PROJECT MANUAL

60 Soldier Barracks Building

Camp Crowder Training Site

Neosho, Missouri

Designed By: Buddy Webb & Company, Inc.
3057 East Cairo
Springfield, MO 65802

Date Issued: July 30, 2020

Project No.: T2018-01

STATE *of* MISSOURI

OFFICE *of* ADMINISTRATION

Facilities Management, Design & Construction

SECTION 00 01 07

PROFESSIONAL SEALS AND CERTIFICATIONS

PROJECT NUMBER: T2018-01

THE FOLLOWING DESIGN PROFESSIONALS HAVE SIGNED AND SEALED THE ORIGINAL PLANS AND SPECIFICATIONS FOR THIS PROJECT, WHICH ARE ON FILE WITH THE DIVISION OF FACILITIES MANAGEMENT, DESIGN AND CONSTRUCTION:

CIVIL ENGINEER – ANDERSON ENGINEERING, INC.
CERTIFICATE OF AUTHORITY NUMBER: 2018025075
This seal is authenticating Technical Specifications contained in Divisions 31 and 33.

STRUCTURAL ENGINEER – JS SMITH CONSULTING ENGINEERS, P.C.
CERTIFICATE OF AUTHORITY NUMBER: 2004026584
This seal is authenticating Technical Specifications contained in Divisions 03 and 04.

ARCHITECT – BUDDY WEBB & COMPANY, INC.
CERTIFICATE OF AUTHORITY NUMBER: 2004028947
This seal is authenticating Technical Specifications contained in Divisions 02, 05, 06, 07, 08, 09, 10, 12, and 32.

MECHANICAL / ELECTRICAL ENGINEER – CJD ENGINEERING LLC
CERTIFICATE OF AUTHORITY NUMBER: 2005026903
This seal is authenticating Technical Specifications contained in Divisions 21, 22, 23, 26, 27, and 28.

TABLE OF CONTENTS

SECTION	TITLE	NUMBER OF PAGES
DIVISION 00 – PROCUREMENT AND CONTRACTING INFORMATION		
000000	**INTRODUCTORY INFORMATION**	
000101	Project Manual Cover	1
000107	Professional Seals and Certifications	2
000110	Table of Contents	3
000115	List of Drawings	2
001116	**INVITATION FOR BID (IFB)** plus Missouri Buys instructions and special notice	3
002113	**INSTRUCTIONS TO BIDDERS (Includes MBE/WBE/SDVE Information)**	8
003144	MBE/WBE/SDVE Directory	1
****The following documents may be found on MissouriBUYS at https://missouribuys.mo.gov/****		
004000	**PROCUREMENT FORMS & SUPPLEMENTS**	
004113	Bid Form	*
004322	Unit Prices Form	*
004336	Proposed Subcontractors Form	*
004337	MBE/WBE/SDVE Compliance Evaluation Form	*
004338	MBE/WBE/SDVE Eligibility Determination Form for Joint Ventures	*
004339	MBE/WBE/SDVE Good Faith Effort (GFE) Determination Forms	*
004340	SDVE Business Form	*
004541	Affidavit of Work Authorization	*
005000	**CONTRACTING FORMS AND SUPPLEMENTS**	
005213	Construction Contract	3
005414	Affidavit for Affirmative Action	1
006113	Performance and Payment Bond	2
006325	Product Substitution Request	2
006519.16	Final Receipt of Payment and Release Form	1
006519.18	MBE/WBE/SDVE Progress Report	1
006519.21	Affidavit of Compliance with Prevailing Wage Law	1
007000	**CONDITIONS OF THE CONTRACT**	
007213	General Conditions	20
007300	Supplementary Conditions	2
007346	Wage Rate	4
DIVISION 1 - GENERAL REQUIREMENTS		
01 11 00	Summary of Work	3
01 21 00	Allowances	2
01 22 00	Unit Prices	2
01 23 00	Alternates	2
01 26 00	Contract Modification Procedures	2
01 31 00	Coordination	4
01 31 15	Project Management Communications	4
01 32 20	Schedules (Bar Chart)	4
01 33 00	Submittals	8
01 35 13.28	Site Security and Health Requirements (MONG)	4
01 45 33	Special Inspections and Procedures	6
01 45 33.10	Statement of Special Inspections	8
01 50 00	Construction Facilities and Temporary Controls	9
01 57 00	Erosion Control / Storm Water Pollution Prevention	10
01 74 00	Cleaning	3
01 74 19	Construction Waste Management and Disposal	4

TECHNICAL SPECIFICATIONS INDEX STARTS ON NEXT PAGE

TECHNICAL SPECIFICATIONS INDEX:

DIVISION 02 – EXISTING CONDITIONS

02 41 00	Demolition	2

DIVISION 03 – CONCRETE

03 30 00	Cast-In-Place Concrete	18
03 41 00	Structural Precast Concrete	18

DIVISION 04 – MASONRY

04 20 00	Unit Masonry	5

DIVISION 05 – METALS

05 40 00	Cold-Form Metal Framing	4
05 50 00	Metal Fabrications	3

DIVISION 06 – WOOD, PLASTICS AND COMPONENTS

06 10 00	Rough Carpentry	3
06 61 16	Solid Surfacing Fabrications	6

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

07 19 00	Water Repellents	2
07 21 00	Building Insulation	4
07 54 23	Single-Ply Membrane Roofing (TPO)	10
07 42 93	Soffit Panels	2
07 60 00	Flashing and Sheet Metal	4
07 72 00	Roof Accessories	2
07 84 00	Firestopping	6
07 92 00	Joint Sealants	4

DIVISION 08 – OPENINGS

08 11 19	Steel Doors & Frames	5
08 41 13	Aluminum Entrances and Storefronts	4
08 55 13	Tornado Resistant Windows	5
08 71 00	Door Hardware	5
08 80 00	Glazing	5

DIVISION 09 – FINISHES

09 21 16	Gypsum Board Assemblies	3
09 51 00	Acoustical Tile Ceilings	4
09 67 23	Resinous Flooring	8
09 90 00	Painting	6

DIVISION 10 – SPECIALTIES

10 21 13	Toilet Compartments	3
10 28 13	Toilet Accessories	4
10 80 00	Miscellaneous Specialties	3

DIVISION 12 – FURNISHINGS

12 21 00	Window Blinds	2

DIVISION 21 – FIRE SUPPRESSION

21 05 00	Common Work Results for Fire Suppression	2
21 13 13	Wet Fire Sprinkler Systems	4

DIVISION 22 – PLUMBING

22 00 00	Common Requirements for Plumbing	3
22 05 23	Valves for Plumbing Piping	1
22 07 19	Plumbing Piping Insulation	12
22 11 10	Piping for Plumbing Systems	8
22 11 19	Plumbing Piping Specialties	2
22 13 16	Sanitary Waste and Vent Piping	2

TECHNICAL SPECIFICATIONS INDEX CONTINUED:

22 14 00	Plumbing Fixtures	1
22 14 23	Drainage Piping Specialties	3
22 31 16	Commercial Domestic Water Softeners	5
22 34 36	Commercial Gas Domestic Water Heaters	2
DIVISION 23 – HVAC		
23 05 00	General HVAC Requirements	8
23 05 93	Testing, Adjusting, and Balancing for HVAC	8
23 07 00	HVAC Insulation	3
23 07 13	Duct Insulation	13
23 11 23	Facility Natural Gas Piping	5
23 31 13	HVAC Ducts and Casings	14
23 33 00	Air Duct Accessories	9
23 34 23	HVAC Power Ventilators	2
23 37 13	Diffuser, Registers and Grilles	1
23 54 00	Furnaces	8
23 81 26	Split-System Air-Conditioners	5
DIVISION 26 – ELECTRICAL		
26 05 00	Common Requirements for Electrical	9
26 05 19	Low-Voltage Electrical Power Conductors and Cables	3
26 05 26	Grounding and Bonding for Electrical Systems	3
26 05 29	Hangers and Supports for Electrical Systems	4
26 05 33	Raceways and Boxes for Electrical Systems	6
26 05 53	Identification for Electrical Systems	3
26 09 23	Lighting Control Devices	2
26 24 16	Panelboards	3
26 27 13	Electricity Metering	1
26 27 26	Wiring Devices	2
26 28 13	Fuses	2
26 28 16	Enclosed Switches and Circuit Breakers	5
26 51 00	Interior Lighting	4
26 56 00	Exterior Lighting	4
DIVISION 27 – COMMUNICATIONS		
27 05 00	Common Requirements for Communications	2
27 10 00	Communications Systems Structured Cabling	9
DIVISION 28 – ELECTRONIC SAFETY AND SECURITY		
28 05 00	Common Requirements for Electronic Safety and Security	2
28 46 00	Fire Detection and Alarm	8
DIVISION 31 – EARTHWORK		
31 00 00	Earthwork	7
31 10 00	Site Clearing	2
DIVISION 32 – EXTERIOR IMPROVEMENTS		
32 13 13	Portland Cement Concrete Paving	2
32 30 00	Site Improvements	2
32 90 00	Landscaping	2
DIVISION 33 – UTILITIES		
33 00 00	Site Utilities	6
33 40 00	Storm Drainage Systems	4
APPENDIX A – INFORMATION AVAILABLE TO BIDDERS		1
Geotechnical Engineering Report Camp Crowder Missouri National Guard Facility, Neosho, Missouri (Dated February 13, 2019), Project No. 018-3101		51

SECTION 00 01 15

LIST OF DRAWINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section provides a comprehensive list of the drawings that comprise the bid documents for this project:

