Certified Test and Balance Engineer or a NEBB Certified Testing, Balancing and Adjusting Supervisor or registered Professional Engineer.

B. Total system balance shall be performed in accordance with AABC National Standards for Field Measurement and Instrumentation, Total System Balance. ASHRAE - 1984 Systems Handbook and NEBB Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems.

1.8 SEQUENCING AND SCHEDULING

A. Sequence work to commence after completion of systems and schedule completion of work before Substantial Completion of Project.

1.9 PRE-INSTALLATION CONFERENCE

A. Convene a conference one week prior to commencing work of this Section.

2. PART 2 - PRODUCTS

2.1 Not Used

3. PART 3 - EXECUTION

3.1 EXAMINATION

A. Before commencing work, verify that systems are complete and operable. Ensure the following:

1. Equipment is operable and in a safe and normal condition.
2. Temperature control systems are installed complete and operable.
3. Proper thermal overload protection is in place for electrical equipment.
4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
5. Duct systems are clean of debris.
6. Correct fan rotation.
7. Fire and volume dampers are in place and open.
8. Coil fins have been cleaned and combed.
9. Access doors are closed and duct end caps are in place.
10. Air outlets are installed and connected.
11. Duct system leakage has been minimized.

B. Report any defects or deficiencies noted during performance of services to Engineer.

C. Promptly report abnormal conditions in mechanical systems or conditions which prevent system balance.

D. If, for design reasons, system cannot be properly balanced, report as soon as observed.

E. Beginning of work means acceptance of existing conditions.

3.2 PREPARATION

A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect/Engineer to facilitate spot checks during testing.

B. Provide additional balancing devices as required.

3.3 TOLERANCES

A. Adjust main ducts in air handling systems to ± 5% of design parameters for supply and exhaust/return systems. Adjust individual branches to ± 7.5% of design conditions for supply and exhaust/return systems.

3.4 ADJUSTING

A. Recorded data shall represent actually measured, or observed condition.

B. Permanently mark settings of valves, dampers and other adjustment devices allowing settings to be restored. Set and lock memory stops.

C. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

D. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

E. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by City.

F. Check and adjust systems approximately six months after final acceptance and submit report.

3.5 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return and exhaust air quantities.

B. Make air quantity measurements in ducts by pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

E. Use volume control devices to regulate air quantities only to extent that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50% loading of filters.

I. Adjust outside air automatic dampers, outside air, return air and exhaust dampers for design conditions.

J. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.

3.6 SCHEDULE

Equipment	Air Balance
Packaged Roof Top Units	X
Exhaust Fans	X
Air Inlets and Outlets	X

-- END OF SECTION --

SECTION 16010
BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. This Section includes general administrative and procedural requirements for electrical installations, and shall apply to all phases of the work specified, indicated on the drawings, or required to provide for complete installation of electrical systems for this project. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division 1:

1. Submittals.
2. Record documents.
3. Maintenance manuals.
4. Rough-ins.
5. Electrical installations.
6. Cutting and patching.
7. Warranties.
8. Temporary.
9. Coordination with local utilities.

1.2 DEFINITIONS

A. The following definitions shall apply throughout the contract documents:

1. Architect/Engineer: Architect or Engineer.
2. Code: All applicable local, state, and national codes - latest edition.
3. Contractor: Any contractor performing work required by the Contract Documents.
4. Electrical: All electrical work required by the contract documents.
5. Furnish: Supply and deliver to the site ready for installation.
6. Indicated: Noted, scheduled, or specified.
7. Installed: Erected, mounted, secured, connected, and ready for use.
8. Mechanical: All mechanical work required by the contract documents.
9. Provide: Furnish, install, and connect, complete and ready for use.

1.3 CODES AND STANDARDS

A. Codes: The electrical system shall comply with the National Fire Protection Association (NFPA), American National Standards Institute (ANSI), Occupational Safety and Health Administration (OSHA), and all other state, local, municipal, and national bureaus and departments which have authority over this project: anything in these contract documents notwithstanding. All systems and components shall be FM approved and listed and labeled by UL. This shall not be construed as waiving compliance with any requirements of the plans and specifications that may be in excess of any requirements of any applicable code.

B. Workmanship: The work shall be performed by competent craftsman, skilled in the trade involved, and shall be done in a manner consistent with the NECA National Electrical Installation Standards.

C. Where there is a conflict between the code and contract documents, the code shall have precedence only when it is more stringent than the contract documents. Items that are allowed by code, but are less stringent than those specified, shall not be substituted.

D. Permits: The contractor shall familiarize themselves with all requirements regarding all permits, fees, etc. and shall comply with them. The contractor at his expense shall obtain all permits, licenses, inspections, and arrangements required for the execution of the work. All utilities shall be installed in accordance with the local rules and regulations, and the contractor shall pay all charges.

E. All permits and certificates of inspection shall be turned over to Owner prior to request for final payment.

1.4 QUALITY ASSURANCE

Not Applicable

1.5 SUBMITTALS

A. General: Follow the procedures specified in Division 1 Section "SUBMITTALS" and as indicated in this section.

B. Where required by other sections of this specification/project manual, the contractor shall submit shop drawings, product data, or samples to the Architect/Engineer for review through the general contractor. If no general contractor is assigned, the contractor may submit directly to the Architect/Engineer.

C. Unrequired submittals will not be reviewed. Faxed, emailed, or incomplete submittals will not be reviewed.

D. Submittals shall be numbered consecutively and referenced to the section number of the specification section.

E. For shop drawings and product data submittals, the contractor shall submit a minimum of six copies for review to the Engineer through the General Contractor. If no general contractor is assigned the submittals may be sent directly to the Architect/Engineer for review.

F. Additional copies may be required by individual sections of these Specifications.

G. Shop drawings are drawings, diagrams, schedules, and other data specifically prepared for this project by the Contractor, or any manufacturer, supplier, or distributor to illustrate some portion of the work

H. Shop drawing shall be drawn to accurate scale and adequate size to illustrate required details. Maximum sheet size shall be 30" x 42". For each shop drawing sheet larger than 11" x 17", submit one drawing on reproducible media, and one blueline or photocopied print. The Architect/Engineer's action shall be indicated on the reproducible drawing, and that drawing shall be returned to the contractor.

I. Product data are illustrations, standard schedules, performance charts, instruction brochures, diagrams, and other information furnished by the contractor to illustrate a material, product, or system for some portion of the work.

J. Samples are physical examples furnished by the contractor to illustrate materials, equipment, or workmanship, and to establish the standards by which the work will be performed.

K. All submittals shall clearly indicate proposed items, capacities, characteristics, and details in conformance with the contract documents. All equipment items shall be marked with the same item number as used on the drawings or schedules. The manufacturer shall certify capacities, dimensions, and special features required.

L. Submittals shall indicate manufacturer's delivery time for the item after review by the Architect/Engineer.

M. The Architect/Engineer shall review or take other appropriate action upon receipt of the contractor's submittals such as shop drawings, product data and samples, but only to determine conformance with the design concept of the work and the information given in the contract documents.

N. The contractor shall not be relieved of responsibility for any deviation from the requirements of the contract documents by the Architect/Engineer's review of shop drawings, product data, or samples. The Contractor shall not be relieved from responsibility for errors or omissions in the shop drawings, product data, or samples by the Architect/Engineer's review of those drawings.

O. No portion of the work requiring submission of a shop drawing, product data, or sample shall commence until the Architect/Engineer has reviewed the submittal. All such portions of the work shall be in accordance with reviewed submittals.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

B. Where recommended by the equipment supplier, deliver equipment in fully enclosed vans after specified environmental conditions have been permanently established in spaces where equipment is to be placed. The products accepted on the site shall be wrapped in factory packing, and shall be inspected for damage prior to acceptance.

C. Store equipment in clean, dry with non-condensing environments that are controlled within manufacturer=s ambient tolerances for non-operating equipment. Protect from weather, dirt, fumes, water, construction debris, and physical damage.

D. Handle equipment carefully to prevent damage, breaking, and scoring. The contractor shall not install damaged units or components; replace with new.

E. Equipment furnished by others. The contractor shall be responsible for receiving, uncrating, inspecting, storing, and installing of Division 16 equipment listed as furnished by others.

1.7 SPARE PARTS

Not Applicable

1.8 WARRANTIES

A. The contractor shall warrant all materials, workmanship, and equipment against defects for a period of one year after the date of substantial completion. Certain equipment shall be warranted at the time of final acceptance, or for longer periods of time as specified in those sections of the project manual.

B. The contractor shall repair or replace, at no additional cost to Owner, any item that may become defective within the warranty period.

C. Any manufacturer's warranties concerning any item installed shall be to the benefit of Owner.

D. The contractor agrees not to void or impair or to allow any sub-contractor to void or impair any warranties regarding products or items installed as part of this project.

E. The repair of faulty workmanship shall be considered to be included in the contract.

1.9 MAINTENANCE MANUALS

A. Prepare maintenance manuals in accordance with Division 1 Section "PROJECT CLOSEOUT." In addition to the requirements specified in Division 1, include the following information for equipment items:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
4. Servicing instructions and lubrication charts and schedules.

B. The Contractor shall prepare three Operating and Maintenance Manuals for the equipment furnished. Manuals shall be submitted to the Architect/Engineer for review and distribution to Owner within thirty (30) days prior to substantial completion of the project. The Architect/Engineer may reject manuals not meeting the following requirements:

1. Each manual shall be assembled in a three-ring binder with a hard cover and plastic finish. Binders shall not exceed 3" thick. Where more than one binder is required, the manuals shall be separated into logical groupings. Where loose-leaf inserts are used, the sheets shall be reinforced to prevent tearing from continuous usage. Each binder shall have the following information clearly printed on its cover:

   a. Project name and address.
   b. Portion of the work covered by each volume (if more than one volume is in the set). Where more than one volume is required, label each volume as "Volume ___ of ___."
   c. Name, address, and telephone number of the Contractor and all Sub-Contractors including night and emergency numbers.

2. The manual shall include, but shall not be limited to, the following:

   a. A complete index.
   b. Names, Addresses, and Telephone Numbers: The list shall include the manufacturer and local representative who stocks and furnishes repair parts for all items of equipment and shall be typed on a single page in the front of the binder.

c. Start-Up, Operation, and Shutdown Procedures: Provide a written description of procedures for start-up, operation, and shutdown procedures for each electrical item or system. This description shall include switches to operate, buttons to push, etc., in proper sequence, and locations of buttons and switches. The description shall include item references or labels used in the contract documents unless otherwise instructed in advance by Owner.

d. Equipment Accessory Schedule: Upon completion of the work, the Contractor shall furnish Owner with a complete equipment accessory schedule listing each piece of equipment and the related size, type, number required, and the manufacturer of all renewable items.

e. Manufacturer's Operation and Maintenance Manuals and Parts List.

f. Emergency Procedures: Provide a written description of emergency operating procedures or a list of service organizations (including complete business address and telephone numbers) capable of rendering emergency services to the various parts of the system.

g. One copy of all shop drawings and product data, clearly marked for each item furnished using the designation label specified or indicated on the contract documents.

h. All manufacturers' warranty information.

i. Normal Maintenance Schedule: Include a listing of work to be performed at various time intervals (e.g., 30, 90, 180 days, yearly).

1.10 COORDINATION DRAWINGS

A. Prepare coordination drawings in accordance with Division 1 Section "PROJECT COORDINATION" to a scale of ¼" = 1'-0" or larger, detailing major elements, components, and systems of electrical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:

1. Indicate the proposed locations of major raceway systems, equipment, and materials. Include the following:

   a. Clearances for servicing equipment, including space for equipment disassembly required for periodic maintenance.

   b. Exterior wall and foundation penetrations.

   c. Fire-rated wall and floor penetrations.

   d. Equipment connections and support details.

   e. Sizes and location of required concrete pads and bases.

2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.

3. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

4. Prepare reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communications systems components, sprinklers, and other ceiling-mounted devices.

1.11 RECORD DOCUMENTS

A. Prepare record documents in accordance with the requirements in Division 1 Section "PROJECT CLOSEOUT."

B. Contractor shall keep an up-to-date set of "as-installed," "red-lined" drawings kept current on a daily basis. Such drawings shall be available to Owner, Engineer, or Owner's representative at the job site at all times.

C. Upon completion of the contract, send to the Architect/Engineer, through the general contractor, one complete set of red-lined drawings showing all deviations.

D. In addition to the requirements specified in Division 1, indicate on the marked up drawings additional information for:

1. Major raceway systems, size and location, for both exterior and interior.
2. Locations of control devices.
3. Distribution and branch electrical circuits.
4. Switch, fuse, and circuit breaker size and arrangements.
5. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
6. Approved substitutions, Contract Modifications, and actual equipment and materials installed.

1.12 SITE EXAMINATION

A. Visit the site prior to submitting bids, examine the premises, and make a thorough survey of the conditions under which the installation is to be made.

B. The submission of a proposal will be construed as evidence that such an examination has been made, and later claims for labor, equipment, or materials required for difficulties encountered which could have been foreseen had such an examination been made, will not be recognized.

1.13 INTERPRETATION OF THE DOCUMENTS

A. Carefully compare the drawings and specifications, checking measurements and conditions under which this installation is to be made.

B. The interpretations of the intent of the plans shall rest solely with the Architect and the Architect's decision shall be considered final.

C. If questions arise during the bidding process regarding the meaning of any portion of the contract documents, the prospective bidder shall submit the questions to the Architect/Engineer for clarification. Any definitive interpretation or clarification of the contract documents will be published by addenda, properly issued to each person holding documents, prior to the bid date. Verbal interpretation or explanation, not issued in the form of an addendum, shall not be considered part of the bidding documents. When submitting questions for clarification, adequate time for issuance and delivery of addenda must be allowed.

1.14 ELECTRICAL SERVICE DISRUPTIONS

A. No electrical service disruptions may occur without permission of Owner.

B. Submit a written request for any work electrical outages before taking any operating electrical equipment out of service. Any work involving a task, which requires an

electrical service disruption to any part of this facility, shall be closely coordinated with Owner prior to the disruption. All disruptions shall occur at times and of durations acceptable to Owner.

1.15 OVERTIME WORK

A. Construction work shall be done during regular working hours on regular working days unless specifically noted otherwise on the drawings, and as required by Owner. If overtime work, other than specified, is required on the project, it shall be performed as indicated under the special conditions of these contracts.

B. Pricing for required overtime work specified shall be included in the Base Bid.

C. Items requiring overtime work are:

1. Exposing any energized bus.
2. Any work above, below, or adjacent to active, operating equipment that must remain in operation during normal hours.
3. Replacement or modification to electrical service and distribution to the facility.

1.16 SAFETY

A. The contractor shall take all steps necessary to ensure the safety of the occupants, students, Owner's employees, visitors, project related personnel, or any other authorized personnel, as well as their own forces, by adequately protecting any exposed energized cable, equipment, or devices throughout the course of this work.

B. Comply with NFPA 241 for safeguarding during construction and alteration operations. In addition, any openings in fire-rated separations between occupied and unoccupied (or operational and non-operational) areas shall be sealed at the end of each work day with an appropriate fire-rated enclosure or sealant. Do not compromise existing security or fire alarm systems serving the occupied or operational areas.

1.17 INTERFERENCE WITH OCCUPANCY

A. If the existing building is occupied, then the work covered by these documents shall be executed with a minimum of inconvenience to the building occupants.

1.18 DAMAGE TO OTHER WORK

A. This contractor shall be responsible for damage to other work caused by this installation. Patching and repairing of damaged work done by this Division shall be part of the cost of this Division.

1.19 LAYOUT OF WORK

A. Layout work to be installed in coordination with other trades engaged on this project whenever their work is likely to affect the electrical installation. Be fully responsible for all dimensions and conflicts between this work and that of other trades, and make the necessary changes in the work without additional cost to Owner if the work does not comply properly with these requirements.

B. Compare contract documents with those of other trades before proceeding with the installation. Electrical wiring, conduits, or electrical equipment which has been installed without checking for interference and without thorough coordination with other trades shall be moved or relocated without additional expense to Owner.

C. Equipment shall be installed with ample space allowed for removal, repair, or change to the equipment. Ready accessibility to removable parts or equipment and to the wiring shall be provided without moving other equipment which is installed or which is already in place.

1.20 OPERATING TRAINING

A. Complete operating training for each system and item of equipment shall be provided to the Owner's designated personnel. The Operation and Maintenance Manuals must be reviewed and accepted by the Architect/Engineer and provided to the Owner prior to operating training. Training sessions shall consist of two 8-hour periods and shall be scheduled at the convenience of Owner. Training shall include instructions on the following:

1. Start-Up and Shutdown Procedures
2. Emergency Operation
3. Periodic Maintenance
4. Safety

B. In addition to the instructions required above, wherever possible the Contractor shall perform the operation being described in order to fully illustrate system operation.

C. At the completion of training, the Contractor shall turn over to Owner all required keys and special tools for the installed equipment. Each key or tool shall be labeled with its use.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Unless otherwise specified, all materials and equipment shall be new, unused, and undamaged. Materials and equipment shall be the current and standard designs of manufacturers regularly engaged in their production.

2.2 MATERIALS AND EQUIPMENT FURNISHED BY OTHERS

A. Where materials and equipment are indicated as furnished by others and installed or connected under this contract, it shall be the Contractor's responsibility to verify installation details prior to proceeding with work.

PART 3 - EXECUTION

3.1 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

B. Refer to equipment specifications in Divisions 2 through 16 for rough-in requirements.

3.2 ELECTRICAL INSTALLATIONS

A. General: Sequence, coordinate, and integrate the various elements of electrical systems, materials, and equipment. Comply with the following requirements:

1. Coordinate electrical systems, equipment, and materials installation with other building components.

2. Verify all dimensions by field measurements.
3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for electrical installations.
4. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the space.
5. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
6. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.
7. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
8. Install electrical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
9. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

3.3 CUTTING AND PATCHING

A. General: Perform cutting and patching in accordance with Division 1 Section "CUTTING AND PATCHING." In addition to the requirements specified in Division 1, the following requirements apply:

1. Perform cutting, fitting, and patching of electrical equipment and materials required to:
   a. Uncover Work to provide for installation of ill-timed Work.
   b. Remove and replace defective Work.
   c. Remove and replace Work not conforming to requirements of the Contract Documents.
   d. Remove samples of installed Work as specified for testing.
   e. Install equipment and materials in existing structures.
   f. Upon written instructions from the Architect, uncover and restore Work to provide for Architect observation of concealed Work.
2. Cut, remove, and legally dispose of selected electrical equipment, components, and materials as indicated, including but not limited to removal of electrical items indicated to be removed and items made obsolete by the new Work.
3. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
4. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

5. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.
6. Patch existing finished surfaces and building components using new materials matching existing materials and experienced installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.
7. Patch finished surfaces and building components using new materials specified for the original installation and experienced installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.

3.4 TEMPORARY LIGHTING POWER, AND FIRE ALARM

A. Work Included:

1. Electrical Contractor shall furnish and install temporary lighting, power, and fire alarm devices for this project as required and remove same at the end of the project.
2. Contractor shall install the above mentioned temporary services in a safe and workmanlike manner.
3. Provide temporary lighting and power as required in areas undergoing work during construction. Furnish and install one OSHA-approved pigtail socket with 150W lamp for every 500 square feet of floor space and a minimum one per room. The temporary lighting shall be left in place until permanent lighting is completely operational.
4. Furnish and install power outlets to a total one for every 2,000 square feet or part thereof of floor area. These shall be 15 amp, single phase receptacles for either 110 or 220V as directed by the General Contractor. Coordinate for additional temporary power requirements with other trades and provide an adequate installation.

B. Contractor to coordinate temporary services with the following:

1. General Contractor.
2. Mechanical Contractor.
3. Owner/Owner Representative.

3.5 COORDINATION WITH LOCAL UTILITIES

A. Utility Power Coordination

1. The Contractor shall perform all coordination and scheduling of local utility power company work effort. Any excess facilities charges will be paid by Owner without mark-up. Contractor shall provide all work required for the new service as shown on the electrical drawings.

B. Local Telephone Provider

1. The Contractor shall coordinate the installation of the local telephone system into the building with the local service provider, including the scheduling of their work effort.

END OF SECTION

SECTION 16050
BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Scope: The work specified in this section includes, but shall not be limited to, providing labor, material, equipment and services necessary for electrical work as shown on the drawings and as herein specified.

B. Section Includes: The work specified in this section includes, but shall not be limited to, providing the following:

1. Motor and Equipment Connections.
2. Sleeves and Openings
3. Coring, Cutting, and Patching
4. Fire stopping
5. Electrical Identification.
6. Hangers and Supports.
7. Equipment Bases.
8. Electrical Utility Services and Metering.
9. Demolition.
10. Warning Signs

1.2 DEFINITIONS

A. Not Applicable

1.3 CODES AND STANDARDS

Codes: The electrical system shall comply with the National Fire Protection Association (NFPA), American National Standards Institute (ANSI), Occupational Safety and Health Administration (OSHA), and all other state, local, municipal, and national bureaus and departments which have authority over this project: anything in these contract documents notwithstanding. All systems and components shall be FM approved and listed and labeled by UL. This shall not be construed as waiving compliance with any requirements of the plans and specifications that may be in excess of any requirements of any applicable code.

1.4 QUALITY ASSURANCE

A. Contractor's Quality Assurance Responsibilities: The Contractor shall be solely responsible for quality control of the work.

B. Manufacturer's Qualifications: Firms shall be engaged in the manufacture of products and materials of types and sizes required, and whose products have been in satisfactory use in similar service for not less than five years.

C. Contractor's Qualifications: Firms shall have at least five years of successful installation experience with projects utilizing products and materials similar to that required for this Project.

D. Regulatory Requirements: Comply with applicable requirements of the laws, codes, ordinances, and regulations of Federal, State, and Municipal authorities having jurisdiction. Obtain approvals from such authorities.

E. Installation: Comply with NECA National Electrical Installation standards for electrical construction methods.

1.5 SUBMITTALS

A. General

1. Submittals shall include, but shall not be limited to, equipment specifications sheets, schematic diagrams, wiring diagrams, sizes, mounting details (with required elevations), technical descriptions of components, and proper calculations to ensure specified performance of the systems.
2. Submittals shall be required for the following products listed in this specification:
   a. Utility Service Equipment
3. See Division 16 Section "Basic Electrical Requirements" for additional submittal requirements.

B. Product Data: Submit manufacturer's product information showing material proposed. Submit sufficient information to determine compliance with the drawings and specifications.

C. Shop Drawings: Submit complete shop drawings as required to determine acceptability.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products and materials properly packaged in factory fabricated containers and mounted on shipping skids.

B. Store products and materials in clean, dry, heated space. Protect from dirt, fumes, water, construction debris, and traffic. Where necessary to store outdoors, store above grade and enclose with watertight wrapping.

C. Handle products and materials carefully to prevent internal damage, breakage, denting, and scoring enclosure finish. Do not install damaged products or materials. Replace and return damaged products or materials to manufacturer.

1.7 SPARE PARTS

A. Not Applicable

1.8 WARRANTY

A. The contractor shall warrant all materials, workmanship, and equipment against defects for a period of one year after the date of substantial completion. Certain equipment shall be warranted at the time of final acceptance, or for longer periods of time as specified in those sections of the project manual.

B. The contractor shall repair or replace, at no additional cost, to Owner, any item that may become defective within the warranty period.

1.9 MAINTENANCE

A. Not Applicable

1.10 PROJECT CONDITIONS

A. Field Measurements: Verify that field measurements are as indicated on the shop drawings and as shown on the drawings.

B. Project Location Environment. Furnish and install materials suitable for the altitude, weather, and seismic requirements of the project location.

1.11 COORDINATION

A. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations that follow.

1. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.

B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.

C. Coordinate electrical service connections to components furnished by utility companies.

1. Coordinate installation and connection of exterior underground and overhead utilities and services, including provision for electricity-metering components.
2. Comply with requirements of authorities having jurisdiction and of utility company providing electrical power and other services.

D. Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces.

E. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.

F. Where electrical identification markings and devices will be concealed by acoustical ceilings and similar finishes, coordinate installation of these items before ceiling installation.

PART 2 - PRODUCTS

2.1 QUALITY

A. Electrical equipment, devices and associated materials used on this project shall be UL listed and/or labeled.

B. Equipment and devices installed under this division and not constructed with enclosure suited for mounting and protecting all live parts shall be installed in approved metal cabinets.

2.2 MOTORS

A. All motors will be furnished and installed under other sections of the specification.

B. All motors shall be connected under this section.

1. Final connection shall be made with suitable length of Liquidtight flexible metallic conduit.
2. All motors shall be grounded with green grounding conductor as required.

C. Electrical characteristics of motors shall be as follows:

1. Motors ½ horsepower and smaller shall be rated for operation at 120 volt, single phase, 60 Hertz.

2. Motors ¾ horsepower and larger shall be rated for operation at 480 volts, 3 phase, 60 Hertz.

2.3 ELECTRICAL IDENTIFICATION

A. Identification Devices: A single type of identification product for each application category. Use colors prescribed by ANSI A13.1, NFPA 70, and these Specifications.

B. Raceway and Cable Labels: Comply with ANSI A13.1, Table 3, for minimum size of letters for legend and minimum length of color field for each raceway and cable size.

1. Type: Pretensioned, wraparound plastic sleeves. Flexible, preprinted, color-coded, acrylic band sized to suit the diameter of the item it identifies.
2. Type: Preprinted, flexible, self-adhesive, vinyl. Legend is over laminated with a clear, weather- and chemical-resistant coating.
3. Color: Black letters on orange background.
4. Legend: Indicates voltage.

C. Colored Adhesive Marking Tape for Raceways, Wires, and Cables: Self-adhesive vinyl tape, not less than 1" wide by 3 mils thick (25 mm wide by 0.08 mm thick).

D. Underground Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape with the following features:

1. Not less than 6" wide by 4 mils thick (150 mm wide by 0.102 mm thick).
2. Compounded for permanent direct-burial service.
3. Embedded continuous metallic strip or core.
4. Printed legend that indicates type of underground line.

E. Tape Markers for Wire: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.

F. Color-Coding Cable Ties: Type 6/6 nylon, self-locking type. Colors to suit coding scheme.

G. Engraved-Plastic Labels, Signs, and Instruction Plates: Engraving stock, melamine plastic laminate punched or drilled for mechanical fasteners 1/16" (1.6-mm) minimum thickness for signs up to 20 sq. in. (129 sq. cm) and ⅛" (3.2-mm) minimum thickness for larger sizes. Engraved legend in black letters on white background for normal systems and white letters on red background for emergency systems.

H. Interior Warning and Caution Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145. Preprinted, aluminum, baked-enamel-finish signs, punched or drilled for mechanical fasteners, with colors, legend, and size appropriate to the application.

I. Exterior Warning and Caution Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396" (1-mm), galvanized-steel backing, with colors, legend, and size appropriate to the application. ¼" (6-mm) grommets in corners for mounting.

J. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers. Self adhesive backing alone is not allowed.

2.4 HANGERS AND SUPPORTS

A. Surface Mounted Cabinets: Secure cabinets directly to wall using suitable wall anchors, or provide a suitable frame for mounting and supporting the cabinets using "Unistrut" type supports as required.

B. Free Standing Motor Starters and Safety Switches: Provide suitable "Unistrut" racks with sheet steel mounting plates for this equipment.

C. Hanger Rods:

1. Provide hanger rods of proper length for electrical items requiring same.
2. Minimum rod diameter shall be ⅝" for cable trays, and racks supporting more than 8" of total conduit diameter.
3. Hanger rods shall be zinc plated or galvanized steel.

D. Cable Supports: Riser cables shall be supported by means of O.Z./Gedney Co, Thomas and Betts, or Joslyn cable supports at each panel and pull box in accordance with Code requirements.

E. Conduit Supports and Hangers:

1. Individually suspended conduits shall be supported with galvanized pipe clamps, from threaded steel rods, spaced 5'-0" on centers.
2. The steel rods shall be affixed to the building structure by means of inserts in concrete slab or beam clamps affixed to the steel structure.
3. Where multiple conduits are installed adjacent to each other, a trapeze hanger consisting of galvanized P-l000 unistrut suspended from at least two threaded steel rods, shall be used. The conduits shall be affixed to the unistrut with galvanized split pipe clamps, Nos. P-1109 through P-1126, for rigid conduit and Nos. P-l425 through P-1431, for EMT.
4. Hangers and clamps shall be as manufactured by Unistrut, B-Line or as approved by Engineer.

2.5 EQUIPMENT BASES

A. The Contractor shall provide concrete pedestals, bases, pads, curbs, anchor blocks, anchor bolts, slab inserts, hangers, channels, cradles, saddles, etc., for installation of equipment and apparatus shown on the drawings.