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 LIST OF DRAWINGS

A. The following list of drawings, is a part of the Bid Documents:

	TITLE	SHEET #	DATE	CADD #
1.	Cover Sheet	G-001	7/30/20	G-001
2.	Sheet Index / Scope of Work Schedule	G-002	7/30/20	G-002
3.	Code Analysis Plan	G-101	7/30/20	G-101
4.	Existing Site Conditions Plan	C-101	7/30/20	C-101
5.	Site Development Plan (Alternate No.1)	C-102	7/30/20	C-102
6.	Site Development Plan (Alternates No.1 & No.3)	C-102.1	7/30/20	C-102.1
7.	Site Grading / Erosion Control Plan	C-103	7/30/20	C-103
8.	Site Grading / Erosion Plan (Alternate No. 3)	C-103.1	7/30/20	C-103.1
9.	Site Utility Plan (Alternate No.3)	C-104	7/30/20	C-104
10.	Site Development Details	C-501	7/30/20	C-501
11.	Miscellaneous Site Details	C-502	7/30/20	C-502
12.	Structural Notes	S-001	7/30/20	S-001
13.	Foundation Plan	S-101	7/30/20	S-101
14.	Foundation Plan (Alternate No.3)	S-101.1	7/30/20	S-101.1
15.	Interior Masonry Wall Plan	S-102	7/30/20	S-102
16.	Foundation Details	S-301	7/30/20	S-301
17.	Foundation Details (Alternate No.3)	S-302	7/30/20	S-302
18.	Floor Plan	A-101	7/30/20	A-101
19.	Floor Plan (Alternate No.3)	A-101.1	7/30/20	A-101.1
20.	Roof Plan	A-102	7/30/20	A-102
21.	Roof Plan (Alternate No. 3)	A-102.1	7/30/20	A-102.1
22.	Exterior Elevations	A-201	7/30/20	A-201
23.	Exterior Elevations (Alternate No. 3)	A-201.1	7/30/20	A-201.1
24.	Building Sections	A-301	7/30/20	A-301
25.	Wall Sections	A-401	7/30/20	A-401
26.	Wall Sections	A-402	7/30/20	A-402
27.	Wall Sections (Alternate No.3)	A-403	7/30/20	A-403
28.	Wall Sections (Alternate No.3)	A-404	7/30/20	A-404
29.	Enlarged Plan, Interior Elevations	A-405	7/30/20	A-405
30.	Roofing Details	A-501	7/30/20	A-501

31.	Roofing Details, Miscellaneous Details	A-502	7/30/20	A-502
32.	Door and Window Schedule	A-601	7/30/20	A-601
33.	Reflected Ceiling Plan	A-701	7/30/20	A-701
34.	Reflected Ceiling Plan (Alternate No.3)	A-701.1	7/30/20	A-701.1
35.	Interior Finish Plan	I-101	7/30/20	I-101
36.	Interior Finish Plan (Alternate No. 3)	I-101.1	7/30/20	I-101.1
37.	Site Electrical Plan	SE-101	7/30/20	SE-101
38.	Site Electrical Plan (Alternate No.3)	SE-101.1	7/30/20	SE-101.1
39.	Underfloor Plumbing Plan	P-101	7/30/20	P-101
40.	Plumbing Plan	P-102	7/30/20	P-102
41.	Enlarged Plumbing Plan and Schedules	P-401	7/30/20	P-401
42.	HVAC Plan and Schedules	M-101	7/30/20	M-101
43.	HVAC Plan (Alternate No. 3)	M-101.1	7/30/20	M-101.1
44.	Lighting Plan	E-101	7/30/20	E-101
45.	Lighting Plan (Alternate No. 3)	E-101.1	7/30/20	E-101.1
46.	Power Plan	E-102	7/30/20	E-102
47.	Power Plan (Alternate No. 3)	E-102.1	7/30/20	E-102.1
48.	Fire Alarm System Plan	E-103	7/30/20	E-103
49.	Fire Alarm System Plan (Alternate No. 3)	E-103.1	7/30/20	E-103.1
50.	Electrical Details and Schedules	E-601	7/30/20	E-601

END OF SECTION 00 01 15

SECTION 001116 - INVITATION FOR BID

1.0 OWNER:

A. The State of Missouri
Office of Administration,
Division of Facilities Management, Design and Construction
Jefferson City, Missouri

2.0 PROJECT TITLE AND NUMBER:

A. 60 Soldier Barracks Building
Camp Crowder Training Site
Missouri National Guard
Neosho, Missouri
Project No.: T2018-01

3.0 BIDS WILL BE RECEIVED:

A. Until: 1:30 PM, Thursday, September 10, 2020

B. **Only electronic bids on MissouriBUYS shall be accepted: https://missouribuys.mo.gov. Bidder must be registered to bid.**

4.0 DESCRIPTION:

A. Scope: The project includes in the Base Bid, construction of a new 60-soldier barracks building with storm shelter, Alternate No. 1 new concrete paving, Alternate No. 2 new tornado resistant window systems and associated openings in storm shelter exterior building envelope, and Alternate No. 3 new lounge area building.

B. Estimate: $1,309,000 to $1,800,000

C. MBE/WBE/SDVE Goals: MBE 10%, WBE 10%, and SDVE 3%**. NOTE: Only MBE/WBE firms certified by the State of Missouri Office of Equal Opportunity as of the date of bid opening, or SDVE(s) meeting the requirements of Section 34.074, RSMo and 1 CSR 30-5.010, can be used to satisfy the MBE/WBE/SDVE participation goals for this project.**

D. **NOTE: Bidders are provided new Good Faith Effort (GFE) forms on MissouriBUYS.

5.0 PRE-BID MEETING:

A. Place/Time**:** August 26, 2020, 10:00 AM, HQ Building, Camp Crowder, 890 Ray A. Carver Ave., Neosho, MO 64850.

B. Access to State of Missouri property requires presentation of a photo ID by all persons

6.0 HOW TO GET PLANS & SPECIFICATIONS:

A. View Only Electronic bid sets are available at no cost or paper bid sets for a deposit of $100 from American Document Solutions (ADS). MAKE CHECKS PAYABLE TO: American Document Solutions. Mail to: American Document Solutions, 1400 Forum Blvd., Suite 7A, Columbia, Missouri 65203. Phone 573-446-7768, Fax 573-355-5433, https://www.adsplanroom.net. NOTE: Prime contractors will be allowed a maximum of two bid sets at the deposit rate shown above. Other requesters will be allowed only one bid set at this rate. Additional bid sets or parts thereof may be obtained by any bidder at the cost of printing and shipping by request to American Document Solutions at the address shown above. **Bidder must secure at least one bid set to become a planholder.**

B. **Refunds: Return plans and specifications in unmarked condition within 15 working days of bid opening to American Document Solutions, 1400 Forum Blvd., Suite 7A, Columbia, Missouri 65203. Phone 573-446-7768, Fax 573-355-5433. Deposits for plans not returned within 15 working days shall be forfeited.**

C. Information for upcoming bids, including downloadable plans, specifications, Invitation for Bid, bid tabulation, award, addenda, and access to the ADS planholders list, is available on the Division of Facilities Management, Design and Construction's web site: https://oa.mo.gov/facilities/bid-opportunities/bid-listing-electronic-plans.

7.0 POINT OF CONTACT:

A. Designer: Buddy Webb & Company, Inc., Buddy Webb, phone # (417) 877-1385

B. Project Manager: Jeremy Newton, phone # 573-638-9500 ext. 37484

8.0 GENERAL INFORMATION:

A. The State reserves the right to reject any and all bids and to waive all informalities in bids. No bid may be withdrawn for a period of 20 working days subsequent to the specified bid opening time. The contractor shall pay not less than the prevailing hourly rate of wages for work of a similar character in the locality in which the work is performed, as determined by the Missouri Department of Labor and Industrial Relations and as set out in the detailed plans and specifications.

B. Bid results will be available at https://oa.mo.gov/facilities/bid-opportunities/bid-listing-electronic-plans after it is verified that at least one bid is awardable and affordable.

Very Important MissouriBUYS Instructions to Help Submit a Bid Correctly

A. The bidder shall submit his or her bid and all supporting documentation on MissouriBUYS eProcurement System. No hard copy bids shall be accepted. Go to https://missouribuys.mo.gov and register. The bidder must register before access is granted to the solicitation details and bidding is possible, however, the bidder can review a summary of the project by selecting "Bid Board" and then checking off "Open" under "Status" and "OA-FMDC-Contracts Chapter 8" under "Organization" in the boxes shown on the left margin.

B. Once registered, log in.
1. Under "Solicitation" select "View Current Solicitations." A new screen will open.
2. Under "Filter by Agency" select "OA-FMDC-Contracts Chapter 8."
3. Under "Filter by Opp. No." type in the State Project Number. Select "Submit."
4. Above the dark blue bar, select "Other Active Opportunities."
5. To see the Solicitation Summary, single click the Opp. No. (Project Number) and the summary will open. Single quick click each blue bar to open detailed information.

C. Here are simplified instructions for uploading the bid to MissouriBUYS:
1. Find the solicitation by completing Steps 1 through 4 above.
2. Select the three dots under "Actions." Select "Add New Response."
3. When the Quote box opens, give the response a title and select "OK."
4. The detailed solicitation will open. Select "Check All" for the Original Solicitation Documents, open each document, and select "Accept." If this step is not completed, a bid cannot be uploaded. Scroll to the bottom of the page and select "Add Attachments." If you do not see this command, not all documents have been opened and accepted.
5. The Supplier Attachments box will open. Select "Add Attachment" again.
6. The Upload Documents box will open. Read the instructions for uploading. Disregard the "Confidential" check box.
7. Browse and attach up to 5 files at a time. Scroll to bottom of box and select "Upload." The Supplier Attachments box will open. Repeat Steps 5 through 7 if more than 5 files are to be uploaded.
8. When the Supplier Attachments box opens again and uploading is complete, select "Done." A message should appear that the upload is successful. If it does not, go to the Bidder Response tab and select "Submit."
9. The detailed solicitation will open. At the bottom select "Close."