B. Concrete pads shall be 4" (102 mm) high, unless otherwise indicated, complete with steel reinforcing and necessary bolts, anchors, etc. Where concrete pad is set directly on concrete floor, provide dowels in floor to tie base to floor. These pads shall be extended at least 4" (102 mm) beyond the equipment outlined on all four sides.

C. Provide concrete as required to install electrical work shall be provided by Division 16 Electrical.

D. Concrete mix shall conform to the requirements of Section 03300 Cast In Place Concrete, however, if no specification is available, the mix shall not be less than 3,500 psi (20 684 kPa) metal reinforced. Pad shall be level to ⅛" per 3 foot in any direction.

2.6 EQUIPMENT TOUCH-UP PAINT

A. The Contractor shall provide the types and brands furnished by manufacturers for all components. Furnish a minimum of one (1) gallon of the manufacturer's paint for future touch up painting to the Owner.

B. Repair damage to factory applied paint finishes with the appropriate touch-up paint.

2.7 EQUIPMENT FOR UTILITY COMPANY'S ELECTRICITY METERING

A. Current-Transformer Cabinets: Comply with requirements of electrical power utility company.

B. Meter Sockets: Comply with requirements of electrical power utility company.

PART 3 - EXECUTION

3.1 DEMOLITION

A. Examination

1. The contractor shall visit the site and examine areas under which the work is to be performed and notify the Owner in writing of any conditions detrimental to the proper and timely completion of the work. Contractor shall not proceed with work until satisfactory conditions have been corrected.
2. Verify field measurements and circuiting arrangements for devices shown on drawings.
3. Demolition drawings are based on casual field observation and existing record drawings. Report discrepancies to Owner before disturbing existing installation.
4. Commencement of demolition means acceptance of existing conditions.

B. Preparation

1. Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.
2. Coordinate utility service shut-down with the utility company.
3. Notify the Owner at least 48 hours before disabling any electrical system.
4. Provide temporary wiring and connections to maintain existing systems in service during construction. Experienced personnel shall be used when working on energized equipment or circuits.
5. Existing electrical service: maintain existing system in service until new service is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from Owner at least 48 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.
6. Maintain existing fire alarm system in service until new system is accepted. Disable system only to make switchovers and connections. Notify Owner at least 48 hours before partially or completely disabling system. Where fire alarm devices must be removed to accommodate the removal of walls, notify the Owner and Engineer in writing with locations of devices.

C. Demolition and Extension of Existing Electrical Work

1. Remove, relocate, and extend existing electrical work as indicated on the drawings and as noted herein.

2. Remove abandoned wiring back to source of supply.
3. Where source of supply is a panelboard, re-label protective device as "Spare." After demolition is complete, submit revised panelboard schedules indicating "Spares" to Owner and Engineer.
4. Remove exposed abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors and patch surfaces.
5. Remove and disconnect abandoned outlets and associated devices.
6. Disconnect and remove abandoned panelboards and distribution equipment.
7. Disconnect and remove electrical devices and equipment that is no longer in use.
8. Disconnect and remove abandoned lighting fixtures. Remove brackets, stems, hangers, and other accessories.
9. Repair adjacent construction and finishes damaged during demolition and extension of work

D. Cleaning, Repair, and Replacement

1. General: Clean and repair existing materials and equipment that will remain or are to be reused.
2. Panelboards: Clean exposed surfaces and tighten all electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed schedule showing revised circuiting information.
3. Lighting fixtures: Remove existing lighting fixtures for cleaning. Use mild detergent to clean exterior and interior surfaces, rinse clean with clean water, and wipe dry. Replace existing lamps and ballasts with new.

E. Disposal

1. Owner shall have right to retain any equipment or materials that have been demolished prior to disposal or removal from site.
2. Any equipment or materials not wanted by the Owner shall become the property of the contractor and removed from site.
3. Contractor shall comply with environmental laws and regulations for disposal of demolished materials and equipment.

3.2 MOTOR CONNECTIONS AND INSTALLATIONS

A. Building utility motors such as fans, etc., and certain starting and controlling equipment for same, as indicated on the drawings, will be furnished under Division 15 of the specifications for the mechanical work and delivered to the building site.

B. Motors which are delivered to the building site independent of their driven equipment shall be set, aligned and secured under Division 15 of the specifications.

C. Motors and electrical apparatus which are delivered to the building site factory set, assembled and attached to their driven machinery or apparatus:

1. The machinery or apparatus will be moved into position along with its attached electrical apparatus under the responsible mechanical trade section of the specifications.
2. The necessary line side electrical connections shall be provided under this section of the specifications. Furnish all labor and material to place all necessary electrical equipment in satisfactory operating condition.

D. Furnish all branch circuits for motors to the starting equipment and then to the motors, complete with control wiring for automatic and remote control where required. Conduits to motors shall terminate in the conduit fittings on the motors, the final connection being made with short length of flexible conduit. Motors shall be bonded with a green equipment grounding conductor.

E. Consult the specifications for the various branches of the mechanical work and ascertain the exact requirements of the various systems of automatic control. Install and connect up same to leave in satisfactory operating condition.

F. Provide all necessary labor and material to completely connect all ventilation equipment including motors, controls, etc., including all alarm and shutdown systems, as specified here and in the mechanical section.

G. The temperature control panel and components shall be provided under Division 15 of the specifications, including the connection of electrical items. Provide adequate slack wire for this purpose as required.

3.3 PHASE SEQUENCE, ROTATION AND IDENTIFICATION

A. Transformers, switchgear, feeders, panelboards, motor branch circuits, etc., shall be completely phased out for sequence and motor rotation. Phase identification shall be permanently identified in all equipment including conductors by use of all temperature adhesive markers or colored tape similar to Minnesota Mining #35 vinyl tape or as approved.

B. Phase sequence shall be A-B-C (viewed from front):

1. Left to right.
2. Top to bottom.
3. Front to rear.

3.4 SLEEVES AND OPENINGS

A. Provide openings and sleeves in walls and floor as required for this work.

B. Sleeves shall be galvanized steel conduit or schedule 40 black steel pipe, unless otherwise noted. Aluminum conduit shall not be used.

C. Unless specific sizes are indicated on the drawings, sleeves shall be sized to provide ½" clearance around outside surface of the item for which they are installed.

D. Annular space between sleeve and surface of item protruding shall be suitably provided with fire stop as hereinafter specified.

E. Sleeves shall be cut flush with wall surfaces and shall extend 1½" above finished floors unless otherwise indicated.

3.5 CORING, CUTTING AND PATCHING

A. Necessary coring or cutting in walls, floors, and ceilings shall be neatly and carefully done and repaired in an approved and workmanlike manner.

B. No cutting into the structural work of the building shall be done without the approval of the Engineer/Architect.

3.6 FIRE STOPPING

A. Provide fire and cold smoke stopping construction, as specified, for all through penetrations in rated fire construction (and smoke barriers) in accordance with UL fire resistance directory under categories XHCR and XHEZ. These guides have specific requirements for core and opening sizes based on the size of the penetrating item.

B. Fire and smoke stopping compounds shall be by 3M, or approved equal.

C. Conduit penetrations through fire rated gypsum and concrete construction shall be filled with 3M Fire Barrier CP 25WB+ Caulk according to UL and 3M guides.

3.7 ELECTRICAL IDENTIFICATION

A. Install at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations indicated in the Contract Documents or required by codes and standards. Use consistent designations throughout Project.

C. Self-Adhesive Identification Products: Clean surfaces before applying.

D. Identify raceways and box covers with color banding or painting as follows:

1. Bands: Pretensioned, snap-around, colored plastic sleeves or colored adhesive marking tape. Make each color band 2" (51 mm) wide, completely encircling conduit, and place adjacent bands of two-color markings in contact, side by side.
2. Conduit Band Locations: At changes in direction, at penetrations of walls and floors, at 20-foot maximum intervals in straight runs, and at 10-foot maximum intervals in congested areas.
3. Junction boxes and pull boxes: Paint only the outside of boxes and covers, with the identifying color.
4. Colors as follows:

Krylon Cat. #	Color	Raceway System
2116	Scarlet Red	Fire Alarm Systems
1910	True Blue	Communications/Telephone
1601	Glossy Black	Low Voltage (Lighting Control)
1929	Plum	Security Alarms
2002	Pastel Aqua	HVAC Controls
2110	Hot Pink	Signal Alarms

E. Tag and label circuits designated to be extended in the future. Identify source and circuit numbers in each cabinet, pull and junction box, and outlet box. Color-coding may be used for voltage and phase identification.

F. For conductors not manufactured with integral color, use conductors with black insulation or jacket and then use color coding tape at intervals not exceeding 5 feet, and at all terminations and splices.

G. Install engraved-laminated emergency-operating signs with white letters on red background with minimum ⅜"- (9 mm-) high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.

H. Provide identification and markings for various items furnished and installed under this division of the specifications as follows:

1. White Phenolic nameplate with black cut letters ⅜" high:

   a. Disconnect switches and individually mounted starters with number or designation of equipment served.
   b. Panelboards: Identification on the outside of the cabinet door.
   c. Switchboards & Switchgear: Name, sections, breaker and switch designations.
   d. Individual starter housing.
   e. Transformers.
   f. Non-emergency transfer switches.
   g. Remote Status Panels.

2. White Phenolic nameplate with black cut letters ⅛" high:

   a. Pilot light identification.
   b. Toggle switch identification.
   c. Hand-Off-Auto selector switch identification.

3. Red Phenolic nameplate with white cut letters ⅜" high:

   a. Fire Alarm Equipment

4. Dymo Tape labels:

   a. Light fixtures.
   b. Light Switches.
   c. Receptacles.
   d. Disconnects.
   e. Where otherwise specifically indicated.

I. Voltage characteristics shall be indicated on each piece of equipment, and at each panel.

J. All panelboards shall be provided with a typed panel board schedule. Include source of power (upstream panel source and breaker or switch).

K. For special ground systems (such as telecommunication facility grounding) provide engraved brass nameplates for all ground conductors at both terminations.

3.8 WARNING SIGNS

A. Install warning, caution, and instruction signs where required to comply with 29 CFR, Chapter XVII, Part 1910.145, and where needed to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.

B. Provide "DANGER - 480 VOLTS" warning signs on all 480 volt equipment.

C. Flash Protection warning Signs

1. The electrical contractor shall provide all flash protection warning signs as required by the NEC Article 100.16. Warning signs shall conform to the requirements of NFPA 70E.

a. All electrical equipment such as switchboards, panelboards, control panels, meter socket enclosures, and motor control centers, that are likely to require examination, adjustment, servicing, or maintenance while energized shall be field marked to warn qualified persons of potential electrical hazards. The marking shall be located so as to be clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment.

b. All warning signs MUST be installed before owner's personnel are trained on the use of the equipment.

END OF SECTION

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SECTION 16060
GROUNDING AND BONDING

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Scope: The work specified in this section includes providing labor, material, equipment, and services necessary for a complete grounding system as shown on the drawings and as herein specified.

B. Grounding Section Includes: The work specified in this section includes, but shall not be limited to, providing grounding of the following:

1. Underground metal water piping.
2. Underground metal structures.
3. Metal building frames.
4. Electrical power systems.
5. Electrical metallic raceways.
6. Service entrance equipment.
7. Metal enclosures.
8. Lighting fixtures.
9. Equipment requiring power.
10. Telecommunications systems.

C. Bonding Section Includes: The work specified in this section includes, but shall not be limited to, providing bonding of the following:

1. Interior metal piping systems.
2. Natural gas piping.
3. Metallic waste, vent, and drain piping.

1.2 DEFINITIONS

Not Applicable

1.3 CODES AND STANDARDS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

B. If the referenced publications have been revised prior to Contract award, the latest edition/revision shall be submitted for the referenced document.

C. ASTM International (ASTM)

1. ASTM B 8 – "Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft."
2. ASTM B 33 – (Revised 1985), "Standard Specification for Tinned Soft or Annealed Copper Wire for Electrical Purposes."

D. Institute of Electrical and Electronics Engineers (IEEE)

1. ANSI/IEEE 80 – "Guide for Safety in AC Substation Grounding" (copyrighted by IEEE, ANSI approved).

2. ANSI/IEEE 81 – "Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System" (copyrighted by IEEE, ANSI approved).
3. ANSI/IEEE 142 – "Recommended Practice for Grounded of Industrial and Commercial Power Systems" (copyrighted by IEEE, ANSI approved).

E. Insulated Cable Engineers Association (ICEA)

1. ICEA 5-68-516 – "Ethylene Propylene Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy."

F. National Fire Protection Association (NFPA)

1. NFPA 70 – "National Electrical Code (hereinafter referred to as NEC).
2. NFPA 780 – "Installation of Lighting Systems."

G. Underwriters Laboratories, Inc. (UL)

1. UL ECMD – "Electrical Construction Materials Directory."
2. UL 467 – "Grounding and Bonding Equipment."
3. UL 486A – "Wire Connectors and Soldering Lugs for Use with Copper Conductors, Seventh Edition."

H. American National Standards Institute, Electronic Industries Alliance/Telecommunications Industry Alliance (ANSI/EIA/TIA), ANSI/EIA/TIA-607 Grounding and Bonding.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms shall be engaged in manufacture of grounding and bonding products, of types, sizes required, and ancillary grounding materials, including stranded cable, copper braid and bus, grounding electrodes, and bonding jumpers, and whose products have been in satisfactory use in similar service for not less than five years.

B. Installer's Qualifications: Firms shall have at least five years of successful installation experience with projects utilizing grounding systems similar to that required for this Project.

C. Compliance: Comply with applicable local electrical code requirements, NEC, ANSI/IEEE 142, and applicable UL requirements.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's product data showing material proposed. Product data shall include, but shall not be limited to, the following:

1. Conductors.
2. Cables.
3. Bus bars.
4. Insulators.
5. Connectors.
6. Ground rods.

B. Shop Drawings: Submit complete shop drawings as required to determine acceptability. Shop drawings shall consist of a complete list of materials, including manufacturer's

descriptive and technical literature, catalog cuts, drawings, and installation instruction. Shop drawings shall include, but shall not be limited to, the following:

1. Special fabricated components, which are not a manufactured standard product.

C. Proof of Compliance: Where materials or equipment are specified to comply with requirements of UL, proof of such compliance shall be submitted.

D. Test Reports: Submit ground testing test report as specified.

E. Operation and Maintenance Manuals: Prepare and deliver complete operating and maintenance manuals. Provide information pertinent to the equipment for preventive maintenance and for replacement of expendable components. Manuals shall include the items listed below and other information recommended by the manufacturer:

1. Cables.
2. Bus bar.
3. Insulators.
4. Complete list of parts with reordering numbers.
5. Electrical characteristics of components.
6. Recommended spare parts list.
7. Complete set of shop drawings.

1.6 DELIVERY, STORAGE, AND HANDLING:

A. Materials and components shall be properly packaged, stored, and handled to prevent damage or breakage.

1.7 SPARE PARTS

Not Applicable

1.8 WARRANTY

A. The contractor shall warrant all materials, workmanship, and equipment against defects for a period of one year after the date of substantial completion. Certain equipment shall be warranted at the time of final acceptance, or for longer periods of time as specified in those sections of the project manual.

B. The contractor shall repair or replace, at no additional cost to Owner, any item that may become defective within the warranty period.

C. The repair of faulty workmanship shall be considered to be included in the contract.

1.9 MAINTENANCE

Not Applicable

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the work, include, but shall not be limited to, the following:

1. Adalet-PLM Division; Scott Fetzer Co.
2. Burndy Corporation.

3. Cadweld Division; Erico Products, Inc.
4. Crouse-Hinds Division; Cooper Industries.
5. Joslyn Corporation.
6. OZ Gedney Division; General Signal Corp.
7. Thomas and Betts Corp.
8. Eritech; Erico Products, Inc.

2.2 CONDUCTORS

A. General: Grounding and bonding conductors shall be bare and insulated copper as shown on the drawings or required by other sections of this specification.

B. Conductivity: Copper conductors shall have a conductivity of not less than 98 percent at 75 degrees C. Conductor resistance values shall be in accordance with the value in ICEA S-68-516.

C. Cable Sizes: Cable sizes shall be as shown on the drawings or as required by this specification.

D. Insulation: Insulated grounding and bonding conductors shall have an insulation equal to the current carrying conductors.

2.3 GROUND RODS

A. Ground rods shall be copper-clad with a minimum of 10 mil thickness of copper bonded to a steel core.

B. Rod shall be non-rusting and shall not be covered with enamel or a non-conducting coating.

C. Size shall be ⅝″ diameter by 10 feet length or as shown on the drawings.

2.4 GROUND BUSES

A. General: Ground buses shall be solid copper, ¼″ by 2″ or ¼″ by 4″ rectangular cross section and the length as shown on the drawings.

B. Isolators: Provide ground bus isolators for isolating ground bus from structures and walls. Isolators shall support ground bus a minimum of 1″ from the mounting strap attached to the wall or structure.

2.5 CONNECTORS

A. Exothermic Welds: Exothermic welds shall be a thermite reaction system employing copper oxide and aluminum powder reaction to melt and fuse copper conductors into welded connections.

B. Ground Rod-to-Cable Connector: Exothermic weld.

C. Metal Pipe Connectors: Connectors shall be copper alloy, U-bolt type.

D. Ground Bushings: Bushings shall be malleable iron, zinc plated, insulated throat with screw type wire connector.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions under which the work is to be installed, and notify the Architect/Engineer in writing of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.2 COORDINATION

A. Coordinate with other work to ensure that installation is not vulnerable to physical damage.

3.3 APPLICATION

A. General: The entire electrical system and building structure shall be grounded. The following items of equipment, appurtenances, and as required by Article 250 of NEC, shall be grounded:

1. Electrical service, equipment, and enclosures.
2. Conduits and raceways.
3. Neutral and ground conductors.
4. Switches and panels.
5. Motor frames, control cabinets, and lighting fixtures.

B. All metallic conduits, supports, cabinets, and all the other electrical equipment shall be permanently and effectively grounded. All grounded shall be in accordance with the applicable code, and shall meet the approval of the local Inspection Department.

C. All metallic raceways shall be mechanically and electrically continuous. Where non-conductive raceways are installed, provided separated equipment grounding conductors bonded to pull and/or junction boxes at each end of each conduit run.

D. Furnish and install a separate equipment grounding wire with each branch circuit conduit, routed with the phase and neutral wires, NEVER in a separate conduit.

E. Equipment grounding wire to be routed in conduit along the phase and neutral wires (NEVER in separate conduit).

F. Exothermic Welds

1. Provided exothermic welds for the following:
   a. Ground rod to cable.
   b. Cable to cable (below grade).
   c. Cable to structural steel.
2. Comply with AWS Code for procedures, appearance, and quality of welds, and for methods used in correcting welding work. The manufacturer's specific instructions and molds shall be used for every weld.

G. Connectors: Provide mechanical connections for the following:

1. Cable-to-pipe
2. Cable-to-ground bus or as otherwise noted on the drawings

H. Bonding Jumpers: Bonding jumpers shall be installed where continuity of piping or metal must be maintained or as required by NEC.

3.4 INSTALLATION

A. Install grounding systems as indicated, in accordance with equipment manufacturer's written instructions and with recognized practices. Comply with applicable requirements of UL 467, UL 486A, NFPA 78 ANSI/IEEE 80, and applicable NEMA standards, to ensure that products fulfill requirements.

B. Connectors

1. Provide mechanicals connections as specified.
2. Remove non-conductive coatings such as paint, lacquer, and enamel on surfaces of equipment to be grounded.
3. Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values for connectors and bolts. Where manufacturer's torquing requirements are not indicated, tighten connections to comply with tightening torque values specified in UL 468A to assure permanent and effective grounding.
4. Apply corrosion-resistant finish to field connections, buried metallic grounding and bonding products, and places where factory-applied protective coatings have been destroyed, which are subjected to corrosive action.
5. No connections below grade shall be covered before inspection by the Architect/Engineer.

C. Bonding Jumpers: Install on water meters and where expansion joints or dielectric unions are used.

D. Ground Bushings: Where a conduit enters a metal enclosure without a ground bus, a ground bushing shall be provided to terminate ground conductor.

E. Manholes: Metal parts and materials in manholes shall be grounded by a No. 4/0 bare copper conductor and connected to the manhole ground rod-and-cable-system ground.

F. Switchgear: Switchgear shall be grounded with a minimum No. 4/0 bare copper conduct to the building ground system or as shown on the drawings.

END OF SECTION

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SECTION 16120
CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Scope: The work specified in this section includes, but shall not be limited to, providing labor, materials, equipment, and services necessary for the electrical work as shown on the drawings and as herein specified.

B. Section includes: building wires, cables, and associated connectors, splices, and terminations for wiring systems rated 600V and less.

1.2 DEFINITION

A. THHN: Heat-resistant thermoplastic insulation

B. THWN: Moisture and heat-resistant thermoplastic insulation

C. XHHW: Moisture-resistant thermoset

1.3 CODES AND STANDARDS

A. NEMA WC3: Rubber-insulated wire and cable for the transmission and distribution of electrical energy.

B. NEMA WC5: Thermoplastic-insulated wire and cable for the transmission and distribution of electrical energy.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: Testing agency as defined by OSHA in 29 CFR 1910.7 or a member company of the International Electrical Testing Association and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the International Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

1.5 SUBMITTALS

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

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products and materials properly packaged in factory fabricated containers and mounted on shipping skids.

B. Store products and materials in clean, dry, heated space. Protect from dirt, fumes, water, construction debris, and traffic. Where necessary to store outdoors, store above grade and enclose with watertight wrapping.

C. Handle products and materials carefully to prevent internal damage, breakage, denting, and scoring enclosure finish. Do not install damaged products or materials. Replace and return damaged products or materials to manufacturer.

1.7 SPARE PARTS

Not Applicable

1.8 WARRANTY

A. The contractor shall warrant all materials, workmanship, and equipment against defects for a period of one year after the date of substantial completion.

B. The contractor shall repair or replace, at no additional cost to Owner, any item that may become defective within the warranty period.

C. The contractor agrees not to void or impair or to allow any sub-contractor to void or impair any warranties regarding products or items installed as part of this project.

D. The repair of faulty workmanship shall be considered to be included in the contract.

1.9 MAINTENANCE

Not Applicable

1.10 PROJECT CONDITIONS

A. Field Measurements: Verify that field measurements are as indicated on the shop drawings and as shown on the drawings

B. Project Location Environment: Furnish and install materials suitable for the altitude, weather, and seismic requirements of the project location.

PART 2 - PRODUCTS

2.1 QUALITY

A. Electrical equipment, devices and associated materials used on this project shall be UL listed and/or labeled.

B. Equipment and devices installed under this division and not constructed with enclosure suited for mounting and protecting all live parts, shall be installed in approved metal cabinets.

2.2 WIRE AND CABLE (600V OR LESS)

A. Wire and cable used in this installation shall be copper and shall have 600 volt insulation unless otherwise noted.

B. The wires used in this installation shall be run in conduits or approved raceways, unless specifically indicated otherwise.

C. Conductors shall conform to the latest requirements of the Code and meet ICEA Specifications. Submit the name of manufacturer for the Engineer/Architect and Owner's approval, before work is started.

D. Acceptable Wire and Cable Manufacturers are:

1. General Cable Corporation (BICC).
2. Southwire.

3. Okonite.
4. Rome.

E. Wire and cable shall be delivered to the project in complete coils with the manufacturer's name and approval tag attached thereto, indicating wire size and type of insulation, and be labeled and listed.

F. Unless otherwise noted, conductors for lighting and power circuits shall be #12 AWG minimum size.

G. Wire for control circuits may be #14 AWG.

H. Wire of #8 AWG size and larger shall be stranded. Wire of #10 and smaller shall be solid.

I. All conductors shall be rated 90 deg C for dry/wet locations.

J. AC branch circuit wiring shall be installed with color-coded conductors throughout the installation as specified in the identification sections of this specification.

2.3 WIRE CONNECTIONS

A. All wire connections shall be made by means of solderless connectors.

B. Split bolt connectors are not acceptable.

C. Clean conductor surfaces before installing lugs and connectors. Apply "no-ox" compound.

D. Use solderless twist type spring connectors (wire nut) with insulating cover for copper wire splices and taps. Use for conductor sizes 10 AWG and smaller. The manufacturers wire fill capacity must be followed.

E. No splices shall be made in a conductor except at outlet boxes, junction boxes, or in splice boxes.

F. Control wires shall be made by crimp connectors.

G. Use high press long barrel, cast copper, compression connectors for splices and joints for wires #8 and higher.

H. Mechanical Connectors: Bolted type tin-plated; high conductivity copper alloy; spacer between conductors; beveled cable entrances.

I. Compression (crimp) Connectors: Long barrel, seamless; tin-plated electrolytic copper tubing; internally beveled barrel ends. Connectors shall be clearly marked with the wire size and type and proper number and location of crimps. Connector must be installed with a crimper tool listed for used with the manufacturer and type of compression connector.

J. Acceptable manufacturers for compression barrel connectors and lugs:

1. Thomas and Betts
2. Hy-Press Corporation
3. FCI Burndy Products

K. The phases of all feeders shall be marked at all taps, joints, splices, and near the lugs at each end with permanently colored tapes. Tapes shall be Minnesota Mining #35 vinyl tape or as approved. Tape un-insulated conductors to 150% of insulation rating of conductor.

2.4 FISH WIRE

A. Conduits which are left empty shall contain fish wire of such a gauge required to pull in wire or cable to fill the conduit as determined by Code.

B. Each length of conduit which is to be used for the telephone system shall contain a #14 gauge nylon fish wire.

C. Terminations of empty conduits shall be properly tagged.

PART 3 - EXECUTION

3.1 CONDUCTOR AND INSULATION APPLICATIONS

A. Service Entrance: Type THHN-THWN, single conductors in raceway or XHHW, single conductors in raceway.

B. Feeders Concealed in Ceilings, Walls, and Partitions: Type THHN, single conductors in raceway.

C. Feeders Concealed in Concrete, Below Slabs-on-Grade, and in Crawlspaces: Type THHN-THWN, single conductors in raceway.

D. Exposed Branch Circuits, Including in Crawlspaces: Type THHN-THWN, single conductors in raceway.

E. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN, single conductors in raceway.

F. Branch Circuits Concealed in Concrete and Below Slabs-on-Grade: Type THHN-THWN, single conductors in raceway.

G. Underground Feeders and Branch Circuits: Type XHHW, single conductors in raceway.

H. Fire Alarm Circuits: Type THHN-THWN, in raceway or power-limited, fire-protective, signaling circuit cable per manufacturer's direction.

I. Class 1 Control Circuits: Type THHN, in raceway.

J. Class 2 Control Circuits: Type THHN, in raceway or power-limited cable, concealed in building finishes, or power-limited tray cable, in cable tray per manufacturer's direction.

3.2 INSTALLATION

A. All wires and cables shall be installed in conduits unless noted otherwise.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

E. Identify and color-code conductors and cables according to Division 16 Section Basic Electrical Materials and Methods, Electrical Identification.

3.3 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

3.4 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified testing agency to perform the following field quality-control testing:

B. Testing: Perform the following field quality-control testing:

1. After installing conductors and cables and before electrical circuitry has been energized, test for proper installation and polarization.
2. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.3.1. Certify compliance with test parameters.

END OF SECTION

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SECTION 16130
RACEWAYS AND BOXES

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. This Section includes raceways, fittings, pull boxes, outlet boxes, floor fittings, surface and tele/power pole raceways, enclosures, and cabinets for electrical wiring.

1.2 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. RMC: Rigid metal conduit (heavy wall steel).

C. FMC: Flexible metal conduit.

D. IMC: Intermediate metal conduit.

E. LFMC: Liquidtight flexible metal conduit.

F. RNC-40: Rigid non-metallic conduit, schedule 40 PVC.

G. RNC-80: Rigid non-metallic conduit schedule 80 PVC.

H. Fittings: Conduit connection or coupling.

I. Body: Enlarged fittings with opening allowing access to the conductors for pulling purposes only.

J. Mechanical Spaces: Enclosed areas, usually kept separated from the general public, where the primary use is to house service equipment and to route services. These spaces generally have exposed structures, bare concrete and non-architecturally emphasized finishes.

K. Finished Spaces: Enclosed areas where the primary use is to house personnel and the general public. These spaces generally have architecturally emphasized finishes, ceilings and floors.

L. Concealed: Not visible by the general public. Often indicates a location either above the ceiling, in the walls, in or beneath the floor slab, in column coverings, or in the ceiling construction.

M. Above Grade: Not directly in contact with the earth. For example, an interior wall located at an elevation below the finished grade shall be considered above grade but a wall retaining earth shall be considered below grade.

N. Slab: Horizontal pour of concrete used for the purposes of a floor or sub-floor.

1.3 CODES AND STANDARDS

A. American National Standards Institute (ANSI)

1. ANSI C80.1 – Rigid Steel Conduit, Zinc-Coated.
2. ANSI C80.3 – Electrical Metallic Tubing, Zinc-Coated and Fittings.
3. ANSI C80.4 – Fittings for Rigid Metal Conduit.
4. ANSI C80.6 – Intermediate Metal Conduit, Zinc-Coated.
5. ANSI/NEMA OS-1 – Sheet Steel Outlet Boxes, Device Box Covers and Bottom Supports.

6. ANSI/NEMA OS-2 – Non-Metallic Outlet Boxes, Device Boxes, and Box Support.

B. Federal Specifications (FS)

1. WC-586 – Conduit Outlet Boxes, Bodies, and Entrance Caps, Electrical Cast Metal.
2. WC-408 – Fittings for Conduit, Metal, Rigid, (Thick-Wall and Thin-Wall [EMT] Type).
3. WC-1904A – PVC Rigid Non-Metallic Conduit.
4. WC-563A – Electrical Metallic Tubing.
5. WC-566 – Specification for Flexible Metal Conduit.
6. WC-581E – Specification for Galvanized Rigid Conduit.

C. NECA "Standard of Installation"

D. National Electrical Manufacturers Association (NEMA)

1. ANSI/NEMA FB 1 – Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
2. RN 2 – Packaging of master bundles for Steel Rigid Conduit, Intermediate Metal Conduit, and Electrical Metallic Tubing.
3. TC 2 – Rigid Non-Metallic Conduit, PVC Schedule 40 (EPC-40) and Schedule 80 (EPC-80) PVC.
4. TC 3 – Rigid Non Metallic Conduit and electrical Non-Metallic Tubing Fittings.
5. TC 6 – PVC and ABS Plastics Utilities Duct for Underground Installation.
6. TC-8 – Extra-Strength PVC Plastic Utilities Duct for Underground Installation
7. TC-9 – PVC and ABS Plastic Utilities Duct and Fittings for Underground Installation.
8. TC 10 – PVC and ABS Plastic Communications Duct and Fittings for Underground Installation.
9. TC 13 – Electrical Non-Metallic Tubing.
10. TC 14 – Filament-Wound Reinforced Thermosetting Resin Conduit and Fittings.
11. TC 18 – Packaging of Master Bundles for EPC 40 (Polyvinyl Chloride) Conduit.
12. NEMA 250 – Enclosures for Electrical Equipment (1,000 volts maximum).

E. National Fire Protection Association (NFPA)

1. ANSI/NFPA 70 – National Electrical Code

F. Underwriters Laboratories (UL): Applicable Listings

1. UL 1 – Flexible Metal Conduit.
2. UL 6 – Rigid Metal Conduit.
3. UL 360 – Liquid Tight Flexible Steel Conduit.
4. UL 514-B – Fittings for Conduit and Outlet Boxes.
5. UL 651-A – Type EB and a PVC Conduit and HDPE Conduit.
6. UL 797 – Electrical Metal Tubing.
7. UL 1242 – Intermediate Metal Conduit.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

C. Contractor's Quality Assurance Responsibilities: The Contractor shall be solely responsible for quality control of the work.

D. Manufacturer's Qualifications: Firms shall be engaged in the manufacture of products and materials of types and sizes required, and whose products have been in satisfactory use in similar service for not less than five years.

E. Contractor's Qualifications: Firms shall have at least five years of successful installation experience with projects utilizing products and materials similar to that required for this Project.

F. Regulatory Requirements: Comply with applicable requirements of the laws, codes, ordinances, and regulations of Federal, State, and Municipal authorities having jurisdiction. Obtain approvals from such authorities.

G. Installation: Comply with NECA National Electrical Installation standards for electrical construction methods.

1.5 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: Show fabrication and installation details of components for raceways, fittings, enclosures, cabinets, floor boxes, pull boxes, and outlet boxes.

C. Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items. Show the following:

1. Ceiling suspension assembly members.
2. Method of attaching hangers to building structure.
3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

D. Manufacturer Seismic Qualification Certification: Submit certification that enclosures, cabinets, accessories, and components will withstand seismic forces as listed for the zone of work that construction occurs. Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

   a. The term "withstand" means "the 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 DELIVERY, STORAGE, AND HANDLING

A. Deliver products and materials properly packaged in factory fabricated containers and mounted on shipping skids.

B. Store products and materials in clean, dry, heated space. Protect from dirt, fumes, water, construction debris, and traffic. Where necessary to store outdoors, store above grade and enclose with watertight wrapping.

C. Handle products and materials carefully to prevent internal damage, breakage, denting, and scoring enclosure finish. Do not install damaged products or materials. Replace and return damaged products or materials to manufacturer.

1.7 SPARE PARTS

Not Applicable

1.8 WARRANTY

A. The contractor shall warrant all materials, workmanship, and equipment against defects for a period of one year after the date of substantial completion.

B. The contractor shall repair or replace, at no additional cost to Owner, any item that may become defective within the warranty period.

C. The contractor aggress not to void or impair or to allow any sub-contractor to void or impair any warranties regarding products or items installed as part of this project.

D. The repair of faulty workmanship shall be considered to be included in the contract.

1.9 MAINTENANCE

Not Applicable

1.10 PROJECT CONDITIONS

A. Field Measurements: Verify that field measurements are as indicated on the shop drawings and as shown on the drawings.

B. Project Location Environment: Furnish and install materials suitable for the altitude, weather, and seismic requirements of the project location.

1.11 COORDINATION

A. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations that follow.

1. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.

B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

A. Rigid Steel Conduit: (Heavy Wall), hot-dipped galvanized with threaded fittings.

B. IMC: zinc-coated steel, with threaded fittings.

C. Plastic-Coated Steel Conduit: NEMA RN 1, with threaded fittings.

D. Plastic-Coated IMC: NEMA RN 1, with threaded fittings.

E. EMT: zinc-coated steel, with insulated throat compression fittings (no set screw).

F. FMC: Zinc-coated steel, with insulated throat squeeze-type connectors.

G. LFMC: Zinc-coated steel with sunlight-resistant and mineral oil-resistant PVC jacket.

H. Fittings: compatible with conduit and tubing materials.

2.2 NONMETALLIC CONDUIT AND TUBING

A. RNC: Schedule 40 and Schedule 80 PVC.

B. RNC Fittings: match to conduit or tubing type and material.

2.3 METAL WIREWAYS

A. Manufacturers:

1. Hoffman.
2. Square D.
3. Approved Equal.

B. Material and Construction: Sheet metal sized and shaped as indicated, NEMA rating as indicated on the electrical drawings.

C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.

E. Wireway Covers: Hinged type, screw-cover type, or flanged-and-gasketed type as indicated on the electrical drawings.

F. Finish: Manufacturer's standard enamel finish.

2.4 SURFACE RACEWAYS AND TELE/POWER ROLE RACEWAYS

A. Surface Metal Raceways: Galvanized steel with snap-on covers. Finish with manufacturer's standard prime coating standard enamel finish unless noted on the electrical drawings.

1. Available manufacturers:

a. Thomas & Betts Corporation.
b. Walker Systems, Inc.; Wiremold Company (The).
c. Wiremold Company (The); Electrical Sales Division.

B. Types, sizes, and channels as indicated and required for each application, with fittings that match and mate with raceways.

2.5 BOXES, ENCLOSURES, AND CABINETS

A. Available manufacturers:

1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. Appleton Electric Company.

3. Erickson Electrical Equipment Co.
4. Hoffman.
5. Hubbell, Inc.; Killark Electric Manufacturing Co.
6. O-Z/Gedney; Unit of General Signal.
7. RACO; Division of Hubbell, Inc.
8. Spring City Electrical Manufacturing Co.
9. Thomas & Betts Corporation.
10. Walker Systems, Inc.; Wiremold Company (The).
11. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.

B. Construction:

1. Sheet Metal Outlet and Device Boxes: Galvanized Steel.
2. Cast-Metal Outlet and Device Boxes: Type FD, with gasketed cover.
3. Floor Boxes: Cast metal, fully adjustable, rectangular.
4. Small Sheet Metal Pull and Junction Boxes: Screwcover or hinged as shown on the electrical drawing.
5. Cast-Metal Pull and Junction Boxes: Cast aluminum with gasketed cover.
6. Cabinets: Galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage and include accessory feet where required for freestanding equipment.

2.6 PULL BOXES

A. Provide pull boxes as shown on the plans and where necessary to meet code and specification requirements for proper installation of associated wiring systems.

B. Pull boxes shall be sized in accordance with the National Electric Code, NFPA 70.

C. Boxes indicated on the plans are not intended to be drawn to scale.

D. Conduit runs of more than 100 feet or with more than the equivalent of three 90 degree bends shall have suitable pull boxes installed in convenient intermediate locations. Such pull boxes shall be shown on the shop drawings and construction record drawings.

E. Pull boxes over 100 cubic inches shall be supported independently of the conduits.

F. Pull boxes shall be accessible after completion of installation.

2.7 OUTLET BOXES

A. Boxes for Suspended or Bracket Mounted Lighting Fixtures: Ceiling outlets and bracket outlets which are to support lighting fixtures shall be equipped with a ⅜" malleable iron fixture stud securely fastened into the outlet box.

B. Flush Mounted Boxes (in plaster, drywall, poured concrete, smooth tile):

1. Outlet boxes for duplex receptacles, single and two-gang toggle switches, shall be a minimum of 4" square by 1½" deep.
2. Outlet boxes for other devices installed under similar conditions shall be a minimum of 4" square 1½" deep.
3. Where more than two conduits enter an outlet box, a 2 ⅛" deep box shall be used, except in columns.

4. Where three or more gangs of devices are required, solid gang boxes a minimum of 4 ½" high by 1⅝" deep shall be used.
5. Provide suitable plaster rings as required.
6. Provide minimum of ½" deep tile covers as required.

C. Flush Mounted Data/Telephone or Clock Outlet Boxes: Outlet boxes which are to be used as data/telephone outlets or clock outlets shall conform to the requirements of switch and receptacle outlets, employing a single gang opening in the plaster cover, unless noted otherwise on the electrical drawings.

D. Capped Outlet Boxes: Outlet boxes which are indicated as capped outlet boxes shall employ flat metal cover plates, fastened to the outlet box with screws.

E. Surface Mounted Outlet Boxes: Where outlet boxes are to be installed exposed on ceiling or wall surfaces, the boxes shall be specifically designed for such a type of installation and shall be square or rectangular as required. Device plates shall match the contour of the boxes and shall be of the type manufactured for these particular type boxes. In finished areas, all boxes shall be flush mounted unless specifically noted otherwise.

F. Suspended Ceiling Outlet Boxes:

1. Where outlet boxes are installed in suspended ceiling cavities for the purpose of splicing fixture wire, branch circuit conductors and for connecting flexible metallic conduit between this box and the lighting fixtures, such boxes shall be of the size required by code requirements pertaining to the number of conductors entering and leaving the box. Minimum box size shall be 4" square by 1½" deep.
2. Each box shall be secured to the ceiling channel irons or building structure and shall have its opening facing the nearest recessed lighting fixture.
3. All boxes shall have covers or device plates as required.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors:

1. Exposed: Rigid steel or IMC.
2. Concealed: Rigid steel or IMC.
3. Underground, concrete encased beyond 5'0" of building: RNC-40.
4. Underground, non-concrete encased beyond 5'0" of building: RNC-80
5. Connection to Vibrating Equipment (including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
6. Boxes and Enclosures: NEMA 250, Type 3R or Type 4.

B. Indoors:

1. Exposed Dry Locations: EMT.
2. Concealed in Interior Partition: EMT.
3. Connection to Vibrating Equipment (including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except use LFMC in damp or wet locations.
4. Damp or Wet Locations: RMC or IMC.
5. Concealed in Concrete or Block Walls: RMC or IMC.

6. Mechanical Rooms and Penthouses: RMC or IMC.
7. Imbedded in Concrete Slabs: RMC or IMC.
8. Boxes and Enclosures: NEMA 250, Type 1, except as follows:
   a. Damp or Wet Locations: NEMA 250, Type 4, stainless steel.

C. Minimum Raceway Size: ¾" trade size (DN 21).

D. Raceway Fittings: Compatible with raceways and suitable for use and location.
   1. Rigid Steel and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
   2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings approved for use with that material. Patch all nicks and scrapes in PVC coating after installing conduits.

3.2 INSTALLATION

A. Keep raceways at least 6" (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

B. Complete raceway installation before starting conductor installation.

C. Support raceways as specified in Division 16 Section "Basic Electrical Materials and Methods."

D. Install temporary caps to prevent foreign matter from entering raceways.

E. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portions of bends are not visible above the finished slab.

F. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and keep straight legs of offsets parallel, unless otherwise indicated.

G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
   1. Install concealed raceways with a minimum of bends in the shortest practical distance, considering type of building construction and obstructions, unless otherwise indicated.

H. Raceways Embedded in Slabs: Install in middle 1/3 of slab thickness where practical and leave at least 2" (50 mm) of concrete cover.
   1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
   2. Space raceways laterally to prevent voids in concrete.
   3. Run conduit larger than 1" trade size (DN 27) parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
   4. Change from nonmetallic tubing to Schedule 80 nonmetallic conduit, rigid steel conduit, or IMC before rising above the floor.

I. Install exposed raceways parallel or at right angles to nearby surfaces or structural members and follow surface contours as much as possible.
   1. Run parallel or banked raceways together on common supports.

2. Make parallel bends in parallel or banked runs. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.

J. Join raceways with fittings designed and approved for that purpose and make joints tight.

K. Terminations:

1. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Use two locknuts, one inside and one outside box.
2. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.

L. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength.

M. Telephone and Signal System Raceways, 2" Trade Size (DN 53) and Smaller: In addition to above requirements, install raceways in maximum lengths of 150 feet (45 m) and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.

N. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where otherwise required by NFPA 70.

O. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used 6" (150 mm) above the floor. Install screwdriver-operated, threaded plugs flush with floor for future equipment connections.

P. Flexible Connections: Use maximum of 72" (1830 mm) of flexible conduit for recessed and semi-recessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use LFMC in damp or wet locations. Install separate ground conductor across flexible connections.

Q. Install hinged-cover enclosures and cabinets plumb. Support at each corner.

R. Bushings

1. Provide bushings wherever IMC, RMC, or EMT conduit is terminated, including stub-outs, and locations not provided with connection fittings or boxes.
2. Insulated Bushings
   a. Provide insulated bushings or connections for IMC, RMC, or EMT conduit terminations.

b. Insulated bushings shall be OZ/Gedney Co., Type PBP for rigid conduit or Type "SBT" for EMT, or approved equal.

3. Grounded Type Insulated Bushings

a. Provide grounded type insulated bushings for all electric service and distribution feeder conduits, including stub-outs.

b. Bushings shall be properly grounded and/or bonded.

c. Ground type insulated bushings shall be OZ/Gedney Co. Type "BLG" or approved equal.

4. Insulating Bushings

a. Provide insulating bushings where cables pass through walls of metal enclosures. Bushings shall be OZ/Gedney Co. Type "BBL" or "ABB" or approved equal.

b. Insulated bushings shall be used at ends of threaded rigid conduits and threaded fittings. Provide double locknuts when terminated in enclosure.

c. Bushings shall be OZ/Gedney Co. Type "A" or approved equal.

S. Rigid Conduit Fittings and Couplings

1. Running threads shall not be used on conduit for connection at couplings.

2. IMC and RMC conduits shall be joined by approved threaded couplings.

a. Threadless couplings and connectors are not acceptable.

b. Set screw couplings are not acceptable.

c. Split couplings are not acceptable.

3. Joints in conduit which are installed under or in the floor slab, or in exterior walls shall be made watertight by using T&B Kopr-shield thread compound on each joint.

T. Electric Metallic Tubing (EMT) Conduit Fittings and Couplings

1. Only insulated throat type compression fittings shall be used.

2. Only compression-type fittings shall be used, set screw fittings and couplings are not acceptable.

U. Couplings and unions shall be mechanically strong and shall be so installed to make a continuous bond between the conduits connected.

3.3 PULLING COMPOUND

A. If it is desired to use a pulling compound on wire and cable, first obtain the approval of the Engineer/Architect before employing such compounds. Compound shall be UL listed and compatible with conductor insulation covering.

B. Conduits shall be swabbed until moisture and dirt are removed and before wires are pulled or cables are installed.

3.4 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.5 CLEANING

A. After completing installation of exposed, factory-finished raceways and boxes, inspect exposed finishes and repair damaged finishes.

END OF SECTION

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SECTION 16140
WIRING DEVICES

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Scope: The work specified in this section includes, but shall not be limited to, providing labor, materials, equipment, and services necessary for the electrical work shown on the drawings and as herein specified.

B. Section includes: receptacles, dimmer switches, toggle switches, and finish plates.

1.2 DEFINITIONS

A. GFI: Ground-fault circuit interrupter.

1.3 CODES AND STANDARDS

A. FS W-C-596 – Electrical Power Connector, Plug, Receptacle, and Cable Outlet.

B. FS W-S-896 – Switch, Toggle.

C. NEMA WD 1 – General Color Requirements for Wiring Devices.

D. NEMA WD 6 – Wiring Devices – Dimensional Requirements.

E. UL 1472 – Solid State Dimming Controls.

F. UL 943 – Standard for Ground Fault Circuit Interrupters.

G. UL 498 – Standard for Attachment Plugs and Receptacles.

H. UL 20 – Standard for General Use Snap Switches.

I. DSCC W-C-896F – General Specification for Electrical Power Connector.

1.4 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.

B. Comply with NFPA 70.

1.5 SUBMITTALS

A. Product Data: For each product specified.

B. Shop Drawings: Legends for receptacles and switch plates.

C. Samples: For devices and device plates for color selection and evaluation of technical features.

D. Maintenance Data: For materials and products to include in maintenance manuals specified in Division 1.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products and materials properly packaged in factory fabricated containers and mounted on shipping skids.

B. Store products and materials in clean, dry, heated space. Protect from dirt, fumes, water, construction debris, and traffic. Where necessary to store outdoors, store above grade and enclose with watertight wrapping.

C. Handle products and materials carefully to prevent internal damage, breakage, denting, and scoring enclosure finish. Do not install damaged products or materials. Replace and return damaged products or materials to manufacturer.

1.7 SPARE PARTS

Not Applicable

1.8 WARRANTY

A. The contractor shall warrant all materials, workmanship, and equipment against defects for a period of one year after the date of substantial completion. Certain equipment shall be warranted at the time of final acceptance, or for longer periods of time as specified in those sections of the project manual.

B. The contractor shall repair or replace, at no additional cost to Owner, any item that may become defective within the warranty period.

C. Any manufacturer's warranties concerning any item installed shall be to the benefit of Owner.

D. The contractor agrees not to void or impair or to allow any sub-contractor to void or impair any warranties regarding products or items installed as part of this project.

E. The repair of faulty workmanship shall be considered to be included in the contract.

1.9 MAINTENANCE

Not Applicable

1.10 PROJECT CONDITIONS

A. Field Measurements: Verify that field measurements are as indicated on the shop drawings and as shown on the drawings.

B. Project Location Environment. Furnish and install materials suitable for the altitude, weather, and seismic requirements of the project location.

1.11 COORDINATION

A. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.

B. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.

C. Receptacles for Owner-Furnished Equipment: Match plug configurations.

1. Cord and Plug Sets: Match equipment requirements.

PART 2 - PRODUCTS

2.1 SWITCHES AND RECEPTACLES

A. Provide the various switches and receptacles shown on the plans.

B. In general, the color of all devices shall be brown or ivory. UPS protected receptacles shall have an orange nylon face, emergency system receptacles shall have a red nylon face, and surge suppression shall have a blue nylon face.

C. All devices shall be Underwriters' Laboratories listed, Federal specification listed, heavy-duty type. Receptacles shall be grounding type.

D. Devices shall be manufactured by the following:

1. Duplex receptacles, 20 Ampere, 125 Volt

a. Standard duplex Ivory

(1) P&S/Legrand #5362
(2) Hubbell #HBL5352
(3) Leviton #5362
(4) Cooper #5362

b. Ground Fault Circuit Interrupter (GFI) Ivory

(1) P&S/Legrand #1591 (Hospital Grade # 2091-HG)
(2) Hubbell #GF5362 (Hospital Grade # HFG 8300)
(3) Leviton #6899-HG (Hospital Grade #6898-HG)
(4) Cooper #GF20 (Hospital Grade #HGF20)

2. Toggle switches 20A, 120-277V Ivory

a. Single Pole

(1) Hubbell 1221
(2) P&S/Legrand #20AC1
(3) Leviton #1221
(4) Cooper #2221

b. Three Way:

(1) Hubbell 1223
(2) P&S/Legrand #20AC3
(3) Leviton #1223
(4) Cooper #2223

c. Four Way: HBL1224

(1) Hubbell 1224
(2) P&S/Legrand #20AC4
(3) Leviton #1224
(4) Cooper #2224V

2.2 OCCUPANCY SENSORS

A. All occupancy sensors shall be hardwired type; battery type shall not be permitted.

B. Wall Mounted (Wall Switch Type)

1. The sensor shall use either passive infrared or, if dual technology, passive infrared and passive acoustic sensing, or passive infrared and ultrasonic, for detecting room occupancy. The unit shall fit in/on a standard single gang switch box.
2. Rated capacity: 600 watts minimum at 120 volts, 60 Hz; 1000 watts minimum at 277 volts, 60 Hz

3. Sensitivity shall be user adjustable or self adjusting type.
4. The delay timer shall be adjusted within a range of 6 to 30 minutes by the contractor in the field. The sensor shall have a test mode for performance testing.
5. The off switch shall have manual override for positive off and automatic on.
6. The test LED shall indicate motion.
7. The area of coverage shall be approximately 180 degrees by 35-40 feet.
8. The unit shall have a five year warranty.

C. Ceiling Mounted

1. The sensor shall use either passive infrared or, if dual technology, passive infrared and passive acoustic sensing, or passive infrared and ultrasonic, for detecting room occupancy. The unit shall fit in/on a standard octagon box. All ceiling mounted sensors shall be installed to a box with ring and box support.
2. Rated capacity shall be 20 amps at 120 or 277 volts, for fluorescent lamps. Provide power pack as required for low voltage sensors.
3. Sensitivity shall be user adjustable or self adjusting type.
4. The delay timer shall be adjusted within a range of 6 to 30 minutes by the contractor in the field. The sensor shall have a test mode for performance testing.
5. The coverage area shall be 360 degrees by approximately 15 feet radius when mounted at 9 foot height. The sensor shall have provisions, such as masking, to block out problem areas.
6. Test LED to indicate motion.
7. The unit shall have a five year warranty.

2.3 DEVICE PLATES

A. Device plates shall be of same manufacture as device, and shall be flat surface type.

B. Device plates in mechanical and electrical equipment rooms and unfinished areas shall be cadmium-plated steel.

C. Device plates in finished areas shall be stainless steel Type 302.

D. All multi-gang plates shall be one piece.

E. Plates for outlet boxes shall contain a label for identifying circuit number and panel source. See specification section 16050, "Electrical Identification," for additional information.

2.4 POWER OUTLETS

A. Power outlets for equipment requiring outlets other than standard duplex receptacle configurations shall match the "NEMA" rating of the equipment to be served or as specified on the electrical drawings.

B. Manufacturers of power outlets shall match those specified under duplex receptacles.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install devices and assemblies plumb and secure.

B. Install wall plates when painting is complete.

C. Install wall dimmers to achieve indicated rating after derating for ganging as instructed by manufacturer.

D. Do not share neutral conductor on load side of dimmers.

E. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical, and grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

F. Protect devices and assemblies during painting.

G. Adjust locations at which floor service outlets and telephone/power service poles are installed to suit arrangement of partitions and furnishings.

3.2 OCCUPANCY SENSORS

A. Provide a minimum of 4' of coiled cable for ceiling-mounted sensors.

B. Sensitivity Test: After the sensor has been energized for at least 15 minutes, walk to the middle of the room (if conference room) or sit at the normal desk position (if and office). Make no motion for 20 seconds. Move one arm up and down slowly. The test LED should blink.

C. Time Delay Test: Set the time delay for 10 minutes. Walk into the room to activate the sensor then leave room. Sensor must turn lights off at approximately 10 minutes. Walk into the room again to reactivate the lights. Lights should activate within 1 second.

D. All occupancy sensors should be programmed to their maximum time setting.

3.3 IDENTIFICATION

A. Comply with Division 16 Section "Electrical Identification."

B. Comply with Division 16 Section "Basic Electrical Materials and Methods."

1. Switches: Where three or more switches are ganged, and elsewhere as indicated, identify each switch with approved legend engraved on wall plate.
2. Receptacles: Identify panelboard and circuit number from which served. Use machine-printed, pressure-sensitive, abrasion-resistant label tape on face of plate and durable wire markers or tags within outlet boxes.

3.4 CONNECTIONS

A. Connect wiring device grounding terminal to outlet box with bonding jumper.

B. Connect wiring device grounding terminal to branch-circuit equipment grounding conductor.

C. Isolated-Ground Receptacles: Connect to isolated-ground conductor routed to designated isolated equipment ground terminal of electrical system.

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.

3.5 FIELD QUALITY CONTROL

A. Test wiring devices for proper polarity and ground continuity. Operate each device at least six times.

B. Check TVSS receptacle indicating lights for normal indication.

C. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.

D. Replace damaged or defective components.

3.6 CLEANING

A. Internally clean devices, device outlet boxes, and enclosures. Replace stained or improperly painted wall plates or devices.

END OF SECTION

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SECTION 16410
SAFETY AND DISCONNECT SWITCHES/ENCLOSED CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. This Section includes the following:

1. Equipment disconnects.
2. Motor-circuit disconnects.
3. Molded case circuit breaker in an individual enclosure.

1.2 DEFINITIONS

Not Applicable

1.3 CODES AND STANDARDS

A. NEMA KS-1 – Enclosed Switches

B. NFPA 70 (NEC)

1.4 QUALITY ASSURANCE

A. Comply with codes for components and installation.

B. Listing and Labeling: Provide products specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.
2. Listing and Labeling Agency Qualifications: A Nationally Recognized Testing Laboratory (NRTL) as defined in OSHA Regulation 1910.7.

C. Single-Source Responsibility: All enclosed switches and circuit breakers shall be the product of a single manufacturer.

1.5 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data for switches and accessories specified in this Section.

C. Descriptive data and time-current curves for protective devices and let-through current curves for those devices with current-limiting characteristics. Include coordination charts and tables, and related data.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

B. Where recommended by the equipment supplier, deliver equipment in fully enclosed vans after specified environmental conditions have been permanently established in spaces where equipment is to be placed. The products accepted on the site shall be wrapped in factory packing and shall be inspected for damage prior to acceptance.

C. Store equipment in clean, dry with non-condensing environments that are controlled within manufacturer's ambient tolerances for non-operating equipment. Protect from weather, dirt, fumes, water, construction debris, and physical damage.

D. Handle equipment carefully to prevent damage, breaking, and scoring. The contractor shall not install damaged units or components; replace with new.

E. Equipment furnished by others. The contractor shall be responsible for receiving, uncrating, inspecting, storing, and installing of Division 16 equipment listed as furnished by others.

1.7 SPARE PARTS

Not Applicable

1.8 WARRANTY

A. Motor and circuit disconnects and breakers shall be warranted for a minimum period of one year after project completion, or longer if manufacturer's warranty allows.

1.9 MAINTENANCE

Not Applicable

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide enclosed switches and circuit breakers by one of the following:

1. Safety Switches:
   a. General Electric
   b. Square D
   c. Cutler-Hammer
2. Circuit Breakers:
   a. General Electric
   b. Square D
   c. Cutler-Hammer

2.2 GENERAL

A. Disconnect and Safety Disconnect Switches:

1. General: Provide heavy duty surface-mounted safety switches for motors and equipment unless otherwise indicated, of types, sizes, and electrical characteristics as indicated on the electrical drawings and equipment schedules.
2. Switch Interiors: Switches shall have switch blades which shall be fully visible in the off position when the enclosure door is open. Current carrying parts shall be plated copper and switch contacts shall be silver-tungsten. Lugs shall be removable and shall be UL-listed for 75 degrees C, copper wire.
3. Switch Operator: Switches shall be quick-made, quick-break type. The operating handle shall be an integral part of the enclosure base and shall be padlockable in the off position. The handle position shall indicate whether the switch is in the on or off position.

4. Interlock Contacts: Provide two Form C auxiliary, 10 ampere, 300V rated contacts. The contacts shall provide for two normally open and two normally closed contacts for switch open or closed position.