D. Any time a bidder wants to modify the bid, he or she will have to submit a new one. FMDC will open the last response the bidder submits. The bidder may revise and submit the bid up to the close of the solicitation (bid date and time). Be sure to allow for uploading time so that the bid is successfully uploaded prior to the 1:30 PM deadline; we can only accept the bid if it is uploaded before the deadline.

E. If you want to verify that you are uploading documents correctly, we encourage you to submit a fake bid early. Label the fake bid as such to distinguish it from the real bid. The contracts person you contact will let you know if your "bid" was received successfully. Please contact Kelly Copeland: 573-522-2283, kelly.copeland@oa.mo.gov., OR Paul Girouard: 573-751-4797, paul.girouard@oa.mo.gov OR Mandy Roberson: 573-522-0074.

F. If you are experiencing login issues, please contact Web Procure Support (Proactis) at 866-889-8533 anytime from 7:00 AM to 7:00 PM Central Time, Monday through Friday. If you try using a userid or password several times that is incorrect, the system will lock you out. Web Procure Support is the only option to unlock you! If you forget your userid or password, Web Procure Support will provide a temporary userid or password. Also, if it has been a while since your last successful login and you receive an "inactive" message, contact Web Procure (Proactis). If you are having a registration issue, you may contact Cathy Holliday at 573-751-3491 or by email: cathy.holliday@oa.mo.gov.

IMPORTANT REMINDER REGARDING REQUIREMENT FOR OEO CERTIFICATION

A. SECTION 002113 – INSTRUCTIONS TO BIDDERS: Article 14.0, Section D1:

As of July 1, 2020, all MBE, WBE, and MBE/WBE contractors, subcontractors, and suppliers must be certified by the State of Missouri, Office of Equal Opportunity. No certifications from other Missouri certifying agencies will be accepted.

SECTION 002113 – INSTRUCTIONS TO BIDDERS

1.0 - SPECIAL NOTICE TO BIDDERS

A. If awarded a contract, the Bidder's employees, and the employees of all subcontractors, who perform the work on the project, will be required to undergo a fingerprint background check and obtain a State of Missouri identification badge prior to beginning work on site. The Bidder should review the information regarding this requirement in Section 013513 – Site Security and Health Requirements prior to submitting a bid.

B. The Bidder's prices shall include all city, state, and federal sales, excise, and similar taxes that may lawfully be assessed in connection with the performance of work, and the purchased of materials to be incorporated in the work. THIS PROJECT IS NOT TAX EXEMPT.

2.0 - BID DOCUMENTS

A. The number of sets obtainable by any one (1) party may be limited in accordance with available supply.

B. For the convenience of contractors, sub-contractors and suppliers, copies of construction documents are on file at the office of the Director, Division of Facilities Management, Design and Construction and on the Division's web site - https://oa.mo.gov/facilities/bid-opportunities/bid-listing-electronic-plans.

3.0 - BIDDERS' OBLIGATIONS

A. Bidders must carefully examine the entire site of the work and shall make all reasonable and necessary investigations to inform themselves thoroughly as to the facilities available as well as to all the difficulties involved in the completion of all work in accordance with the specifications and the plans. Bidders are also required to examine all maps, plans and data mentioned in the specifications. No plea of ignorance concerning observable existing conditions or difficulties that may be encountered in the execution of the work under this contract will be accepted as an excuse for any failure or omission on the part of the contractor to fulfill in every detail all of the requirements of the contract, nor accepted as a basis for any claims for extra compensation.

B. Under no circumstances will contractors give their plans and specifications to another contractor. Any bid received from a contractor whose name does not appear on the list of plan holders may be subject to rejection.

4.0 - INTERPRETATIONS

A. No bidder shall be entitled to rely on oral interpretations as to the meaning of the plans and specifications or the acceptability of alternate products, materials, form or type of construction. Every request for interpretation shall be made in writing and submitted with all supporting documents not less than five (5) working days before opening of bids. Every interpretation made to a bidder will be in the form of an addendum and will be sent as promptly as is practicable to all persons to whom plans and specifications have been issued. All such addenda shall become part of the contract documents.

B. Approval for an "acceptable substitution" issued in the form of an addendum as per Paragraph 4A above, and as per Article 3.1 of the General Conditions; ACCEPTABLE SUBSTITUTIONS shall constitute approval for use in the project of the product.

C. An "acceptable substitution" requested after the award of bid shall be approved if proven to the satisfaction of the Owner and the Designer as per Article 3.1, that the product is acceptable in design, strength, durability, usefulness, and convenience for the purpose intended. Approval of the substitution after award is at the sole discretion of the Owner.

D. A request for "Acceptable Substitutions" shall be made on the Section 006325 Substitution Request Form. The request shall be sent directly to the project Designer. A copy of said request should also be mailed to the Owner, Division of Facilities Management, Design and Construction, Post Office Box 809, Jefferson City, Missouri 65102.

5.0 - BIDS AND BIDDING PROCEDURE

A. Bidders shall submit all submission forms and accompanying documents listed in SECTION 004113 – BID FORM, Article 5.0, ATTACHMENTS TO BID by the stated time or their bid will be rejected for being non-responsive.

Depending on the specific project requirements, **the following is a GENERIC list** of all possible bid forms that may be due with bid submittals and times when they may be due. Please check for specific project requirements on the proposal form (Section 004113). ***Not all of the following bid forms may be required to be submitted.***

Bid Submittal – due before stated date and time of bid opening (see IFB):

004113	Bid Form (all pages are always required)
004322	Unit Prices Form
004336	Proposed Subcontractors Form
004337	MBE/WBE/SDVE Compliance Evaluation Form
004338	MBE/WBE/SDVE Eligibility Determination for Joint Ventures
004339	MBE/WBE/SDVE GFE Determination
004340	SDVE Business Form
004541	Affidavit of Work Authorization

B. All bids shall be submitted without additional terms and conditions, modification or reservation on the bid forms with each space properly filled. Bids not on these forms will be rejected.

C. All bids shall be accompanied by a bid bond executed by the bidder and a duly authorized surety company, certified check, cashier's check or bank draft made payable to the Division of Facilities Management, Design and Construction, State of Missouri, in the amount indicated on the bid form, Section 004113. Failure of the contractor to submit the full amount required shall be sufficient cause to reject his bid. The bidder agrees that the proceeds of the check, draft or bond shall become the property of the State of Missouri, if for any reason the bidder withdraws his bid after closing, or if on notification of award refuses or is unable to execute tendered contract, provide an acceptable performance and payment bond, provide evidence of required insurance coverage and/or provide required copies of affirmative action plans within ten (10) working days after such tender.

D. The check or draft submitted by the successful bidder will be returned after the receipt of an acceptable performance and payment bond and execution of the formal contract. Checks or drafts of all other bidders will be returned within a reasonable time after it is determined that the bid represented by same will receive no further consideration by the State of Missouri. Bid bonds will only be returned upon request.

6.0 - SIGNING OF BIDS

A. A bid from an individual shall be signed as noted on the Bid Form.

B. A bid from a partnership or joint venture shall require only one signature of a partner, an officer of the joint venture authorized to bind the venture or an attorney-in-fact. If the bid is signed by an officer of a joint venture or an attorney-in-fact, a document evidencing the individual's authority to execute contracts should be included with the bid form.

C. A bid from a limited liability company (LLC) shall be signed by a manager or a managing member of the LLC.

D. A bid from a corporation shall have the correct corporate name thereon and the signature of an authorized officer of the corporation manually written. Title of office held by the person signing for the corporation shall appear, along with typed name of said individual. Corporate license number shall be provided and, if a corporation organized in a state other than Missouri, a Certificate of Authority to do business in the State of Missouri shall be attached. In addition, for corporate proposals, the President or Vice-President should sign as the bidder. If the signator is other than the corporate president or vice president, the bidder must provide satisfactory evidence that the signator has the legal authority to bind the corporation.

E. A bid should contain the full and correct legal name of the Bidder. If the Bidder is an entity registered with the Missouri Secretary of State, the Bidder's name on the bid form should appear as shown in the Secretary of State's records.

F. The Bidder should include its corporate license number on the Bid Form and, if the corporation is organized in a state other than Missouri, a Certificate of Authority to do business in the State of Missouri shall be attached to the bid form.

7.0 - RECEIVING BID SUBMITTALS

A. It is the bidder's sole responsibility to assure receipt by Owner of bid submittals by the date and time specified in the Invitation for Bid. Bids received after the date and time specified shall not be considered by the Owner.

B. Bids must be submitted through the MissouriBUYS statewide eProcurement system (https://www.missouribuys.mo.gov/) in accordance with the instructions for that system. The Owner shall only accept bids submitted through MissouriBUYS. Bids received by the Owner through any other means, including hard copies, shall not be considered and will be discarded by the Owner unopened.

C. To respond to an Invitation for Bid, the Bidder must first register with MissouriBUYS by going through the MissouriBUYS Home Page (https://www.missouribuys.mo.gov/), clicking the "Register" button at the top of the page, and completing the Vendor Registration. Once registered, the Bidder accesses its account by clicking the "Login" button at the top of the MissouriBUYS Home Page. Enter your USERID and PASSWORD, which the Bidder will select. Under Solicitations, select "View Current Solicitations." A new screen will open. Under "Filter by Agency" select "OA-FMDC-Contracts Chapter 8." Under "Filter by Opp. No." type in the State Project Number. Select "Submit." Above the dark blue bar, select "Other Active Opportunities." To see the Solicitation Summary, single click the Opp. No. (Project Number) and the summary will open. Single quick click each blue bar to open detailed information. The Bidder must read and accept the Original Solicitation Documents and complete all identified requirements. The Bidder should download and save all of the Original Solicitation Documents on its computer so that the Bidder can prepare its response to these documents. The Bidder should upload its completed response to the downloaded documents as an attachment to the electronic solicitation response.

D. Step-by-step instructions for how a registered vendor responds to a solicitation electronically are provided in Section 001116 – Invitation For Bid.

E. The Bidder shall submit its bid on the forms provided by the Owner on MissouriBUYS with each space fully and properly completed, including all amounts required for alternate bids, unit prices, cost accounting data, etc. The Owner may reject bids that are not on the Owner's forms or that do not contain all requested information.

F. No Contractor shall stipulate in his bid any conditions not contained in the specifications or standard bid form contained in the contract documents. To do so may subject the Contractor's bid to rejection.

G. The completed forms shall be without interlineations, alterations or erasures.

8.0 - MODIFICATION AND WITHDRAWAL OF BIDS

A. Bidder may withdraw his bid at any time prior to scheduled closing time for receipt of bids, but no bidder may withdraw his bid for a period of twenty (20) working days after the scheduled closing time for receipt of bids.

B. The Bidder shall modify his or her original bid by submitting a revised bid on MissouriBUYS.

9.0 - AWARD OF CONTRACT

A. The Owner reserves the right to reject any and/or all bids and further to waive all informalities in bidding when deemed in the best interest of the State of Missouri.

B. The Owner reserves the right to let other contracts in connection with the work, including but not by way of limitation, contracts for the furnishing and installation of furniture, equipment, machines, appliances and other apparatus.

C. In awarding the contract the Owner may take into consideration the bidder's skill, facilities, capacity, experience, responsibility, previous work record, financial standing and the necessity of prompt and efficient completion of work herein described. Inability of any bidder to meet the requirements mentioned above may be cause for rejection of his bid. However, no contract will be awarded to any individual,

partnership or corporation, who has had a contract with the State of Missouri declared in default within the preceding twelve months.

D. Award of alternates, if any, will be made in numerical order unless all bids received are such that the order of acceptance of alternates does not affect the determination of the low bidder.

E. No bid shall be considered binding upon the Owner until the written contract has been properly executed, a satisfactory bond has been furnished, evidence of required insurance coverage, submittal of executed Section 004541, Affidavit of Work Authorization form, documentation evidencing enrollment and participation in a federal work authorization program has been received and an affirmative action plan submitted. Failure to execute and return the contract and associated documents within the prescribed period of time shall be treated, at the option of the Owner, as a breach of bidder's obligation and the Owner shall be under no further obligation to bidder.

F. If the successful bidder is doing business in the State of Missouri under a fictitious name, he shall furnish to Owner, attached to the Bid Form, a properly certified copy of the certificate of Registration of Fictitious Name from the State of Missouri, and such certificate shall remain on file with the Owner.

G. Any successful bidder which is a corporation organized in a state other than Missouri shall furnish to the Owner, attached to the Bid Form, a properly certified copy of its current Certificate of Authority to do business in the State of Missouri, such certificate to remain on file with the Owner. No contract will be awarded by the Owner unless such certificate is furnished by the bidder.

H. Any successful bidder which is a corporation organized in the State of Missouri shall furnish at its own cost to the Owner, if requested, a Certificate of Good Standing issued by the Secretary of State, such certificate to remain on file with the Owner.

I. Transient employers subject to Sections 285.230 and 285.234, RSMo, (out-of-state employers who temporarily transact any business in the State of Missouri) may be required to file a bond with the Missouri Department of Revenue. No contract will be awarded by the Owner unless the successful bidder certifies that he has complied with all applicable provisions of Section 285.230-234.

J. Sections 285.525 and 285.530, RSMo, require business entities to enroll and participate in a federal work authorization program in order to be eligible to receive award of any state contract in excess of $5,000. Bidders should submit with their bid an Affidavit of Work Authorization (Section 004541) along with appropriate documentation evidencing such enrollment and participation. Section-004541, Affidavit of Work Authorization is located on the MissouriBUYS solicitation for this project. Bidders must also submit an E-Verify Memorandum before the Owner may award a contract to the Bidder. Information regarding a E-Verify is located at https://www.uscis.gov/e-verify/. The contractor shall be responsible for ensuring that all subcontractors and suppliers associated with this contract enroll in E-Verify.

10.0 - CONTRACT SECURITY

A. The successful bidder shall furnish a performance/payment bond as set forth in General Conditions Article 6.1 on a condition prior to the State executing the contract and issuing a notice to proceed.

11.0 - LIST OF SUBCONTRACTORS

A. If required by "Section 004113 – Bid Form," each bidder must submit as part of their bid a list of subcontractors to be used in performing the work (Section 004336). The list must specify the name of the single designated subcontractor, for each category of work listed in "Section 004336 - Proposed Subcontractors Form." If work within a category will be performed by more than one subcontractor, the bidder must provide the name of each subcontractor and specify the exact portion of the work to be done by each. Failure to list the Bidder's firm, or a subcontractor for each category of work identified on the Bid Form or the listing of more than one subcontractor for any category without designating the portion of work to be performed by each shall be cause for rejection of the bid. If the bidder intends to perform any of the designated subcontract work with the use of his own employees, the bidder shall make that fact clear, by listing his own firm for the subject category. **If any category of work is left vacant, the bid shall be rejected.**

12.0 - WORKING DAYS

A. Contract duration time is stated in working days and will use the following definition in determining the actual calendar date for contract completion:

1. Working days are defined as all calendar days except Saturdays, Sundays and the following State of Missouri observed holidays: New Year's Day, Martin Luther King, Jr. Day, Lincoln Day, Washington's Birthday, Truman Day, Memorial Day, Independence Day, Labor Day, Columbus Day, Veterans Day, Thanksgiving Day and Christmas Day.

13.0 - AMERICAN AND MISSOURI - MADE PRODUCTS AND FIRMS

A. By signing the bid form and submitting a bid on this project, the Bidder certifies that it will use American and Missouri products as set forth in Article 1.7 of the General Conditions. Bidders are advised to review those requirements carefully prior to bidding.

B. A preference shall be given to Missouri firms, corporations or individuals, or firms, corporations or individuals that maintain Missouri offices or places of business, when the quality of performance promised is equal or better and the price quoted is the same or less.

C. Pursuant to Section 34.076, RSMo, a contractor or Bidder domiciled outside the boundaries of the State of Missouri shall be required, in order to be successful, to submit a bid the same percent less than the lowest bid submitted by a responsible contractor or Bidder domiciled in Missouri as would be required for such a Missouri domiciled contractor or Bidder to succeed over the bidding contractor or Bidder domiciled outside Missouri on a like contract or bid being let in the person's domiciliary state and, further, the contractor or Bidder domiciled outside the boundaries of Missouri shall be required to submit an audited financial statement as would be required of a Missouri domiciled contractor or Bidder on a like contract or bid being let in the domiciliary state of that contractor or Bidder.

14.0 - MBE/WBE/SDVE INSTRUCTIONS

A. Definitions:

1. "MBE" means a Minority Business Enterprise.

2. "MINORITY" has the same meaning as set forth in 1 C.S.R. 10-17.010.

3. "MINORITY BUSINESS ENTERPRISE" has the same meaning as set forth in section 37.020, RSMo.

4. "WBE" means a Women's Business Enterprise.

5. "WOMEN'S BUSINESS ENTERPRISE" has the same meaning as set forth in section 37.020, RSMo.

6. "SDVE" means a Service-Disabled Veterans Enterprise.

7. "SERVICE-DISABLED VETERAN" has the same meaning as set forth in section 34.074, RSMo.

8. "SERVICE-DISABLED VETERAN ENTERPRISE" has the same meaning as "Service-Disabled Veteran Business" set forth in section 34.074, RSMo.

B. MBE/WBE/SDVE General Requirements:

1. For all bids greater than $100,000, the Bidder shall obtain MBE, WBE and SDVE participation in an amount equal to or greater than the percentage goals set forth in the Invitation for Bid and the Bid Form, unless the Bidder is granted a Good Faith Effort waiver by the Director of the Division, as set forth below. If the Bidder does not meet the MBE, WBE and SDVE goals, or make a good faith effort to do so, the Bidder shall be non-responsive, and its bid shall be rejected.

2. The Bidder should submit with its bid all of the information requested in the MBE/WBE/SDVE Compliance Evaluation Form for every MBE, WBE, or SDVE subcontractor or material supplier the Bidder intends to use for the contract work. The Bidder is required to submit all appropriate

MBE/WBE/SDVE documentation before the stated time and date set forth in the Invitation for Bid. If the Bidder fails to provide such information by the specified date and time, the Owner shall reject the bid.

3. The Director reserves the right to request additional information from a Bidder to clarify the Bidder's proposed MBE, WBE, and/or SDVE participation. The Bidder shall submit the clarifying information requested by the Owner within two (2) Working Days of receiving the request for clarification.

4. Pursuant to section 34.074, RSMo, a Bidder that is a SDVE doing business as Missouri firm, corporation, or individual, or that maintains a Missouri office or place of business, shall receive a three-point bonus preference in the contract award evaluation process. The bonus preference will be calculated and applied by reducing the bid amount of the eligible SDVE by three percent of the apparent low responsive bidder's bid. Based on this calculation, if the eligible SDVE's evaluation is less than the apparent low responsive bidder's bid, the eligible SDVE's bid becomes the apparent low responsive bid. This reduction is for evaluation purposes only, and will have no impact on the actual amount(s) of the bid or the amount(s) of any contract awarded. In order to be eligible for the SDVE preference, the Bidder must complete and submit with its bid the Missouri Service Disabled Veteran Business Form, and any information required by the form. The form is available on the MissouriBUYS solicitation for this project.