B. Circuit Breakers:

1. All circuit breakers shall comply with NEMA ABI and FSW-C-375.
2. Circuit breakers shall be securely bolted to the enclosure and be flush with the box assembly.
3. Circuit breakers shall have over center toggle mechanism with quick-make, quick break action, common trip for all pole positions, and a handle position indicator with breaker rating imprinted in a location easily verified without removing the box cover.
4. Circuit breakers for heating, air conditioning, refrigeration and all motor loads shall be HCAR rated.
5. Circuit breaker size(s) shall be listed on the electrical plan drawings or equipment schedule.

2.3 ENCLOSURES

A. NEMA 1: Provide NEMA 1 general purpose enclosures for indoor installation unless otherwise indicated on the drawings. Enclosure covers shall be attached with pin type hinges. Enclosures shall have a gray baked enamel finish, electrodeposited on clean, phosphatized steel.

B. NEMA 3R: Provide NEMA 3R general purpose enclosures for outdoor installation unless otherwise indicated on the drawings. Enclosure cover shall be attached with pin type hinges and shall be securable in the open position. NEMA 3R enclosures shall be manufactured from galvanized steel. Enclosures shall have a gray baked enamel finish, electrodeposited on cleaned, phosphatized steel. Provide rainproof bolt-on hubs.

2.4 RATINGS

A. General: Provide heavy duty safety switches and circuit breakers with ampere rating as shown on the drawings.

B. Horsepower-Rated: Safety switches shall be horsepower-rated for 250, 480, and 600V, AC and DC, and shall be rated for the motor driven loads supplied by the switch.

C. Short Circuit Rating: Safety switches with Class RK1 or Class L fuses shall have a UL short circuit rating of 100,000 amperes RMS symmetrical minimum.

D. Circuit breakers shall have a UL short circuit rating of 65,000 amperes RMS symmetrical minimum.

2.5 IDENTIFICATION

A. Each disconnect switch, circuit breaker, and shunt trip control panel shall have an engraved, laminated bakelite nameplate attached to the outside of the enclosure. The nameplate shall include the switch or breaker designation and the equipment it serves. Attach the nameplate by screws or rivets. See Division 16, Section 16050.

2.6 ELECTRICAL INTERLOCKS

A. Provide electrical interlock switches on disconnects as specified herein. The interlock switches shall open prior the opening of the power switch and close only after the power

switch has been enclosed. Provide two sets normally open (NO) and normally closed (NC) switches for each disconnect.

B. Provide the necessary control wiring to the interlock switch to disconnect the control circuit from the motor controller.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install enclosed switches, breakers, and control panels in locations as indicated, according to manufacturer's written instructions. Comply with all applicable requirements of electrical installations and for the seismic zone of this project.

B. Install enclosures level and plumb.

C. Install wiring between enclosed switches and control/indication devices as required.

D. Connect switches, breakers, panels, enclosures, and components to wiring system and to equipment ground as indicated and 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 torque requirements are not indicated, tighten connectors and terminals according to tightening torques specified in UL Standard 486A.

E. Mounting: Mount enclosures on building structures adjacent to equipment unless otherwise noted. Enclosures shall not be mounted on equipment served, unless it is a part of a preassembled control panel. If building structure is not adjacent to the equipment, provide a separate unistrut rack with supports, clear of equipment, for mounting of switch and breaker enclosure. Conduits shall not be used for the support means.

F. Location:

1. Disconnects and breaker enclosures shall be readily accessible and shall not interfere with removal of equipment parts or with standard maintenance. Disconnects and breaker enclosures shall be installed with their top at 5½ feet above the floor unless otherwise noted on the drawings.

3.2 FIELD QUALITY CONTROL

A. Testing Agency: Owner will employ and pay an independent testing agency to perform specified field quality-control testing.

3.3 CLEANING

A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish including chips, scratches, and abrasions.

3.4 FLASH PROTECTION WARNING SIGNS

A. The electrical contractor shall provide all flash protection warning signs as required by the NEC Article 100.16. Warning signs shall conform to the requirements of NFPA 70E.

1. All electrical equipment such as switchboards, panelboards, control panels, meter socket enclosures, and motor control centers, that are likely to require

examination, adjustment, servicing, or maintenance while energized shall be field marked to warn qualified persons of potential electrical hazards. The marking shall be located so as to be clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment. \

2. All warning signs MUST be installed before owner's personnel are trained on the use of the equipment.

3.5 DEMONSTRATION

A. Train Owner's maintenance personnel on procedures and schedules for start-up and shutdown, troubleshooting, servicing, and preventive maintenance.

B. Review data in the "Operating and Maintenance Manual." Refer to Division 1 Section "Project Closeout."

C. Schedule training with Owner through the Architect with at least 7 days' advance notice.

END OF SECTION

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SECTION 16442
PANELBOARDS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Scope: The work specified in this section includes, but shall not be limited to, providing labor, material, equipment, and services necessary for panelboards as shown on the drawings and as herein specified.

B. Section Includes: The work specified in this section includes, but shall not be limited to, providing the following:

1. Power distribution panelboards.
2. Branch circuit panelboards.
3. Surge Suppression Devices

1.2 DEFINITIONS

A. DP or PP: Power Distribution Panel

B. LP: Lighting Panel

C. RP: Branch Circuit Panel

D. MP: Modular Panel

E. TVSS: Transient Voltage Surge Suppressor.

1.3 CODES AND STANDARDS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

B. The edition/revision of the referenced publications shall be the latest date as of the date of the Contract Documents, unless otherwise specified.

C. Federal Specifications (FS):

1. FS W-C-375B "Circuit Breakers, Molded Case, Branch Circuit and Service."
2. FS W-F-870 "Fuseholders and Fuse clips (for Plug and Enclosed Cartridge Fuses)."
3. FS W-P-115C "Panel, Power Distribution," Type 1, Class 1.
4. FS W-S-865 "Switch Box (Enclosed), Surface Mounted."

D. National Electrical Manufacturers Association (NEMA):

1. NEMA 250 "Enclosures for Electrical Equipment (1000 Volts Maximum)" (copyrighted by NEMA, ANSI approved).
2. NEMA AB 1 "Molded Case Circuit Breakers and Molded Case Switches."
3. NEMA KS 1 "Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)" (copyrighted by NEMA, ANSI approved).
4. NEMA PB 1 "Panelboards" (copyrighted by NEMA, ANSI approved).
5. NEMA PB 1.1 "General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less."

E. National Fire Protection Association (NFPA):

1. NFPA 70 "National Electrical Code" (copyrighted by NFPA, ANSI approved) - hereinafter referred to as NEC.

F. Underwriters Laboratories, Inc. (UL):

1. UL 50 "UL Standard for Safety – Cabinets and Boxes" (copyrighted by UL, ANSI approved).
2. UL 67 "UL Standard for Safety – Panelboards" (copyrighted by UL, ANSI approved).
3. UL 486A "UL Standard for Safety - Wire Connectors and Soldering Lugs for Use with Copper Conductors."
4. UL 869 "UL Standard for Safety - Service Equipment" (copyrighted by UL, ANSI approved).

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

B. Manufacturer's Qualifications: Firms shall be engaged which are in manufacture of panelboards of types and sizes required, and whose products have been in satisfactory use in similar service for not less than five years.

C. Contractor's Qualifications: Firms shall have at least five years of successful installation experience with projects utilizing panelboards similar to that required for this Project.

D. Compliance: Comply with applicable requirements of FS, NEMA and UL standards referenced in Article 1.2 - References, and with NEC.

E. Testing Agency Qualifications: Member Company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

1.5 SUBMITTALS

A. General: Submit the following in accordance with Conditions of the Contract and Division 1 - General Requirements.

B. Product Data: Submit manufacturer's product data showing material proposed. Product data shall include manufacturer's technical data and cut sheets on features, performance, electrical characteristics, ratings and finishes.

C. Shop Drawings: Submit complete shop drawings for each panelboard and related equipment as required to determine acceptability. Shop drawings shall include, but shall not be limited to, the following:

1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types and details for types other than NEMA 250, Type 1. Include finish and mounting types.
3. Detail bus configuration, voltage, ampere, AIC, and integrated interrupting ratings. Include Main, neutral, equipment ground, isolated ground bus drawings and lug configuration.
4. Short-circuit current rating of panelboards and overcurrent protective devices.

5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
6. Include wiring diagrams for power, signal, and control wiring.
7. Include time-current coordination curves for each type and rating of overcurrent protective devices, included in panelboards.
8. UL and NEMA labeling for applications required.
9. Nameplate details.
10. Lock hardware.
11. Number and size of spare switches or breakers.
12. Cut sheets on breakers with model numbers highlighted.
13. Technical data and cut sheets on TVSS devices.

D. Qualification Data: Submit company name that is a qualified testing agency.

E. Operating and Maintenance Manuals: Prepare and deliver complete operating and maintenance manuals. Provide information pertinent to the equipment for preventive maintenance and for replacement of expendable components. Include the items listed below and other features as may be recommended by the equipment manufacturer:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.
3. Catalog information of the unit installed.
4. Capacity and installation details.
5. Wiring diagrams of electrical components.
6. Complete list of parts with reordering numbers.
7. Recommended spare parts list.

F. Panel Board Schedules: For installation in panelboard. Submit final versions after load balancing in field.

G. Submit signed receipt showing keys have been turned over to Owner.

H. Field Test Reports: Submit written test reports and include the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, and handle panelboards to avoid damage to materials, components, and finish.

B. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

C. Handle and prepare panelboards for installation according to NEMA PB 1.

D. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weather tight, wet work in spaces is complete and dry, work above panelboards is complete,

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

2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

a. Ambient Temperature: Not exceeding **23 deg F (minus 5 deg C)** to plus 104 deg F (plus 40 deg C).

b. Altitude: Not exceeding 6600 feet (2000 m).

1.7 SPARE PARTS

A. Keys and Locks: Provide six (6) spares of each type of panelboard lock and key.

B. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

C. Circuit Breakers: Furnish 10% spare circuit breakers of each type and rating installed. If drawings indicate more spares, provide the quantity as shown on the drawings.

1.8 WARRANTY

A. Panelboards shall be warranted for a minimum period of five years from date of Substantial Completion, or longer if the manufacturer's warranty allows.

1.9 MAINTENANCE

Not Applicable

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide products of one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Manufacturer Model: See specifications below for specific manufacturer models to be used for each type of panelboard.

2.2 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Provide panelboards, enclosures, and ancillary components of types, sizes, and ratings as indicated in the panelboard schedules and where shown on the drawings.

B. Panel Rating: Panelboards shall be rated for the amperage, voltage, phase, equipment ground, and isolated ground requirements, shown on the drawings.

C. Enclosures: mounted cabinets as shown on the contract electrical drawings.

1. Provide rated for environmental conditions at installed location.

a. Indoor Dry and Clean Locations: NEMA 250, Type 1.

b. Outdoor Locations: NEMA 250, Type 3R.

c. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

2. Construction: Panelboards shall comply with NEMA 1 requirements unless noted otherwise on drawings. Panelboards shall be enclosed in steel cabinets with the rigidity and gauge of steel complying with UL 50. Wiring gutter space shall comply with UL 67 and NEC and not be less than 5½" top, bottom and sides. Minimum width shall be 20".
3. Front: Secured to box with concealed trim clamps.
   a. Surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap the box by ¾" on all sides.
   b. Doors: Each panelboard front shall have a door and a flush cylinder tumbler-type lock. Doors over 48" shall be equipped with a three-point latch. Fronts shall be code gage steel.
4. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
5. Finishes:
   a. Panels and Trim: Steel, factory finished immediately, after cleaning and pretreating, with manufacturer's standard two-coat, baked-on finish consisting of rust inhibiting primer and gray electrodeposited baked enamel.
   b. Back Boxes: Same finish as panels and trim.
6. Directory Card: Inside panelboard door, mounted in transparent card holder.
7. Panelboard Identification: Each panelboard shall have a laminated bakelite nameplate attached to the outside of the panelboard per Section 16050. The nameplate shall include panelboard designation, location, voltage, and phase.
8. Keys: Panelboard locks shall be keyed alike.

D. Interior: Interiors shall be factory-assembled. Interiors shall be designed such that switching and overcurrent protective devices can be removed without disturbing adjacent units or bus bars. Branch breakers shall be arranged using double row construction. Provision for future circuit breakers shall be located at the bottom of the panelboard.

E. Mains: All panelboards shall be provided with main circuit breakers, or main lugs only (MLO) as shown on the electrical drawings. Mains shall be field convertible for top or bottom feed.

F. Lugs: Lugs shall be copper compatible with the type and size conductors serving the panelboard and breaker.

1. Conductor Connectors: Suitable for use with conductor material and sizes.
   a. Material: Hard-drawn copper, 98 percent conductivity.
   b. Main and Neutral Lugs: Compression type.
   c. Ground Lugs and Bus-Configured Terminators: Compression type.
   d. Feed-Through Lugs: Compression type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
   e. Subfeed (Double) Lugs: Compression type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

f. Gutter-Tap Lugs: **Compression** type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

g. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.

G. Phase, Neutral, and Ground Buses:

1. General: Panelboard bus structure and main circuit breaker shall have the current ratings as shown on the drawings. Such rating shall be established by heat rise test with a maximum hot spot temperature on any conductor or bus bar not to exceed 65 degrees C rise above ambient. Test shall comply with UL 67.
2. Bus Capacity: Copper bus bars shall be of sufficient size to provide a current density which does not exceed 1,000 amperes per square inch of bus cross-section, and which does not exceed 200 amperes per square inch at bolted circuit breaker connections.
3. Main Bus: Panelboards shall be provided with a tin plated copper main bus. Bus shall be full length to accommodate the maximum number of overcurrent protective devices for which the panelboard is designed.
4. Neutral Bus: A full-sized (100% rated) neutral bar shall be included for panels shown with a neutral. Where required on drawings, panelboards shall be provided with a 100% or 200% rated tin-plated copper main neutral bus. The neutral bus (100 or 200%) shall be insulated from the cabinet and other parts shall be provided with solderless cable connectors for each circuit breaker.
5. Equipment Ground Bus: Panelboards shall be provided with a solid copper rectangular cross-section equipment ground bus. Equipment ground bus shall be independent of the neutral bus.
6. Isolated Ground Bus: Where called for on the drawings, panelboards shall be provided with a solid copper rectangular cross-section isolated ground bus. Isolated ground bus shall be independent of the neutral and equipment ground bus, and shall be electrically isolated from the cabinet.

H. Short Circuit Ratings: Panelboard short circuit rating shall be as indicated on schedules or the drawings and specified herein. The short circuit rating of the assembled panelboard shall be determined by utilizing the lowest interrupting rating assigned to any circuit breaker installed in that panelboard. Series-rated panelboards are not acceptable.

I. Circuit Breakers: Circuit breakers shall comply with NEMA AB 1 and FS W-C-375. Circuit breakers shall have over-center toggle, mechanism with quick-make, quick-break action. Circuit breakers shall have a handle position indicator and a common trip for two-pole and three-pole breakers. Circuit breakers shall be bolt-on type (plug in is not acceptable) and equipped with individually insulated, braced, and protected connectors. Circuit breakers shall be flush with each other when assembled in the panelboard. Trip ratings shall be as indicated on panelboard schedules or the drawings. Breakers shall be listed for appropriate applications: SWD for fluorescent lighting, HID for high intensity discharge lighting, and HCAR for heating air conditioning and refrigeration equipment.

J. Spare Circuit Breakers: Where a compartment is shown as spare it shall be provided with a circuit breaker of the size, trip and interrupting capacity, and type shown on the drawings.

K. Space: Where space is shown on the drawings, it shall be provided with mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

L. Auxiliary Protection Functions: Where indicated on the drawings, provide breakers with auxiliary protective functions or devices such as ground fault equipment protection (GFEP), ground fault interruption (GFIC), or arc fault interruption (AFIC), shunt trip, lockouts, or aux switches.

M. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.

N. Seismic Rating: Panelboards shall be rated for the seismic zone of the location for of the project.

2.3 POWER DISTRIBUTION PANELBOARDS.

A. Product: Subject to compliance with requirements, provide one of the following products:

1. Type Power –R-Line 4: Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. Spectra Series: General Electric Company
3. Type I-Line: Square D; a brand of Schneider Electric.

B. Short Circuit Ratings: Panelboard short circuit rating shall be as indicated on schedules or the drawings, and shall be fully rated. The short circuit rating of the assembled panelboard shall be determined by utilizing the lowest interrupting rating assigned to any circuit breaker installed in that panelboard. Series-rated panelboards are not acceptable.

C. Circuit Breakers: Trip ratings shall be as indicated on panelboard schedules or the drawings. The interrupting rating for circuit breakers shall be equal to the full rating of the panelboard as indicated on the drawings. Circuit breakers shall be thermal-magnetic with inverse time current characteristics and UL listed for the application shown on the drawings.

D. The new MDP Power Distribution Panelboard shall be service entrance rated.

2.4 BRANCH CIRCUIT PANELBOARDS (240Y/120 VOLT)

A. Product: Subject to compliance with requirements, provide one of the following products:

1. "AQ," General Electric Co.
2. "Type NQOD," Square D Co.
3. "Type Power-R-Line 1a," Cutler-Hammer

B. Short Circuit Ratings: Panelboard short circuit rating shall be as indicated on schedules or the drawings, and shall be fully rated. The short circuit rating of the assembled panelboard shall be determined by utilizing the lowest interrupting rating assigned to any circuit breaker installed in that panelboard. Series-rated panelboards are not acceptable.

C. Circuit Breakers: Trip ratings shall be as indicated on panelboard schedules or the drawings. The interrupting rating for circuit breakers shall be equal to the full rating of

the panelboard as indicated on the drawings. Breakers shall have inverse time tripping characteristics calibrated for operation in 104F ambient. Breakers shall be UL listed for SWD, HID, and HACR type as required by code.

2.5 SURGE SUPPRESSION DEVICES – SEPARATELY MOUNTED

A. Where indicated on drawings, provide a wall mounted surge suppression device (TVSS) device within 18" (cable length) of the panel to be protected.

B. Enclosures: mounted cabinets as shown on the contract electrical drawings.

1. Provide rated for environmental conditions at installed location.
   a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
   b. Outdoor Locations: NEMA 250, Type 3R.
   c. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
2. Front: Secured to box with faceplate to conform to type of mounting 9flush or surface).
   a. Surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap the box by ¾" on all sides.
3. Back Boxes: Galvanized steel.

C. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.

D. Surge Protection Device: IEEE C62.41-compliant, integrally mounted, solid-state, parallel-connected, non-modular type, with sine-wave tracking suppression and filtering modules, UL 1449, second edition, short-circuit current rating matching or exceeding the panelboard short-circuit rating, and with the following features and accessories:

1. Accessories:
   a. LED indicator lights for power and protection status.
   b. Audible alarm, with silencing switch, to indicate when protection has failed.

E. Peak Single-Impulse Surge Current Rating: 160 kA per mode/320 kA per phase

F. Minimum single-impulse current ratings, using 8-by-20-mic.sec. Waveform described in IEEE C62.41.2.

1. Line to Neutral: 70,000 A.
2. Line to Ground: 70,000 A.
3. Neutral to Ground: 50,000 A.

G. Withstand Capabilities: 12,000 IEEE C62.41, Category C3 (10 kA), 8-by-20-mic.sec. surges with less than 5 percent change in clamping voltage.

H. Protection modes and UL 1449 SVR for 240/120-V, single-phase, three-wire circuits shall be as follows:

1. Line to Neutral: 400 V.

2. Line to Ground: 400 V.
3. Neutral to Ground: 400 V.

I. TVSS shall use MOV technology, provide protection for all modes of the panel, and be directly coupled to the bus.

J. TVSS shall be listed under UL 1449 and UL 1283.

K. TVSS EMI/RFI suppression: Minimum 50 dB @ 100 kHz

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.

B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

C. Examine areas and conditions under which the work is to be installed, and notify Owner in writing of any conditions detrimental to the proper and timely completion of the work.

D. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Coordinate installation of panelboards and enclosures with cable and raceway installation work.

3.3 APPLICATION

A. When a circuit is removed or added to an existing panel, the Contractor shall verify that the remaining load is equally balanced on the existing bus. The Contractor shall ensure that the existing and new circuits are not loaded over 80% percent of capacity. If above conditions exist, then the Contractor shall immediately notify Owner and take corrective action to rectify the condition.

3.4 INSTALLATION

A. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Architect/ Construction Manager/ Owner no fewer than seven days in advance of proposed interruption of electric service.
2. Do not proceed with interruption of electric service without Architect's/ Construction Manager's/ Owner's written permission.
3. Comply with NFPA 70E.

B. General: Install panelboards as indicated, in accordance with equipment manufacturer's written instructions and with recognized industry practices. Comply with applicable requirements of NEC, UL, and NEMA standards to ensure that products fulfill requirements. Comply with all applicable requirements of electrical installations in seismic zones.

C. Mounting: Panelboards shall be installed with the panelboard top 6 feet (72 inches) above finished floor or as otherwise indicated on the schedules or drawings. Panelboards shall be installed plumb and level. Mount and anchor in accordance with local seismic zone.

D. Flush Mount: Panelboards shall be rigidly secured and set so that the trim shall be flush with the wall surface. Flush type cabinets shall be fastened to structural member of the walls.

E. Surface Mount: Panelboards shall be rigidly secured by bolting to walls and structures. Provide marine grade plywood installed on wall with panel installed on wood backboard.

F. Wiring: Panelboard wiring shall have rounded corners and shall be tied off in bundles with cable ties.

G. Grounding: Provide equipment grounding connections for panelboards. Tighten connections to comply with tightening torques specified in UL 486A to assure permanent and effective grounds.

H. Install filler plates in unused spaces.

3.5 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 16050; "Identification."

B. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 16050; "Identification."

3.6 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.
3. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
4. Perform tests and inspections.
   a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
5. Acceptance Testing Preparation:
   a. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
   b. Test continuity of each circuit.
6. Tests and Inspections:

a. Testing: After installing panelboards and after electrical circuitry has been energized, demonstrate product capability and compliance with manufacturer's requirements.

(1) Procedures: Perform each visual and mechanical inspection and electrical test indicated in NETA ATS, Section 7.5.1.1 for switches, air, low voltage; and Section 7.6.1.1 for circuit breakers, air, insulated-case/molded case. Certify compliance with test parameters.

b. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

7. Panelboards will be considered defective if they do not pass tests and inspections.

8. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.7 ADJUSTING

A. Panelboard locks and trims shall be adjusted and operated properly. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.

B. Lugs, bolts, clamps, and screws shall be tightened to manufacturer's recommendation and shall comply with UL 486A.

C. Set field-adjustable circuit-breaker trip ranges as indicated. Send schedule or table of breaker trip settings to engineer for review at least two weeks before acceptance testing. Include in the schedule or table each breaker and the type and setting adjustments available. Include all time current curves for each type of breaker from manufacturer.

3.8 CLEANING

A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air. Repair exposed surfaces to match original surface.

3.9 FLASH PROTECTION WARNING SIGNS

A. The electrical contractor shall provide all flash protection warning signs as required by the NEC Article 100.16. Warning signs shall conform to the requirements of NFPA 70E.

1. All electrical equipment such as switchboards, panelboards, control panels, meter socket enclosures, and motor control centers, that are likely to require examination, adjustment, servicing, or maintenance while energized shall be field marked to warn qualified persons of potential electrical hazards. The marking shall be located so as to be clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment.

2. All warning signs MUST be installed before owner's personnel are trained on the use of the equipment.

END OF SECTION

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SECTION 16500
LIGHTING FIXTURES

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. This Section includes interior lighting fixtures, exterior site fixtures, lighting fixtures mounted on exterior building surfaces, lamps, ballasts, emergency lighting units, poles/supports, lighting fixtures, structures and accessories.

1.2 DEFINITIONS

A. Lighting Unit: A lighting fixture or an assembly of lighting fixtures complete with a common support including pole, post or other structure, and mounting and support accessories.

B. Lighting Fixture: A complete lighting device consisting of lamp(s) and ballast(s), when applicable, together with parts designed to distribute light, to position and protect lamps, and to connect lamps to power supply.

C. Fixture: A complete lighting unit, exit sign, or emergency lighting unit. Fixtures include lamps and parts required to distribute light, position and protect lamps, and connect lamps to power supply. Internal battery-powered exit signs and emergency lighting units also include a battery and the means for controlling and recharging the battery. Emergency lighting units include ones with and without integral lamp heads.

1.3 CODES AND STANDARDS

A. ANSI C82.1: American National Standard for Fluorescent Lamp Ballast – Line Frequency Fluorescent Lamp Ballast.

B. ANSI C82.11: High Frequency Fluorescent Lamp Ballasts.

C. ANSI C82.4: High-Intensity Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type).

D. ANSI C82.6: Ballasts for HID Lamps – Method Measurement.

E. NEMA LE 2: H-I-D Lighting System Noise Criterion (LS-NC).

F. NFPA 70: National Electricity Code (NEC).

G. UL 935: Standard for Fluorescent Lamp Ballasts.

H. UL 598: Luminaires

1.4 QUALITY ASSURANCE

A. Electrical Component Standard: Provide components that comply with National Electrical Code - NFPA-70 and that are listed and labeled by Underwriters Laboratory where available.

B. Listing and Labeling: Provide fixtures, emergency lighting units, and accessory components specified in this Section that are listed and labeled for their indicated use and installation conditions on Project.

C. Special Listing and Labeling: Provide fixtures for use in damp or wet locations, underwater, and recessed incombustible construction that are specifically listed and

labeled for such use. Provide fixtures for use in hazardous (classified) locations that are listed and labeled for the specific hazard.

1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.
2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

1.5 SUBMITTALS

A. Product Data: For each type of lighting fixture indicated, submit each item in this Article according to the conditions of the contract and Division 1 specification section. Arrange in order of fixture designation. Include data on features, accessories, and the following:

1. Dimensions of fixtures.
2. Certified results of independent laboratory tests for fixtures and lamps for electrical ratings and photometric data.
3. Certified results of laboratory tests for fixtures and lamps for photometric performance.
4. Emergency lighting unit battery and charger.
5. Fluorescent and high-intensity-discharge ballasts.
6. Air and Thermal Performance Data: For air-handling fixtures. Furnish data required in "Submittals" Article in Division 15 Section "Diffusers, Registers, and Grilles."
7. Sound Performance Data: For air-handling fixtures. Indicate sound power level and sound transmission class in test reports certified according to ADC.
8. Types of lamps.

B. Shop Drawings: Show details of nonstandard or custom fixtures. Indicate dimensions, weights, method of field assembly, components, features, and accessories.

1. Wiring Diagrams: Detail wiring for fixtures and differentiate between manufacturer-installed and field-installed wiring.
2. Anchor Bolts: Anchor bolt templates keyed to specific poles and certified by the manufacturer.

C. Coordination Drawings: Reflected ceiling plans and sections drawn to scale and coordinating fixture installation with ceiling grid, ceiling-mounted items, and other components in the vicinity. Include work of all trades that is to be installed near lighting equipment.

D. Product Certificates: Signed by manufacturers of lighting fixtures certifying that products comply with requirements.

E. Dimming Ballast Compatibility Certificates: Signed by manufacturer of ballast certifying that ballasts are compatible with dimming systems and equipment with which they are used.

F. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.6 DELIVERY, STORAGE AND HANDLING

A. Package aluminum poles for shipping according to ASTM B 660.

B. Store poles on decay-resistant treated skids at least 12" (300 mm) above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.

C. Retain factory-applied pole wrappings on metal poles until just before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

D. Deliver, store, and handle lighting fixtures to avoid damage to housings, components, and finishes.

1.7 SPARE PARTS

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. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
2. Plastic Diffusers and Lenses: 1 for every 100 of each type and rating installed. Furnish at least one of each type.
3. Battery and Charger For emergency lighting units: 1 for every 10 of each type and rating installed. Furnish at least one of each type.
4. Ballasts: 1 for every 100 of each type and rating installed. Furnish at least one of each type.
5. Globes and Guards: 1 for every 20 of each type and rating installed. Furnish at least one of each type.

1.8 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 for Batteries: Written warranty, executed by manufacturer agreeing to replace rechargeable batteries that fail in materials or workmanship within specified warranty period.

1. Special Warranty Period for Batteries: Manufacturer's standard, but not less than 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for last nine years.

C. Special Warranties for Fluorescent Ballasts: Written warranty, executed by manufacturer agreeing to replace fluorescent ballasts that fail in materials or workmanship within specified warranty period.

1. Special Warranty Period for Electronic Ballasts: Five years from date of manufacture, but not less than four years from date of Substantial Completion.
2. Special Warranty Period for Electromagnetic Ballasts: Manufacturer's standard warranty, but not less than two years from date of manufacture.

D. Special Warranty for Exterior Lighting Fixtures: Written warranty, signed by manufacturer and installer agreeing to replace external parts of lighting fixtures and poles exhibiting a failure of finish as specified below. This warranty is in addition to, and

not a limitation of, other rights and remedies Owner may have under requirements of the Contract Documents.