C. Computation of MBE/WBE/SDVE Goal Participation:

1. A Bidder who is a MBE, WBE, or SDVE may count 100% of the contract towards the MBE, WBE or SDVE goal, less any amounts awarded to another MBE, WBE or SDVE. (NOTE: A MBE firm that bids as general contractor must obtain WBE and SDVE participation; a WBE firm that bids as a general contractor must obtain MBE and SDVE participation; and a SDVE firm that bids as general contractor must obtain MBE and WBE participation.) In order for the remaining contract amount to be counted towards the MBE, WBE or SDVE goal, the Bidder must complete the MBE/WBE/SDVE Compliance Evaluation Form (Section 004337) identifying itself as an MBE, WBE or SDVE.

2. The total dollar value of the work granted to a certified MBE, WBE or SDVE by the Bidder shall be counted towards the applicable goal.

3. Expenditures for materials and supplies obtained from a certified MBE, WBE, or SDVE supplier or manufacturer may be counted towards the MBE, WBE and SDVE goals, if the MBE, WBE, or SDVE assumes the actual and contractual responsibility for the provision of the materials and supplies.

4. The total dollar value of the work granted to a second or subsequent tier subcontractor or a supplier may be counted towards a Bidder's MBE, WBE and SDVE goals, if the MBE, WBE, or SDVE properly assumes the actual and contractual responsibility for the work.

5. The total dollar value of work granted to a certified joint venture equal to the percentage of the ownership and control of the MBE, WBE, or SDVE partner in the joint venture may be counted towards the MBE/WBE/SDVE goals.

6. Only expenditures to a MBE, WBE, or SDVE that performs a commercially useful function in the work may be counted towards the MBE, WBE and SDVE goals. A MBE, WBE, or SDVE performs a commercially useful function when it is responsible for executing a distinct element of the work and carrying out its responsibilities by actually performing, managing and supervising the work or providing supplies or manufactured materials.

D. Certification of MBE/WBE/SDVE Subcontractors:

1. In order to be counted towards the goals, an MBE or WBE must be certified by the State of Missouri Office of Equal Opportunity and an SDVE must be certified by the State of Missouri, Office of Administration, Division of Purchasing and Material Management or by the Department of Veterans Affairs.

2. The Bidder may determine the certification status of a proposed MBE or WBE subcontractor or supplier by referring to the Office of Equal Opportunity (OEO)'s online MBE/WBE directory (https://apps1.mo.gov/oeo/). The Bidder may determine the eligibility of a SDVE subcontractor or supplier by referring to the Division of Purchasing and Materials Management's online SDVE directory (http://oa.mo.gov/purchasing/vendor-information/missouri-service-disabled-veteran-business-enterprise-sdve-information) or the Department of Veterans Affairs' directory (https://www.vip.vetbiz.gov/).

3. Additional information, clarifications, etc., regarding the listings in the directories may be obtained by calling the Division at (573)751-3339 and asking to speak to the Contract Specialist of record as shown in the Supplementary Conditions (Section 007300).

E. Waiver of MBE/WBE/SDVE Participation:

1. If a Bidder has made a good faith effort to secure the required MBE, WBE and/or SDVE participation and has failed, the Bidder shall submit with its bid the information requested in MBE/WBE/SDVE Good Faith Effort (GFE) Determination form. The GFE forms are located on the MissouriBUYS solicitation for this project. The Director will determine if the Bidder made a good faith effort to meet the applicable goals. If the Director determines that the Bidder did not make a good faith effort, the bid shall be rejected as being nonresponsive to the bid requirements. Bidders who demonstrate that they have made a good faith effort to include MBE, WBE, and/or SDVE participation will be determined to be responsive to the applicable participation goals, regardless of the percent of actual participation obtained, if the bid is otherwise acceptable.

2. In determining whether a Bidder has made a good faith effort to obtain MBE, WBE and/or SDVE participation, the Director may evaluate the factors set forth in 1 CSR 30-5.010(6)(C) and the following:

   a. The amount of actual participation obtained;

   b. How and when the Bidder contacted potential MBE, WBE, and SDVE subcontractors and suppliers;

   c. The documentation provided by the Bidder to support its contacts, including whether the Bidder provided the names, addresses, phone numbers, and dates of contact for MBE/WBE/SDVE firms contacted for specific categories of work;

   d. If project information, including plans and specifications, were provided to MBE/WBE/SDVE subcontractors;

   e. Whether the Bidder made any attempts to follow-up with MBE, WBE or SDVE firms prior to bid;

   f. Amount of bids received from any of the subcontractors and/or suppliers that the Bidder contacted;

   g. The Bidder's stated reasons for rejecting any bids;

3. If no bidder has obtained any participation in a particular category (MBE/WBE/SDVE) or made a good faith effort to do so, the Director may waive that goal rather than rebid.

F. Contractor MBE/WBE/SDVE Obligations

1. If awarded a contract, the Bidder will be contractually required to subcontract with or obtain materials from the MBE, WBE, and SDVE firms listed in its bid, in amounts equal to or greater than the dollar amount bid, unless the amount is modified in writing by the Owner.

2. If the Contractor fails to meet or maintain the participation requirements contained in the Contractor's bid, the Contractor must satisfactorily explain to the Director why it cannot comply

with the requirement and why failing meeting the requirement was beyond the Contractor's control. If the Director finds the Contractor's explanation unsatisfactory, the Director may take any appropriate action including, but not limited to:

a. Declaring the Contractor ineligible to participate in any contracts with the Division for up to twelve (12) months (suspension); and/or

b. Declaring the Contractor be non-responsive to the Invitation for Bid, or in breach of contract and rejecting the bid or terminating the contract.

3. If the Contractor replaces an MBE, WBE, or SDVE during the course of this contract, the Contractor shall replace it with another MBE, WBE, or SDVE or make a good faith effort to do so. All MBE, WBE and SDVE substitutions must be approved by the Director.

4. The Contractor shall provide the Owner with regular reports on its progress in meeting its MBE/WBE/SDVE obligations. At a minimum, the Contractor shall report the dollar-value of work completed by each MBE, WBE, or SDVE during the preceding month and the cumulative total of work completed by each MBE, WBE or SDVE to date with each monthly application for payment. The Contractor shall also make a final report, which shall include the total dollar-value of work completed by each MBE, WBE, and SDVE during the entire contract.

STATE OF MISSOURI
DIVISION OF FACILITIES MANAGEMENT, DESIGN AND CONSTRUCTION
MBE/WBE/SDVE DIRECTORY

The MBE/WBE Directory for goods and services is maintained by the Office of Equal Opportunity (OEO). The current Directory can be accessed at the following web address:

https://apps1.mo.gov/MWBCertifiedFirms/

Please note that you may search by MBE, WBE, or both as well as by region, location of the business by city or state, as well as by commodity or service.

The SERVICE DISABLED VETERAN ENTERPRISE (SDVE) Directory (s) may be accessed at the following web addresses:

https://oa.mo.gov/sites/default/files/sdvelisting.pdf

https://www.vip.vetbiz.va.gov

State of Missouri Construction Contract

THIS AGREEMENT, made (DATE) by and between:

Contractor Name and Address

hereinafter called the "Contractor,"

and the **State of Missouri**, hereinafter called the **"Owner"**, represented by the Office of Administration, Division of Facilities Management, Design and Construction, on behalf of the **Department of Public Safety-Missouri National Guard.**

WITNESSETH, that the Contractor and the Owner, for the consideration stated herein agree as follows:

ARTICLE 1. STATEMENT OF WORK

The Contractor shall furnish all labor and materials and perform all work required for furnishing and installing all labor, materials, equipment and transportation and everything necessarily inferred from the general nature and tendency of the plans and specifications for the proper execution of the work for:

Project Name:	**60 Soldier Barracks Building** **Camp Crowder Training Site** **Missouri National Guard** **Neosho, Missouri**
Project Number:	**T2018-01**

in strict accordance with the Contract Documents as enumerated in Article 7, all of which are made a part hereof.

ARTICLE 2. TIME OF COMPLETION

The contract performance time is **200** working days from the transmittal date of this agreement. The contract completion date is **MONTH, DAY, YEAR**. This time includes ten (10) working days for the Contractor to receive, sign and return the contract form along with required bonding and insurance certificates. Failure of the Contractor to provide correct bonding and insurance within the ten (10) working days shall not be grounds for a time extension. Receipt of proper bonding and insurance is a condition precedent to the formation of the contract and if not timely received, may result in forfeiture of the Contractor's bid security. Work may not commence until the Owner issues a written Notice to Proceed and must commence within seven (7) working days thereafter.

ARTICLE 3. LIQUIDATED DAMAGES

Whenever time is mentioned in this contract, time shall be and is of the essence of this contract. The Owner would suffer a loss should the Contractor fail to have the work embraced in this contract fully completed on or before the time above specified. THEREFORE, the parties hereto realize in order to adjust satisfactorily the damages on account of such failure that it might be impossible to compute accurately or estimate the amount of such loss or damages which the Owner would sustain by reason of failure to complete fully said work within the time required by this contract. The Contractor hereby covenants and agrees to pay the Owner, as and for **liquidated damages, the sum of $1,000** per day for each and every day, Sunday and legal holidays excepted, during which the work remains incomplete and unfinished. Any sum which may be due the Owner for such damages shall be deducted and retained by the Owner from any balance which may be due the Contractor when said work shall have been finished and accepted. But such provisions shall not release the Bond of the Contractor from liability according to its terms. In case of failure to complete, the Owner will be under no obligation to show or prove any actual or specific loss or damage.

ARTICLE 4. CONTRACT SUM

The Owner shall pay the Contractor for the prompt, faithful and efficient performance of the conditions and undertakings of this contract, subject to additions, and deductions as provided herein, in current funds the sum of:

Base Bid:	$
Alternate 1:	$
Alternate 2:	$
Alternate 3:	$

TOTAL CONTRACT AMOUNT: ($CONTRACT AMOUNT)

UNIT PRICES: The Owner accepts the following Unit Prices: SEE ATTACHMENT A (one page)

For changing specified quantities of work from those indicated by the contract drawings and specifications, upon written instructions of Owner, the following unit prices shall prevail. The unit prices include all labor, overhead and profit, materials, equipment, appliances, bailing, shoring, shoring removal, etc., to cover the finished work of the several kinds of work called for. Only a single unit price shall be given and it shall apply for either MORE or LESS work than that shown on the drawings and called for in the specifications or included in the Base Bid. In the event of more or less units than so indicated or included, change orders may be issued for the increased or decreased amount.

ARTICLE 5. PREVAILING WAGE RATE

It is understood and agreed by and between the parties that not less than the prevailing hourly rate of wages shall be paid for work of a similar character in the locality in which the work is performed, and not less than the prevailing hourly rate of wages for legal holiday and overtime work in the locality in which the work is performed, both as determined by the Department of Labor and Industrial Relations or as determined by the court on appeal, to all workmen employed by or on behalf of the Contractor or any subcontractor, exclusive of maintenance work. Only such workmen as are directly employed by the Contractor or his subcontractors, in actual construction work on the site shall be deemed to be employed.

When the hauling of materials or equipment includes some phase of the construction other than the mere transportation to the site of the construction, workmen engaged in this dual capacity shall be deemed to be employed directly on the project and entitled to the prevailing wage.

ARTICLE 6. MINORITY/WOMEN/SERVICE DISABLED VETERAN BUSINESS ENTERPRISE PARTICIPATION

The Contractor has been granted a waiver of the 10% MBE and 10% WBE and 3% SDVE participation goals. The Contractor agrees to secure the MBE/WBE/SDVE participation amounts for this project as follows: (OR)

The Contractor has met the MBE/WBE/SDVE participation goals and agrees to secure the MBE/WBE/SDVE participation amounts for this project as follows:

MBE/WBE/SDVE Firm:	Subcontract Amt:$
MBE/WBE/SDVE Firm:	Subcontract Amt:$
MBE/WBE/SDVE Firm:	Subcontract Amt:$
	Total $

MBE/WBE/SDVE assignments identified above shall not be changed without a Contract Change signed by the Owner.

The Director of the Division of Facilities Management, Design and Construction or his Designee shall be the final authority to resolve disputes and disagreements between the Contractor and the MBE/WBE/SDVE firms listed above when such disputes impact the subcontract amounts shown above.

ARTICLE 7. CONTRACT DOCUMENTS

Contract documents shall consist of the following component parts:

1. Division 0, with executed forms
2. Division 1
3. Executed Construction Contract Form
4. The Drawings
5. The Technical Specifications
6. Addenda
7. Contractor's Proposal as accepted by the Owner

By signature below, the parties hereby execute this contract document.

APPROVED:

_____	_____
Mark Hill, P.E., Director Division of Facilities Management, Design and Construction	Contractor's Authorized Signature

DELETE IF PRIVATE OR PARTNERSHIP

I, Corporate Secretary, certify that I am Secretary of the corporation named above and that (CONTRACTOR NAME), who signed said contract on behalf of the corporation, was then (TITLE) of said corporation and that said contract was duly signed for and in behalf of the corporation by authority of its governing body, and is within the scope of its corporate powers.

_____

Corporate Secretary

STATE OF MISSOURI
OFFICE OF ADMINISTRATION
DIVISION OF FACILITIES MANAGEMENT, DESIGN AND CONSTRUCTION

AFFIDAVIT FOR AFFIRMATIVE ACTION

PROJECT NUMBER

NAME

First being duly sworn on oath states: that

he/she is the ☐ sole proprietor ☐ partner ☐ officer or ☐ manager or managing member of

NAME

a ☐ sole proprietorship ☐ partnership

☐ limited liability company (LLC)

or ☐ corporation, and as such, said proprietor, partner, or officer is duly authorized to make this

affidavit on behalf of said sole proprietorship, partnership, or corporation; that under the contract known as

PROJECT TITLE

Less than 50 persons in the aggregate will be employed and therefore, the applicable Affirmative Action

requirements as set forth in Article 1.4 of the General Conditions of the State of Missouri have been met.

PRINT NAME & SIGNATURE	DATE

NOTARY INFORMATION

NOTARY PUBLIC EMBOSSER SEAL	STATE OF	COUNTY (OR CITY OF ST. LOUIS)	**USE RUBBER STAMP IN CLEAR AREA BELOW**
	SUBSCRIBED AND SWORN BEFORE ME, THIS DAY OF YEAR		
	NOTARY PUBLIC SIGNATURE	MY COMMISSION EXPIRES	
	NOTARY PUBLIC NAME (TYPED OR PRINTED)		

MO 300-1401 (05/18) FILE/Construction Contract

Bond No._____

SECTION 006113 - PERFORMANCE AND PAYMENT BOND FORM

KNOW ALL MEN BY THESE PRESENTS, THAT we _____

as principal, and _____

_____as Surety, are held and firmly bound unto the

STATE OF MISSOURI. in the sum of _____ Dollars ($)

for payment whereof the Principal and Surety bind themselves, their heirs, executors, administrators and successors, jointly and severally, firmly by these presents.

WHEREAS, the Principal has, by means of a written agreement dated the _____

day of_____, 20_____, enter into a contract with the State of Missouri for

_____

_____

_____

(Insert Project Title and Number)

NOW, THEREFORE, if the Principal shall faithfully perform and fulfill all the undertakings, covenants, terms, conditions and agreements of said contract during the original term of said contract and any extensions thereof that may be granted by the State of Missouri, with or without notice to the Surety and during the life of any guaranty required under the contract; and shall also faithfully perform and fulfill all undertakings, covenants, terms, conditions and agreements of any and all duly authorized modifications of said contract that may hereafter be made with or without notice to the Surety; and shall also promptly make payment for materials incorporated, consumed or used in connection with the work set forth in the contract referred to above, and all insurance premiums, both compensation and all other kinds of insurance, on said work, and for all labor performed on such work, whether by subcontractor or otherwise, at not less than the prevailing hourly rate of wages for work of a similar character (exclusive of maintenance work) in the locality in which the work is performed and not less than the prevailing hourly rate of wages for legal holiday and overtime work (exclusive of maintenance work) in the locality in which the work is performed both as determined by the Department of Labor and Industrial Relations or determined by the Court of Appeal, as provided for in said contract and in any and all duly authorized modifications of said contract that may be hereafter made, with or without notice to the Surety, then, this obligation shall be void and of no effect, but it is expressly understood that if the Principal should make default in or should fail to strictly, faithfully and efficiently do, perform and comply with any or more of the covenants, agreements, stipulations, conditions, requirements or undertakings, as specified in or by the terms of said contract, and with the time therein named, then this obligation shall be valid and binding upon each of the parties hereto and this bond shall remain in full force and effect; and the same may be sued on at the instance of any material man, laborer, mechanic, subcontractor, individual, or otherwise to whom such payment is due, in the name of the State of Missouri, to the use of any such person.

AND, IT IS FURTHER specifically provided that any modifications which may hereinafter be made in the terms of the contract or in the work to be done under it or the giving by the Owner of any extension of the time for the performance of the contract or any other forbearance on the part of either the Owner or the Principal to the other, shall not in any way release the Principal and the Surety, or either or any of them, their heirs, executors, administrators and successors, from their liability hereunder, notice to the Surety of any such extension, modifications or forbearance being hereby waived.

IN WITNESS WHEREOF, the above bounden parties have executed the within instrument this _____ day of _____, 20 ____.

AS APPLICABLE:

AN INDIVIDUAL

Name: _____

Signature: _____

A PARTNERSHIP

Name of Partner: _____

Signature of Partner: _____

Name of Partner: _____

Signature of Partner: _____

CORPORATION

Firm Name: _____

Signature of President: _____

SURETY

Surety Name: _____

Attorney-in-Fact: _____

Address of Attorney-in-Fact: _____

_____

Telephone Number of Attorney-in-Fact: _____

Signature Attorney-in-Fact: _____

NOTE: Surety shall attach Power of Attorney

STATE OF MISSOURI
OFFICE OF ADMINISTRATION
DIVISION OF FACILITIES MANAGEMENT, DESIGN AND CONSTRUCTION

PRODUCT SUBSTITUTION REQUEST

PROJECT NUMBER

PROJECT TITLE AND LOCATION

CHECK APPROPRIATE BOX

☐ SUBSTITUTION PRIOR TO BID OPENING
(Minimum of (5) working days prior to receipt of Bids as per Article 4 – Instructions to Bidders)

☐ SUBSTITUTION FOLLOWING AWARD
(Maximum of (20) working days from Notice to Proceed as per Article 3 – General Conditions)

FROM: BIDDER/CONTRACTOR (PRINT COMPANY NAME)

TO: ARCHITECT/ENGINEER (PRINT COMPANY NAME)

Bidder/Contractor hereby requests acceptance of the following product or systems as a substitution in accordance with provisions of Division One of the Bidding Documents:

SPECIFIED PRODUCT OR SYSTEM

SPECIFICATION SECTION NO.