1. Protection of Metal from Corrosion: Warranty against perforation or erosion of finish due to weathering.
2. Color Retention: Warranty against fading, staining and chalking due to effects of weather and solar radiation.
3. Warranty Period: Manufacturer's standard, but not less than three years from date of Substantial Completion.

1.9 MAINTENANCE

A. Lamp Seasoning

1. Operate all fluorescent and HID lamps for 100 hours prior to requesting final observation. Season fluorescent lamps at 3 hour on, 20 minute off cycle. Operate dimming fluorescent lamps at 100% output during seasoning. Season HID lamps at an 11 hour on, 1 hour off cycle.

B. Relamping

1. Replace failed lamps at completion of work. Replacement of incandescent and other lamps burnouts after the warranty period starts shall be the responsibility of the Owner.

C. Adjusting and Cleaning

1. Align luminaries and clean lenses and diffusers at completion of work. Clean paint splatters, dirt, and debris from installed luminaries.
2. Touch up lighting fixture and pole finish at completion of work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products indicated on the Electrical Drawings.

B. Products: Subject to compliance with requirements, provide one of the products indicated for each designation on the Lighting Fixture Schedule.

2.2 FIXTURES AND FIXTURE COMPONENTS, GENERAL

A. Metal Parts: Free from burrs, sharp corners, and edges.

B. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

C. Doors, Frames, and Other Internal Access: Smooth operating, free from light leakage under operating conditions, and arranged to permit relamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in operating position.

D. Reflecting Surfaces: Minimum reflectance as follows, unless otherwise indicated:

1. White Surfaces: 85 percent
2. Specular Surfaces: 83 percent

3. Diffusing Specular Surfaces: 75 percent
4. Laminated Silver Metallized Film: 90 percent

E. Lenses, Diffusers, Covers, and Globes: 100 percent virgin acrylic plastic or annealed crystal glass, unless otherwise indicated.

1. Plastic: High resistance to yellowing and other changes due to aging, exposure to heat, and ultraviolet radiation.
2. Lens Thickness: 0.125" (3 mm) minimum, unless greater thickness is indicated.

F. Electromagnetic Interference Filters: Integral to fixture assembly. Provide one filter for each ballast. Suppress conducted electromagnetic interference filters as required by MIL-STD-461.

G. Air-Handling Fixtures: For use with plenum ceiling for air return and heat extraction and for attaching an air-diffuser boot assembly specified in Division 15 Section "Diffusers, Registers, and Grilles."

1. Sound-Pressure Levels: Certified according to ADC.
2. Air-Movement Performance Requirements: Certified according to ADC.
3. Supply Units: Equip with slots in one or both side trims and join with air-diffuser boot assemblies.
4. Heat Removal Units: An air path through lamp cavity.
5. Dampers: Operable from outside fixture for control of return-air volume.
6. Static Fixtures: Supply slots are blanked off, and fixture appearance matches active units.

2.3 OUTDOOR LIGHTING FIXTURES

A. Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for lighting fixtures.

B. Metal Parts: Free from burrs, sharp corners, and edges.

C. Sheet Metal Components: Corrosion-resistant aluminum, unless otherwise indicated. Form and support to prevent warping and sagging.

D. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed lighting fixtures.

E. Doors, Frames, and Other Internal Access: Smooth operating, free from light leakage under operating conditions, and arranged to permit relamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in operating position. Provide for door removal for cleaning or replacing lens. Arrange to disconnect ballast when door opens.

F. Exposed Hardware Material: Stainless steel.

G. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and ultraviolet radiation.

H. Reflecting Surfaces: Minimum reflectance as follows, unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.

I. Lenses and Refractors: Materials as indicated. Use heat- and aging-resistant, resilient gaskets to seal and cushion lens and refractor in lighting fixture doors.

J. Photoelectric Relays: As follows:

1. Contact Relays: Single throw, arranged to fail in the on position and factory set to turn light unit on at 1.5 to 3 fc (16 to 32 lx) and off at 4.5 to 10 fc (48 to 108 lx) with 15-second minimum time delay.
2. Relay Mounting: In lighting fixture housing.

K. High-Intensity-Discharge Ballasts: Comply with ANSI C82.4. Constant wattage autotransformer or regulating high-power-factor type, unless otherwise indicated.

1. Ballast Fuses: One in each ungrounded supply conductor. Voltage and current ratings as recommended by ballast manufacturer.
2. Single-Lamp Ballasts: Minimum starting temperature of minus 40 deg C.
3. Open-circuit operation will not reduce average life.
4. High-Pressure Sodium Ballasts: Equip with a solid-state igniter/starter having an average life in pulsing mode of 10,000 hours at an igniter/starter case temperature of 90 deg C.
5. Noise: Uniformly quiet operation, with a noise rating of B or better.
6. Surge Protector: Hard-wired unit external to ballast case, rated for supply circuit line voltage, and encapsulated for circuit and moisture protection. Three-stage surge protection with three suppression modes provides 330 V peak clamping, line to neutral, line to ground, and neutral to ground. Pulse life is 500 3KA-8x20 microsecond impulses, and response time is less than 1 nanosecond. Internal fuse takes device off line on failure and lights a light-emitting diode failure indicator.

L. Auxiliary, Instant-on, Quartz System: Automatically switches quartz lamp on when lighting fixture is initially energized and when momentary power outages occur. Automatically turns quartz lamp off when high-intensity-discharge lamp reaches approximately 60 percent light output.

1. Mount control components internal to ballast.
2. Connect to ballast with tap so quartz lamp operates at 120 V.

M. Lamps: Comply with the standard of the ANSI C78 series that is applicable to each type of lamp. Provide lighting fixtures with indicated lamps of designated type, characteristics, and wattage. Where a lamp is not indicated for a lighting fixture, provide medium wattage lamp recommended by manufacturer for lighting fixture.

1. Metal-Halide Color Temperature and Minimum Color-Rendering Index: 3600 K and 70 CRI, unless otherwise indicated.

2.4 FLUORESCENT LAMP BALLASTS

A. General Requirements: Unless otherwise indicated, features include the following:

1. Designed for type and quantity of lamps indicated at full light output.
2. Sound Rating: A, except as otherwise indicated.
3. Type: Class P, High Power Factor, except as otherwise indicated.

B. Electronic Ballasts: Unless otherwise indicated, features include the following, besides those in "General Requirements" Paragraph above:

1. Certified Ballast Manufacturer Certification: Indicated by label. (ETL and CBM)
2. Encapsulation: Without voids in potting compound.
3. Parallel Lamp Circuits: Multiple lamp ballasts connected to maintain full light output on surviving lamps if one or more lamps fail.
4. Total Harmonic Distortion & Voltage less than or equal to 10% THD, instant start with dual voltage (120/277v).

C. Ballasts for Lamps in Recessed Fixtures: Unless otherwise indicated, additional features include the following:

1. Type: Electronic, fully encapsulated in potting compound.
2. Power Factor: 95%, minimum.
3. Operating Frequency: 20 kHz or higher.
4. Flicker: Less than 5%.
5. Lamp Current Crest Factor: Less than 1.7.
6. Transient Protection: Comply with IEEE C62.41 for Category A1 locations.
7. Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C for limitations on electromagnetic and radio-frequency interference for non-consumer equipment.

D. Ballasts for Lamps in Non-recessed Fixtures: Unless otherwise indicated, additional features include the following:

1. Power Factor: 95%, minimum.
2. Ballast Coil Temperature: 65 deg C, maximum.
3. Transient Protection: Comply with IEEE C62.41 for Category A1 locations.
4. Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C for limitations on electromagnetic and radio-frequency interference for non-consumer equipment.

E. Ballasts for Dimmer-Controlled Fixtures: Comply with general and fixture-related requirements above for electronic ballasts.

1. Compatibility: Certified by manufacturer for use with specific dimming system indicated for use with each dimming ballast.

F. Ballasts for Low-Temperature Environments: As follows:

1. Temperatures 0F (-17C) and Above: Electronic type rated for 0F (-17C) starting temperature.
2. Temperatures -20F (-29C) and Above: Electromagnetic type designed for use with high-output lamps.

G. Ballasts for Low Electromagnetic Interference Environments: Comply with 47 CFR, Chapter 1, Part 18, Subpart C for limitations on electromagnetic and radio-frequency interference for consumer equipment.

H. Acceptable Manufacturers: Advance; Osram/Sylvania; Lutron; Motorola or approved equal.

2.5 HIGH-INTENSITY-DISCHARGE LAMP BALLASTS

A. General: Comply with ANSI C82.4. Unless otherwise indicated, features include the following:

1. Type: Constant wattage autotransformer or regulating high-power-factor type, unless otherwise indicated.
2. Operating Voltage: Match system voltage.
3. Minimum Starting Temperature: -22F (-30C) for single lamp ballasts.
4. Normal Ambient Operating Temperature: 104F (40C).
5. Open-circuit operation that will not reduce average life.
6. Auxiliary, Instant-on, Quartz System: Automatically switches quartz lamp on when fixture is initially energized and when momentary power outages occur. Automatically turns quartz lamp off when high-intensity-discharge lamp reaches approximately 60 percent light output.

B. Encapsulation: Manufacturer's standard epoxy-encapsulated model designed to minimize audible fixture noise.

C. High-Pressure Sodium Ballasts: Equip with a solid-state igniter/starter having an average life in pulsing mode of 10,000 hours at an igniter/starter case temperature of 90 deg C.

1. Instant Restrike Device: Solid-state, potted module, mounted inside high-pressure sodium fixture and compatible with high-pressure sodium lamps, ballasts, and sockets up to 150 W.

a. Restrike Range: 105 to 130VAC.
b. Maximum Voltage: 250V peak or 150VAC RMS.

2.6 EXIT SIGNS

A. General Requirements: Comply with UL 924 and the following:

1. Sign Colors and Lettering Size: Comply with authorities having jurisdiction.

B. Internally Lighted Signs: As follows:

1. Lamps for AC Operation: Incandescent, two for each fixture, 50,000 hours rated lamp life.
2. Lamps for AC Operation: Fluorescent, two for each fixture, 20,000 hours rated lamp life.
3. Lamps for AC Operation: Light-emitting diodes, 70,000 hours minimum rated lamp life.
4. Additional Lamps for DC Operation: Two minimum, bayonet-base type, for connection to external DC source.

C. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.

1. Battery: Sealed, maintenance-free, nickel-cadmium type with special warranty.
2. Charger: Fully automatic, solid-state type with sealed transfer relay.
3. Operation: Relay automatically energizes lamp from unit when circuit voltage drops to 80% of nominal or below. When normal voltage is restored, relay disconnects lamps, and battery is automatically recharged and floated on charger.

2.7 EMERGENCY LIGHTING UNITS

A. General Requirements: Self-contained units. Comply with UL 924. Units include the following features:

1. Battery: Sealed, maintenance-free, lead-acid type with minimum 10-year nominal life and special warranty.
2. Charger: Fully automatic, solid-state type with sealed transfer relay.
3. Operation: Relay automatically turns lamp on when supply circuit voltage drops to 80% of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps, and battery is automatically recharged and floated on charger.
4. Wire Guard: Where indicated, heavy-chrome-plated wire guard arranged to protect lamp heads or fixtures.
5. Integral Time-Delay Relay: Arranged to hold unit on for fixed interval after restoring power after an outage. Provides adequate time delay to permit high-intensity-discharge lamps to restrike and develop adequate output.

2.8 EMERGENCY FLUORESCENT POWER SUPPLY UNIT

A. Internal Type: Self-contained, modular, battery-inverter unit factory mounted within fixture body. Comply with UL 924.

1. Test Switch and Light-Emitting Diode Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
2. Battery: Sealed, maintenance-free, nickel-cadmium type with minimum 10-year nominal life.
3. Charger: Fully automatic, solid-state, constant-current type.
4. Operation: Relay automatically energizes lamp from unit when normal supply circuit voltage drops to 80% of nominal voltage or below. When normal voltage is restored, relay disconnects lamp, and battery is automatically recharged and floated on charger.

B. External Type: Self-contained, modular, battery-inverter unit. Comply with UL 924.

1. Test Switch and Light-Emitting Diode Indicator Light: Visible and accessible without entering ceiling space.
2. Battery: Sealed, maintenance-free, nickel-cadmium type with minimum 10-year nominal life.
3. Charger: Fully automatic, solid-state, constant-current type.
4. Operation: Relay automatically energizes lamp from unit when normal supply circuit voltage drops to 80% of nominal voltage or below. When normal voltage is restored, relay disconnects lamp, and battery is automatically recharged and floated on charger.
5. Housing: NEMA 250, Class 1 enclosure.

2.9 LAMPS

A. Fluorescent Color Temperature and Minimum Color-Rendering Index: 3500 K and 85 CRI, unless otherwise indicated.

B. Fluorescent Lamp Life: Rated average is 20,000 hours at 3 hours per start when used on rapid-start circuits.

C. Metal-Halide Color Temperature and Minimum Color-Rendering Index: 3600 K and 70 CRI, unless otherwise indicated.

D. Acceptable Manufacturers: General Electric, Phillips or Sylvania.

2.10 FIXTURE SUPPORT COMPONENTS

A. Comply with Division 16 Section "Basic Electrical Materials and Methods," for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: ½" (12-mm) steel tubing with swivel ball fitting and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, ½" (12-mm) steel tubes with single canopy arranged to mount a single fixture. Finish same as fixture.

D. Rod Hangers: 3/16" (5-mm) minimum diameter, cadmium-plated, threaded steel rod.

E. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

F. Aircraft Cable Support: Use cable, anchorages, and intermediate supports recommended by fixture manufacturer.

2.11 FINISHES

A. Fixtures: Manufacturer's standard, unless otherwise indicated.

1. Paint Finish: Applied over corrosion-resistant treatment or primer, free of defects.
2. Metallic Finish: Corrosion resistant.

B. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20; and seal aluminum surfaces with clear, hard-coat wax.
2. Class I, Clear Anodic Finish: AA-M32C22A41 (Mechanical Finish: medium stain; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 607.1.
3. Class I, Color Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: medium satin; 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.
   a. Color: Light bronze.
   b. Color: Medium bronze.
   c. Color: Dark bronze.
   d. Color: Black.
4. Gold Anodic Finish: AA-M32C22A43 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I,

impregnated color coating 0.018 mm or thicker) complying with AAMA 611; gold color.

C. Steel: Grind welds and polish surfaces to a smooth, even finish.

1. Galvanized Finish: Hot-dip galvanize after fabrication to comply with ASTM A 123.
2. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease and other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP8, "Pickling."
3. Interior: Apply one coat of bituminous paint on interior of pole, or otherwise treat to prevent corrosion.
4. Polyurethane Enamel: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
   a. Color: As indicated by manufacturer's designation.
   b. Color: Match Architect's sample.
   c. Color: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fixtures: Set level, plumb, and square with ceiling and walls, and secure according to manufacturer's written instructions and approved submittal materials. Install lamps in each fixture. Support fixtures according to requirements of Division 16 Section 16050 Basic Electrical Materials and Methods.

B. Support for Fixtures in or on Grid-Type Suspended Ceilings: Use grid for support.

1. Install a minimum of four ceiling support system rods or wires for each fixture. Locate not more than 6" (150 mm) from fixture corners.
2. Support Clips: Fasten to fixtures and to ceiling grid members at or near each fixture corner.
3. Fixtures of Sizes Less Than Ceiling Grid: Arrange as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two ¾" (20-mm) metal channels spanning and secured to ceiling tees.

C. Suspended Fixture Support: As follows:

1. Pendants and Rods: Where longer than 48" (1200 mm), brace to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
4. Continuous Rows: Suspend from cable installed according to fixture manufacturer's written instructions and details on Drawings.

D. Air-Handling Fixtures: Install with dampers closed.

E. Concrete Foundations: Construct according to Division 3 Section "Cast-in-Place Concrete."

1. Comply with details for reinforcement and for anchor bolts, nuts, and washers. Verify anchor-bolt templates by comparing with actual pole bases furnished.
2. Finish for Parts Exposed to View: Trowel and rub smooth. Comply with Division 3 Section "Cast-in-Place Concrete" for exposed finish.

F. Embedded Poles: Set poles to indicated depth, but not less than one-sixth of pole length below finish grade. Dig holes large enough to permit use of tampers the full depth of hole. Backfill in 6" (150-mm) layers and thoroughly tamp each layer so compaction of backfill is equal to or greater than that of undisturbed earth.

G. Install poles as follows:

1. Use web fabric slings (not chain or cable) to raise and set poles.
2. Mount pole to foundation with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer.
3. Secure poles level, plumb, and square.
4. Grout void between pole base and foundation. Use non-shrinking or expanding concrete grout firmly packed in entire void space.
5. Use a short piece of ½" (13-mm) diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.

H. Lighting fixture Attachment: Fasten to indicated structural supports.

I. Lighting fixture Attachment with Adjustable Features or Aiming: Attach lighting fixtures and supports to allow aiming for indicated light distribution.

J. Lamp lighting fixtures with indicated lamps according to manufacturer's written instructions. Replace malfunctioning lamps.

3.2 CONNECTIONS

A. 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.

B. Ground metal poles/support structures according to Division 16 Section 16050 "Grounding."

1. Nonmetallic Poles: Ground metallic components of lighting units and foundations. Connect lighting fixtures to grounding system with No. 6 AWG conductor.

3.3 FIELD QUALITY CONTROL

A. Inspect each installed unit for damage. Replace damaged units.

B. Advance Notice: Give dates and times for field tests.

C. Provide instruments to make and record test results.

D. Tests and Observations: Verify normal operation of lighting units after installing lighting fixtures by energizing circuits with normal power source, and performing the following:

1. Measure light intensities at night if specific illumination performance is indicated. Use photometers with calibration referenced to NIST standards.
2. Check intensity and uniformity of illumination.
3. Check excessively noisy ballasts.
4. Emergency Lighting: Interrupt electrical supply to demonstrate proper operation. Verify transfer to emergency/battery source and retransfer to normal.

E. Prepare a written report of tests, inspections, observations and verifications indicating and interpreting results.

F. Malfunctioning Fixtures and Components: Replace or repair, then retest. Repeat procedure until units operate properly.

3.4 CLEANING AND ADJUSTING

A. Clean fixtures internally and externally after installation. Use methods and materials recommended by manufacturer.

B. Adjust aimable fixtures to provide required light intensities.

END OF SECTION

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SECTION 16700
TELEPHONE AND DATA PATHWAYS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Work Includes

1. Electrical Contractor shall provide the following:
   a. Cable pathways to support telecommunications wiring, fiber optic cable, video cable and data cabling. All wiring shall be NEC Class 2 wiring.
   b. All telecommunications, video, video, data, and fiber-optic wiring will be installed in one or more of the cable pathways specified in this section.
2. The Electrical Contractor will cooperate with the architect/engineer, owner/user, and cabling system installer to insure that all rough-in and pathways are fully coordinated with the equipment that is being provided for this project.

B. Section Includes

1. Electrical conduit, fittings, and flexible metal conduit.
2. Multi-outlet assembly (Surface Mounted Raceway)
3. Cable management system (Cable Tray)
4. Horizontal and Vertical Cable Management Systems
5. Ladder rack
6. Backboards
7. Outdoor Rated, Riser Rated, or Plenum Rated Innerduct
8. Outlet boxes
9. Outdoor Rated, Riser Rated, or Plenum Rated Tube Cell Cable.
10. J-Hooks
11. Through-the-wall fire stop system

1.2 DEFINITIONS

A. Wire Cable Tray: A fabricated structure consisting of wire supporting members on the bottom and side rails.

B. EMI: Electromagnetic interference.

C. Innerduct: Flexible non-metallic corrugated raceway used for effective installation of low voltage, telephone, and fiber optic cables.

D. Ladder Rack: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).

E. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.

F. Open Cabling: Passing telecommunications cabling through open space (e.g., between the studs of a wall cavity).

G. RCDD: Registered Communications Distribution Designer.

H. Solid-Bottom or Non-Ventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal side rails, and a bottom without ventilation openings.

I. Trough or Ventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal rails and a bottom having openings sufficient for the passage of air and using 75 percent or less of the plan area of the surface to support cables.

J. Tube Cell Cable: Multi-tube cable assemblies used for the installation of blown-in fiber optic cables.

K. UTP: Unshielded twisted pair.

L. Fiber Optic Cable: Glass, plastic, or hybrid fiber cable that transmits digital signals as light pulses.

1.3 CODES AND STANDARDS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by UL or ETL as suitable for purpose specified or shown. All products furnished shall bear the listing agency's mark.

C. Conform to requirements of ANSI/TIA/EIA/569-A

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member Company of an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.5 SUBMITTALS

A. Provide a complete bill of material of equipment to be installed indicating quantity, manufacturer and model number and other relevant technical data including accessories and options.

B. Include manufacturer's description and technical data, product specification sheets, schedules, and installation/maintenance instructions to clearly indicate to the Engineer that all hardware being provided is consistent with that specified and is compatible to the overall installation.

C. When manufacturer's cut sheets apply to a product series rather than a specific product, the data specifically applicable to the project will be highlighted or clearly indicated by other means. General catalogs will not be accepted as cut sheets to fulfill submittal requirements.

D. Provide floor plans showing all pathways with notes of relevant installation requirements.

1. Engineer's drawings in AutoCAD will be made available for contractor to use as base files to generate plan view shop drawings. Contractor shall provide AutoCAD shop drawings which show the types and numbers of wires and pathways.

E. Provide to the Owner and Engineer any additional information or data which they deem necessary to determine compliance with these specifications or which they deem valuable in documenting the equipment/systems to be installed.

F. Fire stopping for each type of raceway penetration through a fire rated structure.

G. Shop drawings will be approved by both the Engineer and Owner.

H. Accurately record actual routing, type and size of all pathways.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

B. Where recommended by the equipment supplier, deliver equipment in fully enclosed vans after specified environmental conditions have been permanently established in spaces where equipment is to be placed. The products accepted on the site shall be wrapped in factory packing, and shall be inspected for damage prior to acceptance.

C. Store equipment in clean, dry with non-condensing environments that are controlled within manufacturer=s ambient tolerances for non-operating equipment. Protect from weather, dirt, fumes, water, construction debris, and physical damage.

D. Handle equipment carefully to prevent damage, breaking, and scoring. The contractor shall not install damaged units or components; replace with new.

E. Equipment furnished by others. The contractor shall be responsible for receiving, uncrating, inspecting, storing, and installing of Division 16 equipment listed as furnished by others.

1.7 SPARE PARTS

A. Not Applicable

1.8 WARRANTIES

A. The contractor shall warrant all materials, workmanship, and equipment against defects for a period of one year after the date of substantial completion. Certain equipment shall be warranted at the time of final acceptance, or for longer periods of time as specified in those sections of the project manual.

B. The contractor shall repair or replace, at no additional cost to Owner, any item that may become defective within the warranty period.

C. Any manufacturer's warranties concerning any item installed shall be to the benefit of Owner.

D. The contractor agrees not to void or impair or to allow any sub-contractor to void or impair any warranties regarding products or items installed as part of this project.

E. The repair of faulty workmanship shall be considered to be included in the contract.

1.9 MAINTENANCE

A. Not Applicable

PART 2 - PRODUCTS

2.1 ELECTRICAL CONDUIT, FITTINGS, AND FLEXIBLE METAL CONDUIT

A. Refer to Section 16130 – "Raceways and Boxes," Part 2, for conduit specifications.

B. All interior metal conduits for the Telephone and Data Pathway system shall be blue.

2.2 MULTI-OUTLET ASSEMBLY (SURFACE MOUNTED RACEWAY)

A. Refer to Section 16130 – "Raceways and Boxes," Part 2, for raceway specifications.

B. Sheet metal channel with fitted cover, dual channel suitable for use as a multi-outlet assembly.

C. One channel shall be for telecommunications and data outlets and one channel shall be for convenience receptacles.

D. Provide covers and all accessories to accept quantity of convenience receptacles and data outlets shown on the drawing.

E. Color shall be as chosen by Architect/Owner from manufacturer's standard colors.

F. Refer to Section 16050 – "Basic Materials and Methods" for additional information.

2.3 CABLE MANAGEMENT SYSTEM (WIRE CABLE TRAY)

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Snake Tray Series 201
2. Cablofil EZ Tray
3. GS Metals Corp.
4. Pre-approved equal.

B. Provide a wire runway cable management system which shall be defined as a welded steel wire cable conveyance system consisting of flexible linear or module sections designed to support, but are not limited to video, fiber optic, and voice/data telecommunication cables. Tray shall be constructed from cold rolled steel and shall be zinc plated. Tray shall also be designed in such a way as to allow cables to enter or exit the tray in any direction at any point along the length of the tray while also allowing cables to be added or removed without modification or manipulation of the tray system, including hanging hardware.

C. Provide all supports, accessories as recommended by the manufacturer.

D. Cable tray shall not be filled more than 40% of its rated capacity.

2.4 CABLE MANAGEMENT SYSTEM (SOLID CABLE TRAY)

A. Solid-Bottom or Non-Ventilated Cable Trays: Provide [with] [without] solid covers.

1. Manufacturers:

a. Hoffman.

b. Square D.
c. Approved Equal.

2. Material and Construction: One piece metal construction, rectangular shaped with size as indicated on the drawings.
3. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
4. Wireway Covers: Hinged type, screw-cover type, or flanged-and-gasketed type as indicated on the electrical drawings.
5. Finish: Manufacturer's standard enamel finish.

2.5 HORIZONTAL AND VERTICAL CABLE MANAGEMENT SYSTEM

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Amp Netconnect: horizontal and vertical finger duct panels.
2. Panduit Corp: WMPH series
3. Approved Equal.

B. Material and construction: Two piece PVC finger duct system with snap on cover.

C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Cable tray shall not be filled more than 50% of its rated capacity.

2.6 LADDER RACK

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cable Management Solutions, Inc.
2. Cablofil Inc.
3. Cooper B-Line, Inc.
4. Cope - Tyco/Allied Tube & Conduit.
5. GS Metals Corp.
6. Pre-approved equal.

B. Ladder Rack Materials: Metal, suitable for indoors and protected against corrosion by electroplated zinc galvanizing, complying with ASTM B 633, Type 1, not less than 0.000472" (0.012 mm) thick. Hot-dip galvanizing, complying with ASTM A 123/A 123M, Grade 0.55, not less than 0.002165" (0.055 mm) thick.

1. Ladder Cable Trays: Nominally 18" (455 mm) wide, and a rung spacing of 12" (305 mm).

2.7 BACKBOARDS

A. Description: Plywood, fire-retardant treated, ¾" by 48" by 96" (19 by 1220 by 2440 mm).

B. Refer to the drawings for number of plywood panels required in each area.

2.8 INNERDUCT

A. Manufactured to UL-910 (plenum), UL1666 (riser), and UL1581 (general area) Standard.

B. Conforms to NEC Article 770 and is allowed for use with telecommunications cables as described in NEC Article 800.

C. Corrugated flexible nonmetallic conduit with pull tape. Color = orange.

D. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Carlon
2. Pre-approved equal.

E. Plenum Rated (building interior in plenum areas):

1. Carlon Plenum-Gard #C series -length as required
2. Pre-approved equal.

F. Riser Rated (building interior in non plenum areas):

1. Carlon Riser-Gard #D series -length as required
2. Pre-approved equal.

G. Halogen Free riser Rated (verify with owner):

1. Carlon Hal-Free Riser-Gard #H series -length as required
2. Pre-approved equal.

H. Outdoor installation: Corrugated HDPE (high density polyethylene)

1. Carlon Corrugated HDPE #AD2S series – length as required
2. Pre-approved equal.

2.9 OUTLET BOXES

A. Refer to Section 16130 – "Raceways and Boxes," Part 2, for box specifications.

2.10 J-HOOKS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Caddy Cat Links (j-hooks)
2. B-Line (j-hooks)
3. Arlington Industries Inc. (cableway support bracket)
   a. Can be used in non-plenum areas only

2.11 THROUGH THE WALL/FLOOR FIRE STOP SYSTEM

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Wiremold FlameStopper Thru-Wall/Floor Fitting
2. EZ-Path Fire Rated System.

B. Fittings shall not be filled more than 40% of its full rating to allow for future expansion.

PART 3 - EXECUTION

3.1 INSTALLATION OF PATHWAYS

A. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A-7.

B. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.

C. Comply with requirements in Section 16130 – "Raceways and Boxes."

D. Install manufactured conduit sweeps and long-radius elbows if possible.

E. Pathway Installation in Equipment Rooms:

1. Position conduit ends adjacent to a corner on backboard if a single piece of plywood is installed or in the corner of room if multiple sheets of plywood are installed around perimeter walls of room.
2. Install cable trays to route cables if conduits cannot be located in these positions.
3. Secure conduits to backboard if entering room from overhead.
4. Extend conduits 3" (75 mm) above finished floor.
5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

F. Backboards: Install backboards with 96" (2440 mm) dimension vertical. Butt adjacent sheets tightly and form smooth gap-free corners and joints.