SUPPORTING DATA

☐ Product data for proposed substitution is attached (include description of product, standards, performance, and test data)

☐ Sample ☐ Sample will be sent, if requested

QUALITY COMPARISON

	SPECIFIED PRODUCT	SUBSTITUTION REQUEST
NAME, BRAND		
CATALOG NO.		
MANUFACTURER		
VENDOR		

PREVIOUS INSTALLATIONS

PROJECT	ARCHITECT/ENGINEER	
LOCATION		DATE INSTALLED

SIGNIFICANT VARIATIONS FROM SPECIFIED PRODUCT

REASON FOR SUBSTITUTION

_____

_____

_____

_____

_____

_____

DOES PROPOSED SUBSTITUTION AFFECT OTHER PARTS OF WORK?

☐ YES ☐ NO

IF YES, EXPLAIN _____

_____

_____

_____

_____

_____

SUBSTITUTION REQUIRES DIMENSIONAL REVISION OR REDESIGN OF STRUCTURE OR A/E WORK

☐ YES ☐ NO

BIDDER'S/CONTRACTOR'S STATEMENT OF CONFORMANCE OF PROPOSED SUBSTITUTION TO CONTRACT REQUIREMENT:

We have investigated the proposed substitution. We believe that it is equal or superior in all respects to specified product, except as stated above; that it will provide the same Warranty as specified product; that we have included complete implications of the substitution; that we will pay redesign and other costs caused by the substitution which subsequently become apparent; and that we will pay costs to modify other parts of the Work as may be needed, to make all parts of the Work complete and functioning as a result of the substitution.

BIDDER/CONTRACTOR	DATE

REVIEW AND ACTION

☐ Resubmit Substitution Request with the following additional information:

_____

☐ Substitution is accepted.

☐ Substitution is accepted with the following comments:

_____

☐ Substitution is not accepted.

ARCHITECT/ENGINEER	DATE

STATE OF MISSOURI
OFFICE OF ADMINISTRATION
DIVISION OF FACILITIES MANAGEMENT, DESIGN AND CONSTRUCTION

FINAL RECEIPT OF PAYMENT AND RELEASE

PROJECT NUMBER

KNOW ALL MEN BY THESE PRESENT THAT: hereinafter called "Subcontractor" who heretofore entered into an agreement with hereinafter called "Contractor", for the performance of work and/or furnishing of material for the construction of the project entitled

(PROJECT TITLE, PROJECT LOCATION, AND PROJECT NUMBER)

at

(ADDRESS OF PROJECT)

for the State of Missouri (Owner) which said subcontract is by this reference incorporated herein, in consideration of such final payment by Contractor.

DOES HEREBY:

1. ACKNOWLEDGE that they have been **PAID IN FULL** all sums due for work and materials contracted or done by their Subcontractors, Material Vendors, Equipment and Fixture Suppliers, Agents and Employees, or otherwise in the performance of the Work called for by the aforesaid Contract and all modifications or extras or additions thereto, for the construction of said project or otherwise.
2. RELEASE and fully, finally, and forever discharge the Owner from any and all suits, actions, claims, and demands for payment for work performed or materials supplied by Subcontractor in accordance with the requirements of the above referenced Contract.
1. REPRESENT that all of their Employees, Subcontractors, Material Vendors, Equipment and Fixture Suppliers, and everyone else has been **paid in full** all sums due them, or any of them, in connection with performance of said Work, or anything done or omitted by them, or any of them in connection with the construction of said improvements, or otherwise.

DATED this day of , 20 .

NAME OF SUBCONTRACTOR

BY (TYPED OR PRINTED NAME)

SIGNATURE

TITLE

ORIGINAL: FILE/Closeout Documents

STATE OF MISSOURI
OFFICE OF ADMINISTRATION
DIVISION OF FACILITIES MANAGEMENT, DESIGN AND CONSTRUCTION

MBE/WBE/SDVE PROGRESS REPORT

SUBMIT WITH **ALL** INVOICES: (PLEASE CHECK APPROPRIATE BOX BELOW)

☐CONSULTANT ☐CONSTRUCTION

INVOICE NO.	PROJECT NUMBER
CHECK IF FINAL ☐**FINAL**	DATE

PROJECT TITLE

PROJECT LOCATION

FIRM

TOTAL CONTRACT AMOUNT

$

THE PERCENTAGE AND DOLLAR AMOUNT OF THIS PROJECT THAT ARE TO BE MBE/WBE/SDVE AS INDICATED IN THE ORIGINAL CONTRACT: **%** and **$** **.**

CHECK MBE WBE SDVE	ITEM OF WORK	TOTAL AMOUNT OF SUBCONTRACT	$ AMOUNT & % COMPLETE (PAID-TO-DATE)	CONSULTANT/SUBCONSULTANT OR CONTRACTOR/SUBCONTRACTOR/SUPPLIER NAME, ADDRESS, CONTACT, AND PHONE NUMBER
MBE ☐ WBE ☐ SDVE☐		$	$ %	- -
MBE ☐ WBE ☐ SDVE☐		$	$ %	- -
MBE ☐ WBE ☐ SDVE☐		$	$ %	- -
MBE ☐ WBE ☐ SDVE☐		$	$ %	- -
MBE ☐ WBE ☐ SDVE☐		$	$ %	- -

ORIGINAL: Attach to ALL Progress and Final Payments

STATE OF MISSOURI
OFFICE OF ADMINISTRATION
DIVISION OF FACILITIES MANAGEMENT, DESIGN AND CONSTRUCTION

AFFIDAVIT – COMPLIANCE WITH PREVAILING WAGE LAW

PROJECT NUMBER

Before me, the undersigned Notary Public, in and for the County of _____

State of _____ personally came and appeared _____
(NAME)

_____ of the _____
(POSITION) (NAME OF THE COMPANY)

(a corporation) (a partnership) (a proprietorship) and after being duly sworn did depose and say that all provisions and requirements set out in Chapter 290, Sections 290.210 through and including 290.340, Missouri Revised Statutes, pertaining to the payment of wages to workmen employed on public works project have been fully satisfied and there has been no exception to the full and completed compliance with said provisions and requirements and with Wage Determination No: _____ issued by the Department of Labor and Industrial Relations, State of Missouri on the _____ day of _____ 20 __ in carrying out the contract and working in connection with _____
(NAME OF PROJECT)

Located at _____ in _____ County
(NAME OF THE INSTITUTION)

Missouri, and completed on the _____ day of _____ 20 __

SIGNATURE

NOTARY INFORMATION

NOTARY PUBLIC EMBOSSER OR BLACK INK RUBBER STAMP SEAL	STATE		COUNTY (OR CITY OF ST. LOUIS)
	SUBSCRIBED AND SWORN BEFORE ME, THIS DAY OF YEAR		**USE RUBBER STAMP IN CLEAR AREA BELOW**
	NOTARY PUBLIC SIGNATURE	MY COMMISSION EXPIRES	
	NOTARY PUBLIC NAME (TYPED OR PRINTED)		

FILE: Closeout Documents

GENERAL CONDITIONS

INDEX

ARTICLE:

1. General Provisions

1.1. Definitions

1.2. Drawings and Specifications

1.3. Compliance with Laws, Permits, Regulations and Inspections

1.4. Nondiscrimination in Employment

1.5. Anti-Kickback

1.6. Patents and Royalties

1.7. Preference for American and Missouri Products and Services

1.8. Communications

1.9. Separate Contracts and Cooperation

1.10. Assignment of Contract

1.11. Indemnification

1.12. Disputes and Disagreements

2. Owner/Designer Responsibilities

3. Contractor Responsibilities

3.1. Acceptable Substitutions

3.2. Submittals

3.3. As-Built Drawings

3.4. Guaranty and Warranties

3.5. Operation and Maintenance Manuals

3.6. Other Contractor Responsibilities

3.7. Subcontracts

4. Changes in the Work

4.1. Changes in the Work

4.2. Changes in Completion Time

5. Construction and Completion

5.1. Construction Commencement

5.2. Project Construction

5.3. Project Completion

5.4. Payments

6. Bond and Insurance

6.1. Bond

6.2. Insurance

7. Termination or Suspension of Contract

7.1. For Site Conditions

7.2. For Cause

7.3. For Convenience

SECTION 007213 - GENERAL CONDITIONS

A. These General Conditions apply to each section of these specifications. The Contractor is subject to the provisions contained herein.

B. The General Conditions are intended to define the relationship of the Owner, the Designer and the Contractor thereby establishing certain rules and provisions governing the operation and performance of the work so that the work may be performed in a safe, orderly, expeditious and workmanlike manner.

ARTICLE 1 – GENERAL PROVISIONS

ARTICLE 1.1 - DEFINITIONS

A. As used in these contract documents, the following terms shall have the meanings and refer to the parties designated in these definitions.