G. Install pathways for all telephone, data, video, and fiber optic wiring in separate compartments of cable management system.

H. All pathways shall be installed in accordance with the manufacturer's instructions.

I. Pathways shall be run parallel and perpendicular to building lines.

J. Trays, ladder racks, cable management systems, innerduct, and tube cell cables shall be routed to maintain minimum separation distances. Systems that are affected by electrical interference or cause interference to other systems due to not following the greater of minimum separation distances or manufacturer's recommendation shall be rerouted at no additional cost to the Owner.

1. 12" from power lines of 600 volts or less.
2. 18" from high voltage lighting (including fluorescent ballasts and high intensity discharge ballasts).
3. 24" from power lines of 601 volts or greater.
4. 39" from transformers and motors.

3.2 CABLE MANAGEMENT SYSTEM INSTALLATION

A. Install trays, ladder racks, cable management systems, innerduct, and tube cell cables in accordance with recognized industry practices and manufacturer recommended procedures, to ensure that the equipment complies with requirements of the NEC, and applicable portions of EIA/TIA standards and NECA's "Standards of Installation" pertaining to general electrical installation practices.

B. Coordinate installation with other trades.

C. All metal equipment of trays, ladder racks, cable management systems, innerduct, and tube cell cables shall be grounded per NEC Article 250.

D. Provide external grounding strap at expansion joints, sleeves, crossovers and at other locations where metal continuity is interrupted.

E. Support all trays, ladder racks, cable management systems, innerduct, and tube cell cables from building construction. Do not support equipment from ductwork, piping or equipment hangers.

F. Install all trays, ladder racks, cable management systems, innerduct, and tube cell cables level and straight unless noted on the construction drawings.

3.3 INNER DUCT

A. Install per manufacturer's recommended methods.

B. Support at maximum every 4 feet.

3.4 J HOOKS

1. Select hook suitable for the type and quantity of wire.
2. Provide support every 4 feet or less.

3.5 DESIGN REQUIREMENTS

A. Pathway sizes shall be based on the number and sizes of cables.

B. Pathways shall not be loaded more than 40% of the allowable rated capacity of the device.

C. Coordinate all pathway locations with mechanical and plumbing contractors and final locations of termination points.

END OF SECTION

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SECTION 16740
TELEPHONE AND DATA CABLING SYSTEM

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. This Section includes wire, cable, connecting devices, installation, and testing for wiring systems to be used as signal pathways for voice and high speed data transmission.

B. Furnish and install complete with all accessories a Campus Cabling System (CCS). The CCS shall serve as a vehicle for transport of data, video, and voice telephony signals throughout the network from designated demarcation points to outlets located at various desks, workarea, and other locations as indicated on the contract drawings and described herein.

C. Wiring utilized for Telephone Company central office voice service shall originate at a demarcation point determined by the utility. The interconnect wiring to the building or Main Telecommunications Room and the cross connect wiring will be provided by the telephone company. Installation, termination and identification of wiring between workstations and station outlets to the TRs and the ERs shall be considered part of the contractors work.

D. Wiring utilized for data, video, and voice communications shall originate at owner designated hubs and concentrator locations and shall be either wall mounted, in vertical free standing equipment racks, and/or enclosed wall mounted vertical equipment racks. These racks will be located at the Telecommunications Equipment Room (ER), the Main Cross-connect (MC), the Intermediate cross-connect (IC), and/or the Telecommunications Room (TR) location(s). Wiring, terminations, patch panels, terminal panels and punch down blocks required for a complete pathway system between these designated demarcation points and outlet locations designated on the contract drawings shall be considered part of the contract. Telecommunication Outlets (TO) shall be furnished, wired and installed by the CCS system contractor.

E. The system shall utilize a network of shielded twisted pair, plenum rated, EIA/TIA certified communication cables. Cables and terminations shall be provided and located as shown and in the quantities indicated on the drawings.

F. All cables and terminations shall be identified at all locations.

G. All cables shall be labeled with an alphanumeric sequence identifier at all termination locations.

H. All copper cable terminations shall comply with, and be tested to ANSI/TIA/EIA 568-B standards for Category 3, Category 5E and/or Category 6 installations.

I. Available and unused pairs between the ER and TR (s) shall be terminated and shall be identified as spare at each location.

J. All cables at the workarea shall terminated on specified modular jacks and mounted on one, two or three gang wall plates equipped as shown on the drawings.

1.2 DEFINITIONS

A. Campus Cabling System (CCS): A CCS is defined as all required equipment, including all cabling with hardware, termination/punchdown blocks, cross connect wiring, fiber patch cables, and telecommunication outlets with specified modular jacks. All equipment shall be installed and configured to provide computer data, video capabilities, and voice connectivity from each workarea to the network file server or voice network/switch designated as the service point of the local area network.

B. Work Area: The connection point between the (TO) and the electronic equipment in the work area. It consists of cords, adapters, handsets, computers, printers, and other transmission electronics.

C. Horizontal Subsystem: The Horizontal system provides connections from the horizontal cross connect to the Telecommunication Outlets (TOs) in the workarea. It consists of the horizontal transmission media, the associated connecting hardware terminating this media and individual outlets in the workarea. Each floor of a building is served by its own Horizontal Subsystem.

D. Riser Backbone: The Riser Backbone system links the Main Cross connect (MC) in the equipment room to Intermediate Cross connects (IC); horizontal cross connects in the Telecommunications Rooms (TR) and Telecommunications Equipment Room (ER). It consists of the backbone transmission media between these locations and the associated connecting hardware terminating this media. It is normally installed in a star topology.

E. Campus Backbone: A Campus Backbone is used when a distribution system encompasses more than one building. The components and cables that provide the link between buildings constitute the Campus Backbone. This system includes the backbone transmission media, associated connecting hardware terminating this media, and electrical protection devices to mitigate harmful voltages when the media is exposed to lightning and/or power surges.

F. EMI: Electromagnetic interference.

G. IDC: Insulation displacement connector.

H. LAN: Local area network.

I. PVC: Polyvinyl chloride.

J. UTP: Unshielded twisted pair.

1.3 CODES AND STANDARDS

A. NECA/BICSI #568-2006 Installing Commercial Building Telecommunications Cabling

B. TIA/EIA-568-B.1 Commercial Building Telecommunications Cabling Standard Part 1: General Requirements – (May 2001)

C. TIA/EIA-568-B.1-1 Commercial Building Telecommunications Cabling Standard Part 1: General Requirements - Addendum 1 – Minimum 4-Pair UTP and ScTP Patch Cable Bend Radius - (May 2001)

D. TIA/EIA-568-B.1-2 Commercial Building Telecommunications Cabling Standard Part 1: General Requirements Addendum 2 – Grounding and Bonding Requirements for Screened Balanced Twisted-Pair Horizontal Cabling - (February 2003)

E. TIA/EIA-568-B.1-3 Commercial Building Telecommunications Cabling Standard Part 1: General Requirements Addendum 3 – Supportable Distances and Channel Attenuation for Optical Fiber Applications by Fiber Type - (February 2003)

F. TIA/EIA-568-B.1-4 Commercial Building Telecommunications Cabling Standard Part 1: General Requirements > Addendum 4 – Recognition of Category 6 and 850 nm Laser Optimized 50/125 μm Multimode Optical Fiber Cabling - (February 2003)

G. TIA/EIA-568-B.1-5 Commercial Building Telecommunications Cabling Standard Part 1: General Requirements Addendum 5 – Telecommunications Cabling for Telecommunications Enclosures – (March 2004)

H. TIA/EIA-568-B.1-7 Commercial Building Telecommunications Cabling Standard Part 1: General Requirements Addendum 7 - Guidelines for Maintaining Polarity Using Array Connectors – (January 2006)

I. TIA/EIA-568-B.2 Commercial Building Telecommunications Cabling Standard Part 2: Balanced Twisted-Pair Cabling Components - (December 2003)

J. TIA/EIA-568-B.2-1 Commercial Building Telecommunications Cabling Standard Part 2: Balanced Twisted-Pair Cabling Components – Addendum 1 – Transmission Performance Specifications for 4-Pair 100 ohm Category 6 Cabling - (June 2002)

K. TIA/EIA-568-B.2-2 Commercial Building Telecommunications Cabling Standard Part 2: Balanced Twisted-Pair Cabling Components – Addendum 2 – Revision of Sub-clauses - (December 2001)

L. TIA/EIA-568-B.2-3 Commercial Building Telecommunications Cabling Standard Part 2: Balanced Twisted-Pair Cabling Components – Addendum 3 – Additional Considerations for Insertion Loss & Return Loss Pass/Fail Determination - (March 2002)

M. TIA/EIA-568-B.2-4 Commercial Building Telecommunications Cabling Standard Part 2: Balanced Twisted-Pair Cabling Components – Addendum 4 – Solderless Connection Reliability Requirements for Copper Connecting Hardware - (June 2002)

N. TIA/EIA-568-B.2-5 Commercial Building Telecommunications Cabling Standard Part 2: Balanced Twisted-Pair Cabling Components – Addendum 5 – Corrections to TIA/EIA-568-B.2 – (January 2003)

O. TIA/EIA-568-B.2-6 Commercial Building Telecommunications Cabling Standard Part 2: Balanced Twisted-Pair Cabling Components – Addendum 6 – Category 6 Related Component Test Procedures – (December 2003)

P. TIA/EIA-568-B.2-11 Commercial Building Telecommunications Cabling Standard Part 2: Balanced Twisted-Pair Cabling Components – Addendum 11 - Specification of 4-Pair UTP and SCTP Cabling – (December 2005)

Q. TIA/EIA-568-3 Optical Fiber Cabling Components Standard - (April 2002)

R. TIA/EIA-568-3.1 Optical Fiber Cabling Components Standard – Addendum 1 – Additional Transmission Performance Specifications for 50/125 μm Optical Fiber Cables – (April 2002)

S. TIA-569-B Commercial Building Standard for Telecommunications Pathways and Spaces -(October 2004)

T. TIA-598-C Optical Fiber Cable Color Coding - (January 2005)

U. TIA/EIA-606-A Administration Standard for Commercial Telecommunications Infrastructure - (May 2002)

V. J-STD-607-A Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications - (October 2002)

W. TIA-758-A Customer-owned Outside Plant Telecommunications Infrastructure Standard – August 2004

X. ANSI/TIA/EIA 862 Building Automation Systems Cabling for Commercial Buildings, April 11, 2002

Y. Underwriters Laboratories (UL®) Cable Certification and Follow Up Program.

Z. National Electrical Manufacturers Association (NEMA).

AA. American Society for Testing Materials (ASTM).

BB. National Electric Code (NEC®), Latest Issue

CC. Institute of Electrical and Electronic Engineers (IEEE).

DD. UL Testing Bulletin.

EE. American National Standards Institute (ANSI) X3T9.5 Requirements for UTP at 100 Mbps.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications:

1. Firms shall be engaged in the manufacture of products and materials of types and sizes required, and whose products have been in satisfactory use in similar service for not less than five years.
2. The products specified in this specification shall be supplied by a single manufacturer, with the exception of data racks and other hardware that is not defined as part of the channel test configuration by ANSI/TIA/EIA 568-B.
3. Manufacturer shall be ISO 9001 Certified.

B. Contractor's Qualifications:

1. Firms shall have at least five years of successful installation experience with projects utilizing products and materials similar to that required for this Project.
2. An experienced installer and project manager who is a registered communication distribution designer certified by the Building Industry Consulting Service International (BICSI), and certified by the manufacturer for the installation of the cabling specified in this Section.
3. The selected contractor shall provide the installation of this system and shall be certified by the manufacturing company in all aspects of design, installation and testing of the products described herein.
4. The contractor shall utilize the authorized manufacturer components and distribution channels in provisioning this Project.
5. The contractor shall be in compliance with all federal, state and local statutes regarding qualifications of firms.
6. The contractor shall be experienced in all aspects of this work and shall be required to demonstrate direct experience on recent systems of similar type and size.

7. The contractor shall own and maintain tools and equipment necessary for successful installation and testing of optical systems, Category 5E systems, and Category 6 copper premise distribution systems.
8. The contractor shall have personnel who are adequately trained in the usage of such tools and equipment.
9. Contractor shall submit a resume of qualification with the Contractor's proposal indicating the following:
    a. A list of recently completed projects of similar type and size with contact names and telephone numbers for each.
    b. A list of test equipment proposed for use in verifying the installed integrity of metallic and fiber optic cable systems on this project.
    c. A technical resume of experience for the contractor's Project Manager and on-site installation supervisor who will be assigned to this project.
    d. A list of technical product training attended by the contractor's personnel that will install the CCS system.
    e. Any sub-Contractor, who will assist the CCS contractor in performance of this work, shall have the same training and certification as the CCS contractor.

C. Comply with NFPA 70 (latest edition).

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.5 SUBMITTALS

A. Product Data: Include data on features, ratings, and performance for each component specified.

B. Provide manufacturer's catalog information showing dimensions, colors, and configurations.

C. Submittals shall include all items called for in PART 2 – PRODUCTS of this document and the manufacturers cut sheets for the following:
1. All fiber optic and copper cable: to include patch cords, cross connect wire and cross connect cordage.
2. All connectors and required tooling.
3. All termination system components for each cable type.
4. All ER, MC, IC and TR equipment frame types, hardware (and LAN equipment if applicable).
5. All grounding and surge suppression system components.
6. All test equipment to be used for fiber and copper channels
7. A technical data sheet showing manufacturer's Guaranteed Channel Performance over the full swept frequency range.
8. Technical data sheets shall include the physical specifications as well as the following electrical and transmission characteristics:
    a. Mutual Capacitance
    b. Impedance
    c. DC Resistance

d. Attenuation
e. Worst Pair-to-Pair Near End Crosstalk
f. Power Sum Near End Crosstalk
g. ELFEXT
h. Power Sum ELFEXT
i. Return Loss
j. Manufacturer's Instructions

9. Indicate application conditions and limitations of use stipulated by product testing agency specified under regulatory requirements.
10. Include instructions for storage, handling, protection, examination, preparation, operation and installation of product.
11. Pre-Qualification Certificate

D. Contractor shall submit the following documents with project proposal:

1. A letter of approval from the manufacturer indicating completion of pre-qualification requirements.
2. Training certificates for design, engineering and installation of the proposed products.

E. Vendor shall submit, to the Engineer/Owner, all factory test information prior to installation. If equivalent product(s) are substituted, the equivalent product(s) must show demonstrated and documented equivalence to the product(s) specified.

F. Shop Drawings: Include dimensioned plan and elevation views of components. Show access and workspace requirements.

1. System labeling schedules, including electronic copy of labeling schedules, as specified in Part 3, in software and format selected by Owner.

G. Samples: For workstation outlet connectors, jacks, jack assemblies, and faceplates for color selection and evaluation of technical features.

H. Product Certificates: Signed by manufacturers of cables, connectors, and terminal equipment certifying that products furnished comply with requirements.

I. Qualification Data: For firms and persons specified in "Quality Assurance" Article. Provide evidence of applicable registration or certification.

J. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

K. Maintenance Data: For products to include in maintenance manuals specified in Division 1.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

B. Where recommended by the equipment supplier, deliver equipment in fully enclosed vans after specified environmental conditions have been permanently established in spaces where equipment is to be placed. The products accepted on the site shall be wrapped in factory packing, and shall be inspected for damage prior to acceptance.

C. Store equipment in clean, dry with non-condensing environments that are controlled within manufacturer=s ambient tolerances for non-operating equipment. Protect from weather, dirt, fumes, water, construction debris, and physical damage.

D. Handle equipment carefully to prevent damage, breaking, and scoring. The contractor shall not install damaged units or components; replace with new.

E. Equipment furnished by others. The contractor shall be responsible for receiving, uncrating, inspecting, storing, and installing of Division 16 equipment listed as furnished by others.

1.7 SPARE PARTS

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. Cable: 1,000 feet of each size and type used for Project. Furnish on reels.
2. Patch Panel Units: One of each type for every six installed, but not less than one.
3. Connecting Blocks: One of each type for every 25 installed, but not less than one.
4. Cable Jacks: 10% of each type and color installed, but not less than one of each type or color.
5. Device Plates: 10% of each type installed, but not less than one.
6. Patch Cords: 10% of each type installed or provided to owner, but not less than one of each type.

1.8 WARRANTY

A. Material Guarantee: The wiring vendor (installer) shall guarantee at the time of the bid that all Category 5E, Category 6 and fiber optic cabling and components meet or exceed specifications (including installation) of ANSI/TIA/EIA-568-B.1, 568-B.2, 568-B.3 and 569.

B. Material Provided: The successful wiring vendor (installer) shall be certain that all correct parts are ordered per Products Section of this document and installed in accordance with manufacturers design and installation guidelines. Vendor shall submit complete parts and part numbers to Engineer/Owner prior to installation of equipment.

C. Warranty Documentation: Warranty shall be for 15 years.

1. Complete documentation regarding the manufacturer's warranty shall be submitted as part of the submittal process. This shall include, but is not limited to a sample of the warranty that shall be provided to the owner when the installation is complete and documentation of the support procedure for warranty issues.
2. A systems application assurance manual documenting the vendor supported applications and application guidelines shall be provided as part of the submittals.

D. Persons / Entity Covered

1. This Limited Warranty shall be for the benefit of the person or entity to which the manufacturer's CCS Registration Certificate is issued and any successor (Transferable) in interest to the site in which such System was originally installed by the manufacturer or an Authorized manufacturer's Reseller.

2. If manufacturer repairs the product, it may use new or reconditioned replacement parts. If manufacturer chooses to replace the product, manufacturer may replace it with a new or reconditioned one of the same or similar design. Any such repair or replacement will be warranted for either (a) 90 days or (b) the remainder of the original 15 -year warranty period, whichever is longer.
3. Extended Product Warranty
   a. The Extended Product Warranty covers product defects for all passive components of the CCS. Passive components are defined as those exhibiting no gain or contributing no energy. The manufacturer shall warrant, from the date a Registration Certificate is issued by the manufacturer to the end-user, the following:
      (1) That the passive products that comprise the registered CCS will be free from manufacturing defects in material or workmanship under normal and proper use;
      (2) That all CCS approved passive cabling products that comprise the registered CCS solution exceed the specification of TIA 568-B.1, B.2, B.3 and exceed ISO/IEC 11801 standards and will conform to the performance specifications of the manufacturer's associated product data sheet in effect at the time the Registration Certificate is issued;
      (3) That the installation will exceed the insertion and return loss, attenuation and near end crosstalk (NEXT) requirements of TIA 568-B and the ISO/IEC 11801 standards for cabling links/channel configurations specified in these standards.
   b. This extended Product Warranty shall be applicable to the CCS only on the original site of installation. Under the Extended Product Warranty, manufacturer shall either repair or replace the defective product itself at manufacturer's cost. And in the U.S.A., manufacturer shall pay an Authorized manufacturer's Reseller for the cost of labor to repair or replace any such defective product on behalf of the manufacturer.

1.9 MAINTENANCE

A. NOT APPLICABLE

1.10 COORDINATION

A. Coordinate Work of this Section with the existing telephone service, telephone/data locations and Owner's technical personnel.
   1. Meet jointly with representatives of the local exchange carrier and Owner's representatives to exchange information and agree on details of equipment arrangements and installation interfaces.
   2. Record agreements reached in meetings and distribute record to other participants.
   3. Adjust arrangements and locations of distribution frames, patch panels, and cross connects in equipment rooms and wiring closets to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.

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:

1. Amp Connect
2. Berk-Tek and Ortronics (Net Clear)
3. Belden IBDN
4. Hubbell and Mohawk (Sure bit)
5. Leviton and Superior Essex (Next lad)
6. Sumitomo Electric – Future Flex
7. The Siemon Company
8. Pre approved equal

B. Unspecified equipment and material

1. Any item of equipment or material not specifically addressed on the drawings or in this document and required to provide a complete and functional CCS installation shall be provided in a level of quality consistent with other specified items.

C. Cabling Part numbers: The following catalog numbers are based upon communications cable and termination components manufactured by Amp Netconnect. Subject to the available manufacturers list above, contractor shall provide equivalent equipment by the listed manufacturers.

1. Category 3 UTP cables
   a. (Plenum Rated): Colors [_____] for data, [_____] for phone.
      (1) Amp Netconnect #57241-X
   b. (Riser Rated): Colors [_____] for data, [_____] for phone.
      (1) Amp Netconnect #57240-X
2. Category 5e UTP cables
   a. (Plenum Rated): Colors [_____] for data, [_____] for phone.
      (1) Amp Netconnect #219513-X
   b. (Riser Rated): Colors [_____] for data, [_____] for phone.
      (1) Amp Netconnect #219538-X
3. Category 6 FTP (shielded) cables
   a. (Plenum Rated): Colors [_____] for data, [_____] for phone.
      (1) Amp Netconnect #1499416-X
   b. (Riser Rated): Colors [_____] for data, [_____] for phone.
      (1) Amp Netconnect #1499389-X
4. Terminal Patch Panel (CAT-5e cables)
   a. Amp Netconnect #406331-1

5. Terminal Patch Panel (CAT-6 shielded cables):
   a. Amp Netconnect #1644042-2
6. Terminal Fiber Patch Components:
   a. 24 fibers, 2U rack mounted: Amp Netconnect #559542-2
   b. 48 fibers, 3U rack mounted: Amp Netconnect #559614-2
   c. 96 fibers, 4U rack mounted: Amp Netconnect #559552-2
7. Connectors, Jacks, Plates:
   a. Jacks B compatible with selected cable manufacturer throughout. Color: [_____] for data, [_____] for telephone.
      (1) CAT6 Modular Jack: Amp Connect #1375055-X (unshielded)
      (2) CAT6 Modular Jack: Amp Connect #1375118-1 (shielded)
      (3) CAT 5e Modular Jacks: Amp Netconnect #1375191-X unshielded)
      (4) CAT 5e Modular Jacks: Amp Netconnect #1375189-1 (shielded)
      (5) CAT 3 Modular Jacks: Amp Netconnect #1375195-X
   b. Fact Plates B Color: [_____,] 4 -position to mount on single gang outlet box and 12 position to mount on a 2-gang outlet box. Provide blank fill modules as required (to match plate) to close up all unused positions.
      (1) Amp Netconnect #557505-X (2-position)
      (2) Amp Netconnect #558088-X (4-position)
      (3) Amp Netconnect #83936-X (6 position)
      (4) Amp Netconnect #55808-X (12 position)
8. 110 Blocks:
   a. 50 pair blocks: Amp Netconnect #558841-1
   b. 100 pair blocks: Amp Netconnect #558842-1

D. Distribution Racks:
   a. Homaco #19-84-6T2SD-CMB/VO-84-6M6E Organizer (large "MDF" rack) with #GS-8 ground strap and #PS-48-20A-10P power strip. (Hoffman Company As equal).
   b. Great Lakes #GL48WM with power strip and ground strap (48" lockable cabinets. See plans for locations).

E. Equivalent products
   1. Equivalent product(s) may be considered for substitution for those products specified, however, the equivalent product(s) must be approved and show demonstrated and documented equivalence to the product(s) specified.
   2. Documentation shall include, but is not limited to: product samples, data sheets, and actual test data.
   3. The request for product substitution, and supporting documentation, must be submitted, in writing, prior to submitting the bid.
      a. Written approval for product substitution must be submitted with the bid.

2.2 SYSTEM REQUIREMENTS

A. General: Coordinate the features of materials and equipment so they form an integrated system. Match components and interconnections for optimum future performance.

B. Expansion Capability: Unless otherwise indicated, provide spare fibers and conductor pairs in cables, positions in patch panels, cross connects, and terminal strips, and space in backbone cable trays and wireways to accommodate 20% future increase in active workstations.

C. Guaranteed Performance

1. Category 3 Guaranteed performance

   a. The Category 3, 4 pair UTP channel shall consist of all cable and components that comprise the full length circuit from the punch down blocks located in the ER and TR rooms to the TO at the work station inclusive of all patch cables and work station cables.

   b. A single manufacturer shall be responsible for all of the Category 3 cable and all Category 3 channel components.

   c. The manufacturer shall warrant the Category 3 channel cable, components, and applications for a minimum period of 15 years.

   d. The 15 -year warranty shall be a transferable warranty and include all labor to replace any defective components as well as the component replacement.

2. Category 5E Guaranteed Channel Performance

   a. The Category 5E, 4 pair UTP channel shall consist of all cable and components with up to two connections that comprise the full 100 meter (328 feet) length circuit from the Hub/Server/LAN Electronics port located in the ER and TR rooms to the TO location Work Station inclusive of all patch cables and work station cables.

   b. The Category 5E, 4 pair UTP channel shall be capable of providing stable and continual performance up to 155.5MHz over the entire swept frequency.

   c. The Category 5E channel shall support emerging high-bandwidth applications, including 1000 Base-T Ethernet, Multi-Tasked Split Screen Computing, Virtual Holographic Video Conferencing, Instant Access Telemedicine, 3D CAD/CAM Engineering, Internet-Intranet Communications/Commerce, ATM as well as all 77 channels (550 MHz) of analog broad band video.

   d. All copper cable and apparatus shall exceed the Category 5/Class E Channel Performance Specification.

   e. The copper cable and apparatus channel performance shall be measured over the full 100 meters (328 feet) length and include 4 connection points.

   f. A single manufacturer shall be responsible for all of the Category 5E cable and all Category 5E channel components.

   g. The manufacturer shall warrant the Category 5E channel cable, components, and applications for a minimum period of 15 years.

h. The 15 -year warranty shall be a transferable warranty and include all labor to replace any defective components as well as the component replacement.

i. The guaranteed channel performance requirements of the Category 5E Channel with cable, cords, outlets and four (4) connections as compared to standard Category 5 shall apply to worst-case 100-meter channels using 4-pair Category 5E horizontal cable and shall be as follows:

Electrical Parameter (1 – 155.5MHz)	Guaranteed Margins to Category 5E / Class D Channel Specifications
Insertion Loss	5.0 %
NEXT	3.0 dB
PSNEXT	5.5 dB
ELFEXT	4.5 dB
PSELFEXT	5.5 dB
Return Loss	1.0 dB

Category 5E Guaranteed Channel Performance Specifications:

Freq (MHz)	Atten (dB)	pr-pr NEXT (dB)	ACR (dB)	PS NEXT (dB)	PS ACR (dB)	pr-pr ELFEXT (dB)	PS ELFEXT (dB)	Return Loss (dB)	Phase Delay (ns)	Delay Skew (ns)
1	2.1	63.0	60.9	62.5	60.4	61.8	59.8	18.0	580	30
4	4.2	56.6	52.4	56.2	52.0	49.8	47.8	18.0	562	30
8	6.0	51.6	45.6	51.2	45.2	43.8	41.8	18.0	557	30
10	6.7	50.0	43.3	49.6	42.9	41.8	39.8	18.0	555	30
16	8.6	46.6	38.0	46.2	37.6	37.8	35.7	18.0	553	30
20	9.7	45.0	35.4	44.6	34.9	35.8	33.8	18.0	552	30
25	10.9	43.4	32.5	42.9	32.1	33.9	31.9	17.0	551	30
31.25	12.2	41.8	29.5	41.3	29.1	31.9	29.9	16.0	550	30
62.5	17.7	36.6	19.0	36.1	18.4	25.9	23.9	13.1	549	30
100	22.8	33.1	10.3	32.6	9.8	21.8	19.8	11.0	548	30
125	25.8	31.5	5.7	30.9	5.1	19.9	17.9	10.1	547	30
155.5	29.1	29.8	0.7	29.2	0.1	18.0	16.0	9.1	547	30

3. Category 6 Guaranteed Channel Performance

a. All copper cable and apparatus shall conform to the Category 6 Channel Performance Specification.

b. The copper cable and apparatus channel performance shall be measured over the full 100 meters (328 feet) length and include 4 connection points.

c. The specifications for the 4 pair UTP Category 6 channel are divided into two primary groups based upon high performance and premium performance cable. The Category 6 channel shall consist of all cable and components with four connections that comprise the full 100 meter (328 feet) length circuit from the Hub/Server/LAN Electronics port located in the ER and TR rooms to the TO at the Work Station inclusive of all patch cables and work station cables.

d. The Category 6, 4 pair UTP channel shall support emerging high-bandwidth applications, including 1 Gbps Ethernet, potentially 1.2 Gbps ATM and 2.4 Gbps ATM, Multi-Tasked Split Screen Computing, Virtual Holographic Video Conferencing, Instant Access Telemedicine, 3D CAD/CAM Engineering, Internet-Intranet Communications/Commerce, as well as all 77 channels (550 MHz) of analog broad band video.

e. The Category 6 cable and Category 6 channel components shall be manufactured by a single manufacturer. The manufacturer shall warrant the Category 6 channel cable, components, and applications for a minimum period of 15 years.

f. The 15 year warranty shall be a transferable warranty and include all labor to replace any defective components as well as the component replacement.

g. The Category 6 channel with four (4) connections shall have a minimum of 10dB Attenuation to Crosstalk Ratio (ACR), across the full frequency range of 1MHz - 149.1MHz. At no point across the frequency range of 1MHz - 149.1MHz shall the ACR drop below 10dB.

h. The Delay Skew on the 100 meter channel shall not exceed 30 ns.

i. The Category 6 cable and components shall be electrically backward compatible with existing Category 3, 5, 5E plus future networks.

j. The Category 6 components shall be engineered and manufactured to compensate for any CAT 3, 5 or 5E component crosstalk and shall provide at least CAT 3, 5 or 5E performance in all of the customer's existing installed base of voice/data/video.

k. The Category 6 cable and components shall be physically compatible with existing installed base of equipment.

l. The Category 6 cable and components shall not require special cords, specialty tools or special installation requirements.

m. The guaranteed channel performance requirements of the Category 6 Channel described above with cable, cords, outlets manufactured by the same manufacturer and four (4) connections for 100 meters shall be as shown in the following tables:

Guaranteed Channel Performance Specifications for Category 6 Systems												
Frequency (MHz)	1	4	8	10	16	20	25	31.25	62.5	100	200	250
Insertion Loss (dB)	2.1	3.9	5.4	6.1	7.7	8.7	9.7	10.9	15.8	20.4	30.3	34.5
NEXT (dB)	69.0	67.0	62.2	60.6	57.2	55.6	54.0	52.4	47.4	43.9	38.8	37.1
ACR (dB)	66.9	63.2	56.7	54.5	49.5	47.0	44.3	41.5	31.6	23.5	8.5	2.6
PSNEXT (dB)	67.5	66.0	61.1	59.5	56.1	54.5	52.8	51.2	46.1	42.6	37.4	35.7
PSACR (dB)	65.4	62.1	55.7	53.4	48.4	45.8	43.1	40.3	30.3	22.1	7.1	1.2
ELFEXT (dB)	67.3	55.2	49.2	47.3	43.2	41.2	39.3	37.4	31.3	27.3	21.2	19.3
PSELFEXT (dB)	66.3	54.2	48.2	46.3	42.2	40.2	38.3	36.4	30.3	26.3	20.2	18.3
Return Loss (dB)	21.0	21.0	21.0	21.0	20.0	19.5	19.0	18.5	16.0	14.0	11.0	10.0
Delay (ns)	580	562	557	555	553	552	551	550	549	548	547	546
Delay Skew (ns)	30	30	30	30	30	30	30	30	30	30	30	30

Note: The table provides reference values only. All parameters comply with the governing equations given below over the entire frequency range. All values and equations apply to worst-case channels utilizing four-pair High Performance E series cables with full cross-connects, consolidation points and work area outlets (4 connectors in a channel) for any channel lengths up to 100 meters.

Electrical Parameter (1 - 250MHz)	Guaranteed Margins to draft Category 6 / Class E channel Specifications
Insertion Loss	4 %
NEXT	4 dB
PSNEXT	5.5 dB
ELFEXT	4 dB
PSELFEXT	6 dB
Return Loss	2 dB

(1) Governing Equations for 6-Connection High Performance Category 6 Channels (1-250MHz):

$$Insertion\ Loss \le 1.8472 \times \sqrt{f} + 0.0166 \times f + \frac{0.1958}{\sqrt{f}} + 2.88 \times 10^{-4} \times f^{1.5}$$

$$NEXT \ge -\left[20 \times \log\left(1.2162 \times 10^{-4} \times f^{0.75} + 2.5179 \times 10^{-5} \times f\right)\right]$$

$$PSNEXT \ge -\left[20 \times \log\left(1.2882 \times 10^{-4} \times f^{0.75} + 3.3576 \times 10^{-5} \times f\right)\right]$$

$$ELFEXT \ge -\left[20 \times \log\left(4.3367 \times 10^{-4} \times f\right)\right]$$

$$PSELFEXT \ge -\left[20 \times \log\left(4.8658 \times 10^{-4} \times f\right)\right]$$

$$RL \ge 21,\ 1 \le f < 10\ MHz;\quad RL \ge 26 - 5 \times \log(f),\ 10 \le f < 40\ MHz;\quad RL \ge 34 - 10 \times \log(f),\ 40 \le f < 250\ MHz$$

$$Delay \le 544 + \frac{36}{\sqrt{f}};\quad Skew \le 30$$

D. Outlets

1. Outlet Locations

a. Unless otherwise noted on the floor plans or within this document, all voice and data wall outlets for 24 AWG copper cable shall be:

(1) [____-]position/ [____-]conductor modular outlets
(2) Insulation displacement
(3) Support Universal applications in a multivendor environment, accepting modular RJ-11 jacks (telephone) and RJ-45 Jacks (data).
(4) Provided with blank module inserts for all unused module locations. Jack module arrangements are shown on the drawings. Provide color coded inserts at each outlet, termination block and at patch panels as shown on the drawings.
(5) Mounted in one or two gang utility outlet boxes.
(6) Equipped with EIA/TIA-T568A and EIA/TIA-T568B universal wiring labels.

2. Category 3 Outlets

a. All Category 3 outlets shall conform to ANSI/TIA/EIA 568-B Commercial Building Telecommunications Cabling Standard, Horizontal Cable Section, and be part of the UL® LAN Certification and Follow-up Program.
b. Shall be UL® Verified Category 3 Electrical Performance
c. Shall comply with FCC Part 68
d. ISO 9001 Certified Manufacturer
e. All Category 3 shall meet or exceed the following electrical and mechanical specifications:

(1) Electrical Specifications: ANSI/TIA/EIA 568-B Category 3 minimum transmission requirements

Insulation resistance	500 MΩ minimum
Dielectric withstand voltage	1,000 VAC RMS, 60 Hz minimum, contact-to-contact and 1,500 VAC RMS, 60 Hz minimum from any contact to exposed conductive surface.
Contact resistance	20 mΩ maximum
Current rating	1.5 A at 68° F (20°C) per IEC Publication 512-3, Test 5b.

(2) Mechanical Performance:

Plug Insertion Life:	750 insertions
IDC Terminations:	200 terminations
Contact Force:	3.5 oz (99.2 g) minimum using FCC-Approved modular plug
Plug Retention Force:	30 lb (133 N) minimum between modular plug and jack
Temperature Range:	-40 to 150°F (-40 to 66°C)

3. Category 5E Power Sum Outlets

   a. All Category 5E outlets shall meet or exceed Power Sum NEXT and Category 5E transmission requirements for connecting hardware, as specified in ANSI/TIA/EIA 568-B Commercial Building Telecommunications Cabling Standard, Horizontal Cable Section, and be part of the UL® LAN Certification and Follow-up Program.

   b. The Category 5E outlets shall be capable of being in a modular patching situation or as a modular telecommunication outlet (TO) supporting current and evolving high-speed, high-bandwidth applications, including Ethernet, 1000BASE-T, Token Ring, 100 Mbps TP-PMD, 155 Mbps ATM, 622 Mbps ATM using parallel transmission schemes.

   c. The outlet shall use either the EIA/TIA-T568A or EIA/TIA-T568B wiring.

   d. The Category 5E outlets shall be capable of being installed at a 90° angle in any series of modular faceplate, frame, or surface-mounted box avoiding the need for special faceplates.

   e. Snap-on icons shall identify the outlet as a Category5E to distinguish it from other Category Series outlets.

   f. General specifications:

      (1) Meets or exceeds the mechanical, electrical, and clearance specifications in FCC Rules and Regulations, Part 68, Subpart F

      (2) Meet or exceed the Category 5E requirements in ISO/IEC 11801, CENELEC EN 50173, and ANSI/EIA/TIA 568B

      (3) Certifications: UL Listed, CSA Certified and AUSTEL approved.

g. Electrical Performance:

Dielectric Withstand Voltage	1000 VAC RMS, 60 Hz minimum, contact-to-contact
Insulation Resistance	500 M ohms minimum
Contact Resistance	20 M ohms maximum
Current Rating	1.5A at 68°F (20° C) per IEC Publication 512-3, Test 5b
Transmission Performance	NEXT, FEXT, ELFEXT, and Attenuation measurements were made per ANSI/EIA/TIA 568-B

h. Mechanical Performance:

Plug/Jack Contact Force	100 grams minimum per contact using FCC approved plug
Plug Retention Force	30 lb. (133 N) minimum
Temperature Range	-40° to 150° F (-40° C to 66° C)
Plug Insertion Life:	750 insertions
IDC Terminations:	200 terminations

i. Physical Characteristics:

Dimensions	0.8" (20 mm) W x 0.8" (20 mm) H x 1.2" (31 mm) D
Plastic	High-Impact, flame-retardant. UL-rated 94V-0 thermoplastic
Outlet Wires	Copper alloy, 1.27 μm lubricated gold plating over 2.54 μm nickel underplate
Connector	Insulation displacement connectors (IDC) accept 22 & 24 AWG wire

4. Category 6 Gigabit outlets

a. All Category 6 outlets shall meet or exceed Category 6 transmission requirements for connecting hardware, as specified in ANSI/TIA/EIA 568-B Commercial Building Telecommunications Cabling Standard and be part of the UL® LAN Certification and Follow-up Program.

b. The Category 6 outlets shall be backward compatible with Category 5E, 5 and 3 cords and cables.

c. The Category 6 outlets shall be capable of being in a modular patching situation or as a modular telecommunication outlet (TO) supporting current 10Base-T, Token Ring, 100 Mbps TP-PMD, 155 Mbps ATM, 622 Mbps ATM using parallel transmission schemes and evolving high-speed, high-bandwidth applications, including Ethernet, 1000BASE-T and 1.2 Gbps ATM.

d. The Category 6 outlets shall be capable of being installed at a 90° angle in any series modular faceplate, frame, or surface-mounted box avoiding the need for special faceplates.

e. The Category 6 outlets shall have improved pair splitters and wider channel for enhanced conductor placement. The outlet shall also have a low-profile wire cap, which protects against contamination and secures the connection. Multicolored identification labels shall be available to assure accurate installation.

f. The Category 6 outlets shall meet the following Guaranteed Margin Performance and Physical Specifications:

(1) Guaranteed Margin:

	Category 6 Outlet	High Performance Channel	Premium Performance Channel
	Typical Worst Pair Margin*	Guaranteed Margin**	Guaranteed Margin**
Insertion Loss	26.9%	5.0%	7.5%
NEXT	5.4 dB	6.0 dB	7.0 dB
PSNEXT	4.7 dB	7.5 dB	8.5 dB
ELFEXT	10.5 dB	6.0 dB	8.0 dB
PSELFEXT	10.8 dB	8.0 dB	10.0 dB
Return Loss	8.0 dB	4.0 dB	4.0 dB
Frequency Range	1-250 MHz	1-250 MHz	1-250 MHz

* Typical worst pair swept margin when measured with same manufacture's Cat 6 modular patch cord.

**Guaranteed margin is valid at any frequency from 1-250 MHz for the single manufacturer's certified channel comprising the single manufacturer's Cat 6 apparatus and the single manufacturer's High Performance series cable or Premium Performance series. Values represent margin over the draft Category 6/Class E channel specifications.

(2) Physical Specifications:

Dimensions	0.8 in (20 mm) W x 0.8 in (20 mm) H x 1.2 in (31 mm) D
Plastic	High-impact, flame-retardant, UL rated 94V-0 thermoplastic
Connector	Copper alloy, 100 micro-inch bright solder over 100 micro-inch nickel underplate
Outlet Wires	Copper alloy, 50 micro-inch lubricated gold plating over 100 micro-inch nickel underplate
Operating Temperature	14°F to 140°F (-10°C to 60°)
Storage Temperature Range	-40°F to 158°F (-40°C to 70°C)
Humidity	95% (noncondensing)
Nominal Solid Conductor Diameter:	0.025 to 0.020 in (22 to 24 AWG)
Nominal Stranded Conductor Diameter	0.64 to 0.51mm (22 to 24 AWG)
Plug Retention Force	30lb (133 N) minimum
Plug / Jack Contact Force	100 grams minimum per contact using FCC-8 position telecommunication plug
Insertion Life	750 cycles minimum using FCC-8 position telecommunication plug

2.3 MOUNTING ELEMENTS

A. Cable Trays, innerducts, conduits, ladder racks, and horizontal and vertical cable management systems: Comply with Section 16700.

B. Raceways and Boxes: Comply with Section 16130.

C. Telephone Terminal Backboards: ¾" (19-mm) interior grade, fire resistive treated plywood. Comply with Section 16700.

2.4 TWISTED-PAIR CABLES, CONNECTORS, AND TERMINAL EQUIPMENT

A. Listed as complying with Category 3, 5E, and 6 of EIA/TIA-568-B.

B. Conductors: Solid copper.

C. Station cable

1. Category 5E UTP, 4 Pair

a. Category 5E UTP cables shall extend between the station location and its associated TR and consists of 4 pair, 24 gauge, UTP, and shall terminate on 8 pin modular jacks provided at each outlet.

b. Cable jacket shall comply with Article 800 NEC for use as a plenum or non-plenum cable. The 4 pair UTP cable shall be UL® and c (UL®) Listed Type CMP (plenum) or CM (non-plenum).

c. All 4 pair Category 5E cables shall conform to ANSI/TIA/EIA 568-B Commercial Building Telecommunications Cabling Standard, Horizontal Cable Section, and be part of the UL® LAN Certification and Follow-up Program.

d. Applications standards supported should include, but not limited to, IEEE 802.3, 1Base5, 10BASE-T; IEEE 802.5, 4 Mbps, 16Mbps (328 ft [100m], 104 Workstations) and TP-PMD. In addition, cables shall be capable of supporting current and evolving high-speed, high-bandwidth applications, including Ethernet, 1000BASE-T, Token Ring, 100 Mbps TP-PMD, 155 Mbps ATM, 622 Mbps ATM using parallel transmission schemes.

e. All Category 5E cables shall meet or exceed the electrical and physical specifications; and the guaranteed performance characteristics as follows:

(1) Electrical Specification:

Nominal Velocity of Prop (NVP)	Non-plenum 0.70, Plenum 0.75
Maximum DC Resistance	28.6 OHM/1000ft (9.38 OHM/100m)
Max DC Resistance Unbalance	5%
Mutual Capacitance at 1 kHz	14 nF/1000 ft (4.59 nF/100 m)
Max Capacitance Unbalanced p to g	400 pF/1000 ft (131.2 pF/100 m)
Characteristic Impedance	At 0.772 MHz: 105 +/- 15 OHM
	At 1.0-100 MHz: 100 +/- 15 OHM
Attenuation dB/328 ft [100 m]	At 1 MHz 1.9
	At 4 MHz 3.8
	At 10 MHz 6.1
	At 16 MHz 7.7
	At 20 MHz 8.7
	At 62.5 MHz 15.8
	At 100 MHz 20.4
Standards	ANSI/TIA/EIA-568-B.1 and ANSI/TIA/EIA-568-B.2 Category 5E
	ISO/IEC 11801: 2002 (2nd Edition) Class D
	CENELEC EN-50173: 2002 2nd Edition Category 5E

(2) Physical Specification:

Gauge	24 AWG
Insulation Thickness	Non-plenum - 0.008 in (0.20 mm) Plenum – 0.005 in (0.13 mm)
Jacket Thickness	Non-plenum - 0.026 in (0.66 mm) Plenum - 0.015 (0.38 mm)
Outside Diameter	Non-plenum - 0.220 in (5.60 mm) Plenum - 0.015 in (0.38 mm)

(3) Category 5E cables guaranteed performance to 350 MHz over Swept Frequency:

Freq. MHz	Atten. dB/100m	CAT 5E Standard	Power Sum Near End Crosstalk dB	CAT 5E Standard	Pair to Pair Near End Crosstalk dB	CAT 5E Standard	Attenuation to Crosstalk Ratio dB/100m	CAT 5E Standard
0.772	1.7	< 1.8	67.0	64.0	70.0	67.0	68.3	n/a
1	2.0	< 2.0	65.3	62.3	68.3	65.3	66.3	n/a
4	3.9	< 4.1	56.3	53.3	59.3	56.3	55.4	n/a
8	5.6	< 5.8	51.8	48.8	54.8	51.8	49.2	n/a
10	6.3	< 6.5	50.3	47.3	53.3	50.3	47.0	n/a
16	8.0	< 8.2	47.3	44.3	50.3	47.3	42.3	n/a
20	9.0	< 9.3	45.8	42.8	48.8	45.8	39.8	n/a
25	10.1	< 10.4	44.3	41.3	47.3	44.3	37.2	n/a
31.25	11.4	< 11.7	42.9	39.9	45.9	42.9	34.5	n/a
62.5	16.5	< 17.0	38.4	35.4	41.4	38.4	24.9	n/a
100	21.3	< 22.0	35.3	32.3	38.3	35.3	17.0	n/a
155	27.2	n/a	32.5	n/a	35.5	n/a	8.2	n/a
200	31.4	n/a	30.8	n/a	33.8	n/a	2.4	n/a
220	33.2	n/a	30.2	n/a	33.2	n/a	0.0	n/a
300	39.7	n/a	28.2	n/a	31.2	n/a	n/a	n/a
350	43.5	n/a	27.2	n/a	30.2	n/a	n/a	n/a
0.772	70.0	66.0	68.0	63.0	n/a	n/a	25.0	< 45
1	67.8	63.8	65.8	60.8	20.0	20.0	25.0	< 45
4	55.7	51.7	53.7	48.7	23.0	23.0	25.0	< 45
8	49.7	45.7	47.7	42.7	24.5	24.5	25.0	< 45
10	47.8	43.8	45.8	40.8	25.0	25.0	25.0	< 45
16	43.7	39.7	41.7	36.7	25.0	25.0	25.0	< 45
20	41.7	37.7	39.7	34.7	25.0	25.0	25.0	< 45
25	39.8	35.8	37.8	32.8	24.3	24.3	25.0	< 45
31.25	37.9	33.9	35.9	30.9	23.6	23.6	25.0	< 45
62.5	31.8	27.8	29.8	24.8	23.0	21.5	25.0	< 45
100	27.8	23.8	25.8	20.8	23.0	20.1	25.0	< 45
155	23.9	n/a	21.9	n/a	18.8	n/a	25.0	n/a
200	21.7	n/a	19.7	n/a	18.0	n/a	25.0	n/a
220	20.9	n/a	18.9	n/a	17.7	n/a	25.0	n/a
300	18.2	n/a	16.2	n/a	16.8	n/a	25.0	n/a
350	16.9	n/a	14.9	n/a	16.3	n/a	25.0	n/a

2. Category 6 FTP, 4 Pair (High Performance Shielded Cable)

a. The high performance Category 6 UTP cable shall be of the traditional round design with mylar separator tape between pairs 2 & 3 and 1 & 4 and integral foil shield.

b. The cable shall support Voice, Analog Baseband Video/Audio, Fax, Modem, T-1, ISDN,RS-232, RS422, RS-485, 10BASE – T Ethernet, Token Ring, 100Mbps TP-PMD, 100BASE-T Ethernet, 155 Mbps ATM, AES/EBU Digital Audio, 270 Mbps Digital Video, 622 Mbps 64-CAP ATM and emerging high-bandwidth applications, including 1 Gbps Ethernet, gigabit ATM, as well as all 77 channels (550 MHz) of analog broadband video.

c. The cable jacket shall comply with Article 800 NEC for use as a riser, plenum or non-plenum cable. The 4 pair UTP cable shall be UL® Listed Type CMP (plenum) or CM (non-plenum).

d. Performance shall be characterized to 550 MHz to support high-bandwidth video applications

e. All Category 6 high performance cables shall the following specification:

	Non Plenum	**Plenum**
Weight	25.3 lb (1000 ft)	29 lb (1000 ft)
Outside Diameter	0.232 in	0.22 in
Conductor Diameter	.022 in	.022 in
Jacket Material	PVC	Low Smoke PVC
Maximum Pulling Tension	25 lbs	25 lbs
Nom. Velocity of Propagation	0.69	0.72
Max DC Resistance	9.83 Ohms/100m	9.83 Ohms/100m
Mutual Capacitance @ 1kHz	4.95 nF/100m	4.78 nF/100m
Operating Temperature	-20 to 60° C	-20 to 60° C
UL Type	CMR & CMG	CMP

f. The high performance Category 6 cable shall be specified to 550 MHz and shall meet the guaranteed swept margin as follows:

	High Performance Cable	High Performance Channel	Premium Performance Channel
	Typical Worst Pair Margin*	Guaranteed Margin**	Guaranteed Margin**
Insertion Loss	3.0 %	5.0%	7.5%
NEXT	6.0 dB	6.0 dB	7.0 dB
PSNEXT	6.0 dB	7.5 dB	8.5 dB
ELFEXT	5.0 dB	6.0 dB	8.0 dB
PSELFEXT	5.0 dB	8.0 dB	10.0 dB
Return Loss	4.0 dB	4.0 dB	4.0 dB
Frequency Range	1-550 MHz	1-250 MHz	1-250 MHz

* Typical worst pair swept margin.

**Guaranteed margin is valid at any frequency from 1-250 MHz for the single manufacturer's certified channel comprising the single manufacturer's Cat 6 apparatus and the single manufacturer's High Performance series cable or Premium Performance series. Values represent margin over the draft Category 6/Class E channel specifications.

D. Copper cable – Telephone Building Riser

1. Shielded 24 AWG multi-pair copper cables shall be used as the vertical riser cables. The cable shall support voice data applications.
2. Shielded
3. The shielded riser rated, plenum and nonplenum cable shall consist of solid-copper conductors insulated with expanded polyethylene covered by a PVC skin, be conformance tested to meet EIA/TIA 568-B for Category 5 cables, be UL® and c (UL®) Listed as CMR.
4. The PVC sheath shall have improved frictional properties, allowing it to be pulled through conduit without the use of lubricants.
5. The cable shall be available in 25, 50, 100, 150, 200, 300, 400, 600, 900, 1200, 1500, and 1800 pair counts.
6. UL® and c (UL®) Listed for Fire Safety
7. ISO 9001 Certified Manufacturer
8. The copper riser cable shall meet or exceed the following electrical specifications listed below:

Electrical Specifications:

Average DC Resistance	26.5Ω/1,000 ft (8.7Ω/100m), maximum
Average DC Resistance Unbalance	1.7%, maximum
Mutual Capacitance @ 1kHz	16 nF/1000 ft (5.25 nF/100 m), maximum
Capacitance Unbalance (pair to ground)	201pF/1,000 ft (65.94 pF/100m) maximum

Attenuation (dB/100 m [328 ft.] :

Frequency	Attenuation (Max.)
1.00 MHz	2.3 dB
4.00 MHz	4.9 dB
10.00 MHz	8.5 dB
16.00 MHz	12 dB

Worst Pair Near-End Crosstalk (NEXT) dB/100 m [328 ft]:

Frequency	Pair-To-Pair NEXT (Max.)
1.0 MHz	13.8 dB
4.0 MHz	11.2 dB
10.0 MHz	10.2 dB
16.0 MHz	9.2 dB

E. 110 wiring block

1. The wiring block shall support Category 3, Category 5E and Category 6 applications and facilitate cross connection and interconnection using either cross connect wire (voice only) or the appropriate category patch cords.
2. The wiring blocks shall be fire retardant, molded plastic consisting of horizontal index strips for terminating 25 pairs of conductors each. The index strips shall be

marked with five colors on the high teeth, separating the tip and ring of each pair, to establish pair location.

3. A series of fanning strips shall be located on each side of the block for dressing the cable pairs terminated on the adjacent index strips.
4. The wiring block shall accommodate 22- through 26-AWG conductors and shall be able to mount directly on wall surfaces with plywood backboards or on a 19" free-standing frame.
5. Clear label holders with the appropriate colored inserts shall be provided with the wiring blocks. The insert labels shall contain vertical lines spaced on the basis of circuit size (3-, 4-, or 5-pair) and shall not interfere with running, tracing or removing jumper wire/patch cords.
6. The wiring blocks shall be available in 25, 50, 100, and 300 pair sizes. The 100 and 300 pair wiring blocks shall be available with or without legs.
7. The 25 and 50 pair sizes are not available with legs and shall be utilized for low pair count and/or depth restrictive situations.
8. The wiring block shall be able to accommodate over 500 repeated insertions without incurring permanent deformation and it shall pass the reliability test of no more than one contact failure in 10000 connections.
9. The 110 wiring blocks shall meet the following specifications:

Physical Specifications:

Height:	25-, 50-Pair – 1.75 in. (4.45 cm) 100-Pair – 3.59 in. (9.12 cm) 300-Pair, 10.79 in. (27.41 cm)

Electrical Specifications:

ANSI/EIA/TIA – T-568-B	Category 5, 5E, 6

F. Category 6 modular patch panels

1. The Category 6 modular jack panels shall meet or exceed the proposed Category 6 standards requirements in ISO/IEC 11801, CENLEC EN 50173 and ANSI/TIA/EIA and shall be UL Listed.
2. The modular jack panel shall utilize universal A/B wiring.
3. The jack panels shall be either wall or 19-inch rack mountable.

Physical specifications: 24and 48 port patch panels:

Insertion Life: 750 cycles minimum
Plug/Jack Contact Force: 100 g minimum
Plug retention Force: 133 N minimum
Operating Temperature Range: 0 to 60°C
Storage Temperature Range: -40 to 66°C
Humidity: 5 to 95% (noncondensing)
Height: 24-Ports:4.38cm (1u); 48-Ports:8.83cm (2u);64-Ports 17.7cm (4U0)
Width: 48.26cm (19 inch)
Depth: 4.06cm

Guaranteed Margin:

	Category 6 Patch Panel	High Performance Channel	Premium Performance Channel
	Typical Worst Pair Margin*	Guaranteed Margin**	Guaranteed Margin**
Insertion Loss	64.3%	5.0%	7.5%
NEXT	6.6 dB	6.0 dB	7.0 dB
PSNEXT	7.3 dB	7.5 dB	8.5 dB
ELFEXT	6.4 dB	6.0 dB	8.0 dB
PSELFEXT	6.1 dB	8.0 dB	10.0 dB
Return Loss	6.6 dB	4.0 dB	4.0 dB
Frequency Range	1-250 MHz	1-250 MHz	1-250 MHz

* Typical worst pair swept margin when measured with same manufacture's Category 6 patch cord.

**Guaranteed margin is valid at any frequency from 1-250 MHz for the single manufacturer's certified channel comprising the single manufacturer's Cat 6 apparatus and the single manufacturer's High Performance series cable or Premium Performance series. Values represent margin over the draft Category 6/Class E channel specifications.

G. Copper patch cords

1. Category 5E Patch Cords

a. The Category 5E patch cord shall meet or exceed attenuation and NEXT Category 5 and Category 5E specifications for patch cords as specified in ISO/IEC 11801, CENELEC EN50173, and TIA/EIA 568A.

b. The Category 5E patch cords shall meet the following specifications:

Operating Temperature	14°F-140°F (-10°C-60°C)
Contact Plating	1.27 μm Gold over 2.540 μm Nickel
Contact Stability	20m Ω max. change (1kg=2.205lb)
Plug Retention Force	110 N (24.73lb)
Insertion Life	750 insertions

2. Category 6 Patch Cords

a. All patch cords shall exceed ANSI/TIA/EIA and ISO/IEC Category 6/Class E specifications.

b. All patch cords shall be backward compatible with Category 5 and Category 5E systems.

c. The patch cords shall incorporate an anti-snag feature that provides maximum protection from snagging during moves and re-arrangements.

d. Patch cords shall be UL listed, UL-C certified and AUSTEL approved.

e. Patch cords shall support network line speeds in excess of 1 gigabit per second.

f. Patch cords shall be available in stranded and solid conductor in lengths to 100 feet.

g. The Category 6 modular patch cord shall have guaranteed margin as follows:

Guaranteed Margin:

	Category 6 Modular Patch Cord (4 Pair)	High Performance Channel	Premium Performance Channel
	Typical Worst Pair Margin*	Guaranteed Margin**	Guaranteed Margin**
Insertion Loss	NA	5.0%	7.5%
NEXT	4.4 dB	6.0 dB	7.0 dB
PSNEXT	NA	7.5 dB	8.5 dB
ELFEXT	NA	6.0 dB	8.0 dB
PSELFEXT	NA	8.0 dB	10.0 dB
Return Loss	5.9 dB	4.0 dB	4.0 dB
Frequency Range	1-250 MHz	1-250 MHz	1-250 MHz

* Typical worst pair swept margin to TIA Patch cord specification when measured with same manufacturer's Category 6 information outlet.
**Guaranteed margin is valid at any frequency from 1-250 MHz for the single manufacturer's certified channel comprising the single manufacturer's Cat 6 apparatus and the single manufacturer's High Performance series cable or Premium Performance series. Values represent margin over the draft Category 6/Class E channel specifications.

2.5 EQUIPMENT RACKS

A. The equipment racks shall be made of lightweight steel, black in color and include steel mounting hardware for mounting 110 wiring blocks, Category 3, 5e, and 6 modular patch panels, and fiber termination panels to the frame. In addition, the mounting hardware must provide vertical and horizontal wireways for cross connect wire.

B. Racks shall be mounted on an isolation pad and utilize non-conductive washers to secure the rack to the floor.

C. Floor mounted open racks shall be secured from the top rail to the backboard in the room with a length of cable runway to prevent movement.

D. All racks shall be grounded to the isolated ground bar within the MC/TR/ER using a standard ground lug and #6 jacketed green cable.

E. The standard frame must be available in two configurations, which are commonly referred to as single-sided or double-sided frames. Frames must meet the following specifications:

23" Single-sided Dimensions - 7 ft. x 24 inches x 3 inches with 23 inch center mounting

Footprint	24 inches (length) x 15 inches (depth)
Hole pattern	half-inch centered
Screw size	12-24 thread, half-inch length
Pair termination capacity	3600 UTP copper pairs

23" Double-sided Dimensions - 7 ft. x 24 inches x 6 inches with 23 inch center mounting

Footprint	24 inches (length) x 18 inches (depth)
Hole Pattern	half-inch centered
Screw size	12-24 thread, half-inch length.
Pair termination capacity	7200 UTP copper pairs

19" Single-sided Dimensions - 7 ft. x 20 inches x 3 inches with 19 inch center mounting

Footprint	20 inches (length) x 15 inches (depth)
Hole pattern	half-inch centered
Screw size	12-24 thread, half-inch length
Pair termination capacity	3600 UTP copper pairs

19" Double-sided Dimensions - 7 ft. x 20 inches x 6 inches with 19 inch center mounting

Footprint	20 inches (length) x 18 inches (depth)
Hole Pattern	half-inch centered
Screw size	12-24 thread, half-inch length.
Pair termination capacity	7200 UTP copper pairs

2.6 MODULAR PATCH PANELS AND 110 WIRING BLOCKS

A. The wiring block shall support Category 3, Category 5E and Category 6 applications and facilitate cross connection and interconnection using either cross connect wire (voice only) or the appropriate category patch cords.

B. The wiring blocks shall be fire retardant, molded plastic consisting of horizontal index strips for terminating 25 pairs of conductors each. The index strips shall be marked with five colors on the high teeth, separating the tip and ring of each pair, to establish pair location.

C. A series of fanning strips shall be located on each side of the block for dressing the cable pairs terminated on the adjacent index strips.

D. The wiring block shall accommodate 22- through 26-AWG conductors and shall be able to mount directly on wall surfaces with plywood backboards or on a 19" free-standing frame.

E. Clear label holders with the appropriate colored inserts shall be provided with the wiring blocks. The insert labels shall contain vertical lines spaced on the basis of circuit size (3-, 4-, or 5-pair) and shall not interfere with running, tracing or removing jumper wire/patch cords.

F. The wiring blocks shall be available in 100, pair sizes. The wiring blocks shall be available with or without legs.

G. The 25 and 50 pair sizes are not available with legs and shall be utilized for low pair count and/or depth restrictive situations.

H. The wiring block shall be able to accommodate over 500 repeated insertions without incurring permanent deformation and it shall pass the reliability test of no more than one contact failure in 10000 connections.

I. The 110 wiring blocks shall meet the following specifications:

Physical Specifications:

Height:	25-, 50-Pair – 1.75 in. (4.45 cm) 100-Pair – 3.59 in. (9.12 cm) 300-Pair, 10.79 in. (27.41 cm)

Electrical Specifications:

ANSI/EIA/TIA – T-568-B	Category 3, 5E, 6

J. Category 6 modular patch panels

1. The Category 6 modular jack panels shall meet or exceed the proposed Category 6 standards requirements in ISO/IEC 11801, CENLEC EN 50173 and ANSI/TIA/EIA and shall be UL Listed.
2. The modular jack panel shall utilize universal A/B wiring.
3. The jack panels shall be either wall or 19-inch rack mountable.

Physical specifications: 24and 48 port patch panels:

Insertion Life: 750 cycles minimum
Plug/Jack Contact Force: 100 g minimum
Plug retention Force: 133 N minimum
Operating Temperature Range: 0 to 60°C
Storage Temperature Range: -40 to 66°C
Humidity: 5 to 95% (noncondensing)
Height: 24-Ports:4.38cm (1u); 48-Ports:8.83cm (2u);64-Ports 17.7cm (4U0)
Width: 48.26cm (19 inch)
Depth: 4.06cm

Guaranteed Margin:

	Category 6 Patch Panel	High Performance Channel	Premium Performance Channel
	Typical Worst Pair Margin*	Guaranteed Margin**	Guaranteed Margin**
Insertion Loss	64.3%	5.0%	7.5%
NEXT	6.6 dB	6.0 dB	7.0 dB
PSNEXT	7.3 dB	7.5 dB	8.5 dB
ELFEXT	6.4 dB	6.0 dB	8.0 dB
PSELFEXT	6.1 dB	8.0 dB	10.0 dB
Return Loss	6.6 dB	4.0 dB	4.0 dB
Frequency Range	1-250 MHz	1-250 MHz	1-250 MHz

* Typical worst pair swept margin when measured with same manufacture's Category 6 patch cord.

**Guaranteed margin is valid at any frequency from 1-250 MHz for the single manufacturer's certified channel comprising the single manufacturer's Cat 6 apparatus and the single manufacturer's High Performance series cable or Premium Performance series. Values represent margin over the draft Category 6/Class E channel specifications.

2.7 IDENTIFICATION PRODUCTS

A. Comply with Section 16050 "Basic Electrical Materials and Methods," "Electrical Identification" and the following:

1. Cable Labels: Self adhesive vinyl or vinyl cloth wraparound tape markers, machine printed with alphanumeric cable designations.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine pathway elements intended for cable. Check raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 CABLING SYSTEM BASIC REQUIREMENTS

A. Cable Pathway

1. Installation of all fiber, data, and voice cables shall be within raceway, conduit, cable tray jhooks, bridal rings or other designated cable delivery system provided and installed by the electrical contractor as specified in Section 16700 " Telephone and Data pathways", and as shown on the electrical drawings.

a. All cables installed concealed in walls shall be installed in conduit only.

b. All cables installed surface mounted on walls shall be installed in surface mounted raceway, as shown on the electrical or communication drawings.

c. All exposed cabling above ceilings in plenum and non-plenum spaces may be run in conduit, cable tray, or other designated cable delivery system(s) as indicated on the electrical or communication drawings.

B. Hardware

1. Provide all required hardware including, but is not limited to, termination panels and blocks, fastening devices, data outlets, voice outlets, connectors and all required accessories to comply with this specification.

3.3 INSTALLATION

A. Install cable using techniques, practices, and methods that are consistent with category rating of components and that ensure category performance of completed and linked signal paths, end to end.

B. Install cable without damaging conductors, shield, or jacket.

C. Do not bend cable in handling or in installing to smaller radii than minimums recommended by manufacturer.

D. Pull cables without exceeding cable manufacturer's recommended pulling tensions.

1. Pull cables simultaneously if more than one is being installed in the same raceway.

2. Use pulling compound or lubricant if necessary. Use compounds that will not damage conductor or insulation.

3. Use pulling means; including fish tape, cable, rope, and basket weave wire/cable grips, which will not damage media or raceway.

E. Install exposed cable parallel and perpendicular to surfaces or exposed structural members, and follow surface contours where possible.

F. Secure and support cable at intervals not exceeding 30" and not more than 6" from cabinets, boxes, fittings, outlets, racks, frames, and terminals.

G. Wiring on Wiring Racks and Enclosures: Provide adequate length of conductors. Train conductors to terminal points with no excess. Use lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.

H. Separation of Wires: Comply with EIA/TIA-569 rules for separating unshielded copper communication and data processing equipment cables from potential EMI sources, including electrical power lines and equipment.

I. Make terminations only at indicated outlets, terminals, and cross connect and patch panels.

J. The entire in installation shall be completed in conformance with ANSI/EIA/TIA 568-B standards, NECA/BICSI 586-2006 Installing Commercial Building Telecommunications Cabling standard, all federal and local standards and the manufacturer's design and installation guidelines.

1. The Contractor shall ensure that the maximum pulling tensions of the specified distribution cables are not exceeded and cable bends maintain the proper radius during the placement of the facilities. Failure to follow the appropriate guidelines will require the Contractor to provide in a timely fashion the additional material and labor necessary to properly rectify the situation. This shall also apply to any and all damages sustained to the cables by the Contractor during the implementation.

K. Power Separation

1. The Contractor shall not place any distribution cabling alongside power lines, or share the same conduit, channel or sleeve with electrical apparatus.

L. Miscellaneous Equipment

1. The Contractor shall provide any necessary screws, anchors, clamps, tie wraps, distribution rings, wire molding (MC, ER, & TR locations), miscellaneous grounding and support hardware, etc., necessary to facilitate the installation of the System.

M. Special Equipment and Tools

1. It shall be the responsibility of the Contractor to furnish any special installation equipment or tools necessary to properly complete the System.

a. Tools shall include, but are not limited to:

(1) tools for terminating cables,
(2) testing and splicing equipment for copper/fiber cables,
(3) communication devices,

(4) jack stands for cable reels,
(5) cable winches.

N. Cable Storage

1. The Contractor shall not roll or store cable reels without an appropriate underlayment and the prior approval of Engineer/Owner, or it's General Contractor.

O. Cable Records

1. The Contractor shall maintain conductor polarity (tip and ring) identification at the main equipment room (switch room), risers, and station connecting blocks in accordance with industry practices.

3.4 GROUNDING AND BONDING

1. All grounding and bonding shall meet the National Electrical Code (NEC®) as well as local codes, which specify additional grounding and/or bonding requirements.
2. Bonding and Grounding
   a. Communication bonding and grounding shall be in accordance with the NEC and NFPA. Horizontal cables shall be grounded in compliance with ANSI/NFPA 70 and local requirements and practices. Horizontal equipment includes cross connect frames, patch panels and racks, active telecommunication equipment and test apparatus and equipment.

B. Comply with Division 16 Section "Grounding."

C. Ground cable shields, drain conductors, and equipment to eliminate shock hazard and to minimize ground loops, common mode returns, noise pickup, cross talk, and other impairments.

D. Bond shield and drain conductors to ground at only one point in each circuit.

E. Bonding and Grounding Terminal: Locate in each equipment room and wiring closet.

1. Telecommunications Bonding Backbone
   a. Provide a Telecommunications Bonding Backbone utilizing a #6-AWG or larger bonding conductor that provides direct bonding to the building's electrical system and all conductive metallic parts of the communications system in accordance with Article 250 of the NEC. Supplementary grounding systems will not be allowed. This is part of the grounding and bonding infrastructure (part of the telecommunications pathways and spaces in the building structure), and is independent of equipment or cable.

3.5 WORKMANSHIP

A. Components of the CCS system shall be installed in a neat, workmanlike manner.

B. Wiring color codes shall be strictly observed and terminations shall be uniform throughout the system.

C. Identification markings and systems shall be uniform.

D. ANSI/TIA/EIA 568-B wiring codes shall standardize all CCS wiring.

3.6 HORIZONTAL CABLING

A. Contractor shall supply horizontal cables to connect each information outlet to the backbone system as shown on the contract drawings.

B. Unless otherwise noted on the floor plans or within this document, the type of horizontal cables used for each work location shall be 4-pair shielded twisted pair (FTP), as specified in this section.

C. The 4-pair shall be run using a star topology format from the administration subsystem (Telecommunications Room) on each floor to every individual Telecommunication Outlet.

D. All cable routes to be approved by Engineer/Owner prior to installation of the cabling.

E. The length of each individual run of horizontal cable from the administration subsystem (Telecommunications Closet) on each floor to the Telecommunication Outlet shall not exceed 295 ft (90 m).

F. Contractor shall observe the bending radius and pulling strength requirements of the 4-pair cable during handling and installation.

G. Each run of cable between the termination block and the information outlet shall be continuous without any joints or splices.

H. In suspended ceiling and raised floor areas where duct, cable trays or conduit are not available, the Contractor shall bundle station wiring with Velcro cable ties at a distance not to exceed 5'-0" on center.

I. The cable bundling shall be supported via "J" hooks and bridal rings attached to the existing building structure and framework. Refer to Section 16700; Telephone and Cable Pathways.

J. Plenum cable will be used in all appropriate areas.

K. Every effort will be made to schedule the requirements under this Contract in such a manner so as to complete all above ceiling work prior to ceiling tile installation. In the event Contractor is required to remove ceiling tiles, such Work shall not break or disturb grid and must be coordinated with the General Contractor.

L. Contractor shall provide Engineer/Owner with detailed cable run diagrams for cable runs within raised floors detailing exact locations of cable for review and approval by Engineer/Owner after coordination with other contractors, architect and general contractor.

M. Conduit installation shall be as required in Section 16130 of these specifications.

N. Station cables and tie cables installed within ceiling spaces shall be routed through these spaces at right angles to electrical power circuits.

3.7 INSTALLATION IN EQUIPMENT ROOMS AND WIRING CLOSETS

A. Provide plywood backboards as shown on drawings.

B. Mount terminal strips, and other connecting hardware on backboards, unless otherwise indicated.

C. Group connecting hardware for cables into separate logical fields.

D. Terminations

1. Contractor shall connect the trunk cross connect and the distribution cross connect to the common equipment such as PBX or host computer in the equipment room.

E. Electrical Protection

1. Contractor shall supply lightning protectors and wires used to ground the equipment.
2. The electrical protection devices supplied by the contractor shall be in multi-pair form.
3. For small pair count applications, contractor shall supply electrical protection devices, which consist of a mounting panel for a series of solid-state, or gas tube protector units and a wiring block. The wiring block shall be used for input and output cable terminations. Insertion of the protector units into the mounting block will complete the circuit.
4. The protection devices shall be available in 4, 6, 25, 50 and 100 pair sizes.
5. If the electrical protection circuit is separated from the cross connect field, contractor shall supply protector units consisting of a metal housing containing mountings for a series of solid-state or gas tube protector units. The protector shall include a 25 foot, 26 AWG stub cable that serves as a fusible link, a 24 AWG terminating cable, and two connectors for external ground connections.

3.8 IDENTIFICATION

A. Identify system components complying with applicable requirements in Division 16 Section "Basic Electrical Materials and Methods," "Electrical Identification" and the following Specifications.

B. System: Use a unique, four syllable alphanumeric designation for each cable, and label cable and jacks, connectors, and terminals to which it connects with the same designation. Use logical and systematic designations for facility's architectural arrangement.

1. First syllable identifies whether it is a data or telephone outlet.
2. The second letters or numbers indicate MDF or IDF termination point.
3. The remaining numbers indicate cable designation.

C. Workstation: Label cables within outlet boxes.

D. Distribution Racks and Frames: Label each unit and field within that unit.

E. Within Connector Fields, in Wiring Closets and Equipment Rooms: Label each connector and each discrete unit of cable terminating and connecting hardware. Where similar jacks and plugs are used for both communication and data processing equipment, use a different color for jacks and plugs of each service. (Match cable color).

F. Cables, General: Label each cable within 4 inches of each termination, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.

G. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.

H. Cable Schedule: Post in prominent location in each wiring closet and equipment room. List incoming and outgoing cables and their designations, origins, and destinations.

Protect with rigid frame and clear plastic cover. Provide electronic copy of final comprehensive schedules for Project, in software and format selected by Owner.

I. All labels shall be machine printed. Labels shall not be written by hand.

3.9 SPECIAL REQUIREMENTS FOR CABLE ROUTING

A. Cabling

1. All communications cabling used throughout this project shall comply with the requirements as outlined in the National Electric Code (NEC) Articles 725, 760, 770, and 800 and the appropriate local codes.
2. All copper cabling shall bear CMP (Plenum Rated), CM/CMR (Riser Rated) and/or appropriate markings for the environment in which they are installed.
3. All fiber optic cabling shall bear OFNP (Plenum Rated), OFNR (Riser Rated) and/or appropriate markings for the environment in which they are installed.

B. Cable Pathway

1. In suspended ceiling and raised floor areas where duct, cable trays or conduit are not available, the Contractor shall install cable bundles of 50 or less, station wiring with VELCRO cable ties snug, but not deforming the cable geometry.
2. Cable bundles shall be supported via "J" hooks or bridal rings attached to the existing building structure and framework at a maximum of five (5) foot intervals.
3. Plenum rated cable ties shall be used in all appropriate areas.
4. The contractor shall adhere to the manufacturers' requirements for bending radius and pulling tension of all data and voice cables.
5. Cables shall not be attached to lift out ceiling grid supports or laid directly on the ceiling grid.
6. Cables shall not be attached to or supported by fire sprinkler heads or delivery systems or any environmental sensor located in the ceiling air space (NO EXCEPTIONS).
7. Cables shall not be supported from the suspended ceiling grid hangers (NO EXCEPTIONS).

C. Fire Stopping

1. Sealing of openings between floors, through rated fire and smoke walls, existing or created by the contractor for cable pass through shall be the responsibility of this contractor.
2. Sealing material and application of this material shall be accomplished in such a manner, which is acceptable to the local fire and building authorities having jurisdiction over this work. Refer to Section 16050 "Basic Materials and Methods" for Fire stopping specifications.
3. Creation of such openings as are necessary for cable passage between locations as shown on the drawings shall be the responsibility of this contractor's work.
4. Any openings created by or for the contractor and left unused shall also be sealed as part of this work.

D. Contractor Responsibility

1. The contractor shall be responsible for damage to any surfaces or work disrupted as a result of his work. Repair of surfaces, including painting, shall be included as necessary.

3.10 PLANNING AND COORDINATION

A. Planning meetings and schedule

1. An initial planning meeting will be held with the successful bidder to:
   a. Clarify all requirements (systems, services, distribution methods, etc.),
   b. Identify responsibilities,
   c. Schedule the events that will transpire during the implementation of the project.
2. Within two (2) weeks of the initial meeting, the contractor shall provide a written report and project schedule to clearly document the events and responsibilities associated with the project.

B. Drawings and review

1. In order to start the initial planning phase, Engineer/Owner shall provide the Contractor with one (1) clearly readable, up-to-date scale copy of all architectural, electrical, and mechanical drawings, two (2) weeks prior to the commencement of any planning activities. This will allow for a one (1) week review of the diagrams by the Contractor, and allow one (1) week for Engineer/Owner, to answer any queries pertaining to the Contractor's review. In reviewing such drawings Contractor shall be obligated to make an on-site inspection with Engineer/Owner and its General Contractor for on-site verification of access routes for cabling and other matters.

C. Proposed Wiring Solution

1. Upon completion of the initial planning stage, the Contractor shall provide five (5) draft copies of proposed cabling layout documentation for review by Engineer/Owner. Engineer/Owner will review the engineering documentation within a two (2) week period.
2. This documentation will include, but is not limited to the following:
   a. A detailed layout drawing of the proposed MC space.
   b. A detailed layout drawing of each proposed IC space.
   c. A detailed layout drawing of each proposed ER space.
   d. A detailed layout drawing of each proposed TR space.
3. If no revisions are required, the documentation shall be stamped and noted with "Complies With Design Intent" and returned to the contractor for execution of the work.
4. If minor revisions are noted, the documentation shall be may be stamped with "Comments Noted" and returned to the contractor. Contractor may begin the installation based upon these comments.
5. If the documentation does not comply with the design intent, they may be stamped with "Rejected", with comments noted. Contractor shall revise the documentation to comply with the design intent and resubmit all copies to the

Engineer/Owner for a second review. Any revisions shall be completed by the contractor within a two (2) week time period and resubmitted for review.

6. No work may begin until the documentation has been reviewed and stamped in accordance with comments in sentences #3 or 4 of this paragraph.

D. Drawings and diagrams

1. Upon completion of final planning stage and the incorporation of Engineer/Owner review comments, Contractor shall provide to Engineer/Owner for its records the following:

a. MC, ER and TR Diagrams which shall include:

(1) cable routing
(2) position of all components and
(3) detailed layout of the wallfield
(4) labeling plan.

b. Work Area Floor Plans which shall Include:

(1) detailed cable routes
(2) approved labeling plan for all work areas.

c. Cross Connect Documentation which shall include:

(1) cross connect records for all voice, and data devices.

d. Riser Distribution Plan
e. Cable Tray, Conduit, and Raceway Plans
f. Campus Distribution Plan (if applicable)

2. Documentation shall be in the following format:

a. Four (4) copies and one reproducible sepia of all diagrams and drawings in "D" size (24" x 36") or "E" size (30" x 42") as appropriate,
b. Two (2) copies of all cross connect documentation in printed form

E. As Built Documentation

1. Upon completion of the project, Contractor shall prepare "As Built" documentation showing actual site conditions and installation as constructed.
2. Provide copies of such documentation to Engineer/Owner as mentioned above.

F. Additional Records

1. In addition to the engineering diagrams, the following items shall be provided by the contractor:

a. Cable Records and Assignments

3.11 DAMAGES

A. The Contractor shall be liable for any and all damages to portions of the building caused by it, its employees or subcontractors; including but not limited to:

1. Damage to any portion of the building caused by the movement of tools, materials or equipment.
2. Damage to any component of the construction of spaces "turned over" to the Contractor.

3. Damage to the electrical distribution system and/or other space "turned over" to the Contractor.
4. Damage to the electrical, mechanical and/or life safety or other systems caused by inappropriate operation or connections made by the Contractor or other actions of Contractor.
5. Other damage to the materials, tools and/or equipment of the owner, its consultants, General Contractor, subcontractors, Architect, Engineer, other contractors, agents and lessees.

3.12 PENETRATIONS OF WALLS, FLOORS, AND CEILINGS

A. Prior consent

1. The Contractor shall make no penetration of floors, walls or ceiling without the prior consent of the Architect/Engineer/Owner and General Contractor.

B. Sealing penetrations

1. Where penetrations through acoustical walls or other walls for cableways have been provided for the Contractor or made by the Contractor, such penetrations shall be sealed by the Contractor in compliance with applicable code requirements and as directed by Engineer, Owner, Architect, or General Contractor.
2. Where penetrations through fire-rated walls for cableways have been provided for the Contractor or made by the Contractor, such penetrations shall be sealed by the Contractor as required by code and as directed by Engineer, Owner, Architect, or General Contractor.
3. Contractor shall, prior to the commencement of on-site activities, submit to Engineer/Owner for review by its Architect, details of any special systems to be used.

3.13 ON SITE MOVE-IN DAY SUPPORT

A. Technical Support

1. Contractor will provide technical support on a per/hour basis at such levels and at such times as Owner deems necessary during the physical move to the site.
2. The personnel providing technical support will:
   a. Have intimate knowledge of the System and Materials that were used
   b. Be skilled in all use of equipment and materials used under the Contract.
   c. Be competent to troubleshoot and fix problems associated with Contractor provided materials.

3.14 PROJECT DIRECTION

A. Single Point of Contact

1. Contractor will provide a single point of contact, i.e., Project Manager, to speak for the Contractor and to provide the following functions:
   a. Initiate and coordinate tasks with Owner, its General Contractor, Architect, Engineer, and others as specified by the Owner.
   b. Provide day-to-day direction and on-site supervision of Contractor personnel:

B. Ensure conformance with all Contract provisions

3.15 INSPECTION

A. On-going inspections shall be performed during construction by the Project Manager and/or the CCS System Manager. All work shall be performed in a high quality manner and the overall appearance shall be clean, neat and orderly.

B. The following shall be examined and shall comply satisfactorily in all instances.

1. Is the design documentation complete?
2. Are all cables properly labeled, from end-to-end?
3. Have all terminated cables been properly tested in accordance with the specifications for the specific category as well as tested for opens, shorts, polarity reversals, transposition and presence of AC and/or DC voltage?
4. Is the cable type suitable for its pathway?
5. Are the cables bundled in parallel?
6. Have the pathway manufacturer's guidelines been followed?
7. Are all cable penetrations installed properly and fire stopped according to code?
8. Have the Contractors avoided excessive cable bending?
9. Have potential EMI and RFI sources been considered?
10. Is Conduit/Cable Fill Correct?
11. Are hanging supports within 1.5 meters (5 feet)?
12. Does hanging cable exhibit some sag?
13. Are telecommunications closet terminations compatible with applications equipment?
14. Have Patch Panel instructions been followed?
    a. jacket removal point
    b. termination positions
    c. all pair terminations tight with minimal pair distortions
    d. twists maintained up to Index Strip
15. Have Modular Panel instructions been followed?
    a. cable dressing first
    b. jackets remain up to the Connecting Block
    c. all pair terminations tight and undistorted
    d. twists maintained up to the Connecting Block
16. Are M1/ MPS100E / MGS400 connectors properly turned right side up in the Jack Panels without cables wrapped or twisted around the Mounting Collars?
    a. Have the correct outlet connectors been used (M1 / MPS100E / MGS400)
    b. Have outlets been wired correctly? (T568A or T568B)?
    c. Is the cable jacket maintained up to the M1/MPS100E/MGS400?
    d. Are identification markings uniform, permanent and readable?

3.16 FIELD QUALITY CONTROL

A. Copper Cable testing

1. Testing of all copper wiring shall be performed prior to system cutover.
2. 100 percent of the horizontal and riser wiring pairs shall be tested for opens, shorts, polarity reversals, transposition and presence of AC voltage.

3. Voice and data horizontal wiring pairs shall be tested from the information outlet to the ER or TR.
4. The Category 3 cable runs shall be tested for conformance to the specifications of EIA/TIA 568-B Category 3.
5. The Category 5E cable runs shall be tested for conformance to the specifications of EIA/TIA 568-B Category 5E.
6. The Category 6 cable runs shall be tested for conformance to the specifications of EIA/TIA 568-B Category 6.
7. Category 5E and Category 6 horizontal cables shall be tested according to test set manufacturer's instructions utilizing the latest firmware and software.
   a. Testing shall include all of the electrical parameters as specified in the Products Section of this document.
   b. Any pairs not meeting the requirements of the standard shall be brought into compliance by the contractor, at no charge to the Owner.
8. Complete, end to end, test results must be submitted to Engineer/Owner.

B. Optical Fiber Cable Testing

1. All fiber testing shall be performed on all fibers in the completed end to end system.
2. Testing shall consist of a bi-directional end to end OTDR trace performed per EIA/TIA 455-61 or a bi-directional end to end power meter test performed per EIA/TIA 455-53A.
3. The system loss measurements shall be provided at 850 and 1310 nanometers for multimode fibers and 1310 and 1550 for single mode fibers.
4. Pre-installation cable testing
   a. The Contractor shall test all lightguide cable prior to the installation of the cable.
   b. The Contractor shall assume all liability for the replacement of the cable should it be found defective at a later date.
5. Loss Budget
   a. Fiber links shall have a maximum loss of:
      (1) Allowable cable loss per km)(km of fiber in link) + (.4dB)(number of connectors) = maximum allowable loss
         (a) A mated connector to connector interface is defined as a single connector for the purpose of this RFP
   b. Loss numbers for the installed link shall be calculated by taking the sum of the bi-directional measurements and dividing that sum by two.
   c. Any link not meeting the requirements of the standard shall be brought into compliance by the contractor, at no charge to the Owner.
   d. Documentation shall be provided in both hard copy and 3 1/2 inch diskette to the point of contact.

3.17 CLEANING

A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

3.18 COMPLETION OF WORK

A. At the completion of the System, the Contractor shall restore to its former condition, all aspects of the project site and on a daily basis, shall remove all waste and excess materials, rubbish debris, tools and equipment resulting from or used in the services provided under this Contract.

B. All clean up, restoration, and removal noted above shall be by the Contractor and at no cost to the Owner.

C. If the Contractor fails in its duties under this paragraph, the Owner may upon notice to the Contractor perform the necessary clean up and deduct the costs thereof from any amounts due or to become due to the Contractor.

D. The Owner, through the General Contractor will provide a dumpster for the use of the Contractor.

E. It shall be the Contractor's responsibility to remove trash from the areas it is working in and bring trash and debris to the dumpster.

F. The Contractor shall not use the General Contractor's dumpsters or trash disposal without prior approval of the General Contractor.

3.19 TRAINING

A. The CCS Contractor shall provide a minimum of (1) technician for one (1) week beginning with the first scheduled move-in date.

B. This technician will also assist the owner in cross connecting the voice and data services throughout the building during the move-in period. It is at this time that all Owner provided connectivity schedules for voice and data services will be provided to the Contractor.

C. Patching (cross connection) of the station assignments between the Owners service demarc shall also be considered part of this Contractors work.

END OF SECTION

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