1. **"COMMISSIONER":** The Commissioner of the Office of Administration.
2. **"CONSTRUCTION DOCUMENTS":** The "Construction Documents" shall consist of the Project Manual, Drawings and Addenda.
3. **"CONSTRUCTION REPRESENTATIVE:"** Whenever the term "Construction Representative" is used, it shall mean the Owner's Representative at the work site.
4. **"CONTRACTOR"**: Party or parties who have entered into a contract with the Owner to furnish work under these specifications and drawings.
5. **"DESIGNER"**: When the term "Designer" is used herein, it shall refer to the Architect, Engineer, or Consultant of Record specified and defined in Paragraph 2.0 of the Supplemental Conditions, or his duly authorized representative. The Designer may be either a consultant or state employee.
6. **"DIRECTOR"**: Whenever the term "Director" is used, it shall mean the Director of the Division of Facilities Management, Design and Construction or his Designee, representing the Office of Administration, State of Missouri. The Director is the agent of the Owner.
7. **"DIVISION":** Shall mean the Division of Facilities Management, Design and Construction, State of Missouri.
8. **"INCIDENTAL JOB BURDENS":** Shall mean those expenses relating to the cost of work, incurred either in the home office or on the job-site, which are necessary in the course of doing business but are incidental to the job. Such costs include office supplies and equipment, postage, courier services, telephone expenses including long distance, water and ice and other similar expenses.
9. **"JOINT VENTURE"**: An association of two (2) or more businesses to carry out a single business enterprise for profit for which purpose they combine their property, capital, efforts, skills and knowledge.
10. **"OWNER"**: Whenever the term "Owner" is used, it shall mean the State of Missouri.
11. **"PROJECT"**: Wherever the term "Project" is used, it shall mean the work required to be completed by the construction contract.
12. **"PROJECT MANUAL"**: The "Project Manual" shall consist of Introductory Information, Invitation for Bid, Instructions to Bidders, Bid Documents, Additional Information, Standard Forms, General Conditions, Supplemental General Conditions, General Requirements and Technical Specifications.
13. **"SUBCONTRACTOR"**: Party or parties who contract under, or for the performance of part or this entire Contract between the Owner and Contractor. The subcontract may or may not be direct with the Contractor.
14. **"WORK"**: Labor, material, supplies, plant and equipment required to perform and complete the service agreed to by the Contractor in a safe, expeditious, orderly and workmanlike manner so that the project shall be complete and finished in the best manner known to each respective trade.
15. "**WORKING DAYS**": are all calendar days except Saturdays, Sundays and the following holidays: New Year's Day, Martin Luther King, Jr. Day, Lincoln Day, Washington's Birthday (observed), Truman Day, Memorial Day, Independence Day, Labor Day, Columbus Day, Veterans Day (observed), Thanksgiving Day, Christmas Day.

ARTICLE 1.2 DRAWINGS AND SPECIFICATIONS

A. In case of discrepancy between drawings and specifications, specifications shall govern. Should discrepancies in architectural drawings, structural drawings and mechanical drawings occur, architectural drawings shall govern and, in case of

conflict between structural and mechanical drawings, structural drawings shall govern.

B. Specifications are separated into titled divisions for convenience of reference only and to facilitate letting of contracts and subcontracts. The Contractor is responsible for establishing the scope of work for subcontractors, which may cross titled divisions. Neither the Owner nor Designer will establish limits and jurisdiction of subcontracts.

C. Figured dimensions take precedence over scaled measurements and details over smaller scale general drawings. In the event of conflict between any of the documents contained within the contract, the documents shall take precedence and be controlling in the following sequence: addenda, supplementary general conditions, general conditions, division 1 specifications, technical division specifications, drawings, bid form and instructions to bidders.

D. Anything shown on drawings and not mentioned in these specifications or vice versa, as well as any incidental work which is obviously necessary to complete the project within the limits established by the drawings and specifications, although not shown on or described therein, shall be performed by the Contractor at no additional cost as a part of his contract.

E. Upon encountering conditions differing materially from those indicated in the contract documents, the Contractor shall promptly notify the Designer and Construction Representative in writing before such conditions are disturbed. The Designer shall promptly investigate said conditions and report to the Owner, with a recommended course of action**.** If conditions do materially differ and cause an increase or decrease in contract cost or time required for completion of any portion of the work, a contract change will be initiated as outlined in Article 4 of these General Conditions.

E. Only work included in the contract documents is authorized, and the Contractor shall do no work other than that described therein or in accordance with appropriately authorized and approved contract changes.

ARTICLE 1.3 - COMPLIANCE WITH LAWS, PERMITS, REGULATIONS AND INSPECTIONS

A. Since the Owner is the State of Missouri, municipal or political subdivisions, zoning ordinances, construction codes (other than licensing of trades), and other like ordinances are not applicable to construction on Owner's property, and Contractor will not be required to submit drawings and specifications to any municipal or political subdivision, authority, obtain construction permits or any other licenses (other than licensing of trades) or permits from or submit to inspections by any municipality or political subdivision relating to the construction for this project. All permits or licenses required by municipality or political subdivision for operation on <u>property not belonging</u> to Owner shall be obtained by and paid for by Contractor. Each Contractor shall comply with all <u>applicable</u> laws, ordinances, rules and regulations that pertain to the work of this contract.

B. Contractors, subcontractors and their employees engaged in the businesses of electrical, mechanical, plumbing, carpentry, sprinkler system work, and other construction related trades shall be licensed to perform such work by the municipal or political subdivision where the project is located, if such licensure is required by local code. Local codes shall dictate the level (master, journeyman, and apprentice) and the number, type and ratio of licensed tradesmen required for this project within the jurisdiction of such municipal or political subdivision.

C. Equipment and controls manufacturers and their authorized service and installation technicians that do not maintain an office within the jurisdiction of the municipal or political subdivision but are a listed or specified contractor or subcontractor on this project are exempt from Paragraph 1.3 B above.

D. The Contractor shall post a copy of the wage determination issued for the project and included as a part of the contract documents, in a prominent and easily accessible location at the site of construction for the duration of the project.

E. Any contractor or subcontractor to such contractor at any tier signing a contract to work on this project shall provide a ten-hour Occupational Safety and Health Administration (OSHA) construction safety program for their on-site employees which includes a course in construction safety and health approved by OSHA or a similar program approved by the Department of Labor and Industrial Relations which is at least as stringent as an approved OSHA program. The contractor shall forfeit as a penalty to the public body on whose behalf the contract is made or awarded, two thousand five hundred dollars plus one hundred dollars for each employee employed by the contractor or subcontractor, for each calendar day, or portion thereof, such employee is employed without the required training.

ARTICLE 1.4 - NONDISCRIMINATION IN EMPLOYMENT

A. The Contractor and his subcontractors will not discriminate against individuals based on race, color, religion, national origin, sex, disability, or

age, but may use restrictions which relate to bona fide occupational qualifications. Specifically, the Contractor and his subcontractors shall not discriminate:

1. Against recipients of service on the basis of race, color, religion, national origin, sex, disability or age.
2. Against any employee or applicant, for employment on the basis of race, color, religion, national origin, sex or otherwise qualified disability status.
3. Against any applicant for employment or employee on the basis of age, where such applicant or employee is between ages 40 and 70 and where such Contractor employs at least 20 persons.
4. Against any applicant for employment or employee on the basis of that person's status as a disabled or Vietnam-era veteran.

The Contractor and his Subcontractors will take affirmative action to insure applicants for employment and employees are treated equally without regard to race, color, religion, national origin, sex, disability, or age. Such action shall include, but not be limited to, the following: employment, upgrading, demotion and transfer; recruitment or recruitment advertising; and selection for training, including apprenticeship. The Contractor and his Subcontractors will give written notice of their commitments under this clause to any labor union with which they have bargaining or other agreements.

B. The Contractor and his Subcontractors shall develop, implement, maintain and submit in writing to the Owner an affirmative action program if at least fifty (50) persons in the aggregate are employed under this contract. If less than fifty (50) persons in the aggregate are to be employed under this contract, the Contractor shall submit, in lieu of the written affirmative action program, a properly executed Affidavit for Affirmative Action in the form included in the contract specifications. For the purpose of this section, an "affirmative action program" means positive action to influence all employment practices (including, but not limited to, recruiting, hiring, promoting and training) in providing equal employment opportunity regardless of race, color, sex, national origin, religion, age (where the person affected is between age 40 and 70), disabled and Vietnam-era veteran status, and disability. Such "affirmative action program" shall include:

1. A written policy statement committing the total organization to affirmative action and assigning management responsibilities and procedures for evaluation and dissemination;
2. The identification of a person designated to handle affirmative action;
3. The establishment of non-discriminatory selection standards, objective measures to analyze recruitment, an upward mobility system, a wage and salary structure, and standards applicable to lay-off, recall, discharge, demotion and discipline;
4. The exclusion of discrimination from all collective bargaining agreements; and
5. Performance of an internal audit of the reporting system to monitor execution and to provide for future planning.

In the enforcement of this non-discrimination clause, the Owner may use any reasonable procedures available, including, but not limited to: requests, reports, site visits and inspection of relevant documents of contractors and subcontractors.

C. In the event of the Contractor's or his subcontractor's noncompliance with any provisions of this Article of the Contract, the Owner may cancel this contract in whole or in part or require the Contractor to terminate his contract with the subcontractor.

ARTICLE 1.5 - ANTI-KICKBACK

A. No employee of the division, shall have or acquire any pecuniary interest, whether direct or indirect, in this contract or in any part hereof. No officer, employee, designer, attorney, or administrator of or for the Owner who is authorized in such capacity and on behalf of the Owner to exercise any legislative, executive, supervisory or other similar functions in connection with the construction of the project, shall have or acquire any pecuniary interest, whether direct or indirect, in this contract, any material supply contract, subcontract, insurance contract, or any other contract pertaining to the project.

ARTICLE 1.6 - PATENTS AND ROYALTIES

A. The Contractor shall hold and save the Owner and its officers, agents, servants and employees harmless from liabilities of any nature or kind, including cost and expenses, for, or on account of, any patented or unpatented invention, process, article or appliance manufactured or used in the performance of this contract, including its use by the Owner, unless otherwise specifically stipulated in the contract documents.

B. If the Contractor uses any design, device or materials covered by letters, patent or copyright,

the Contractor shall provide for such use by suitable agreement with the Owner of such patented or copyrighted design, device or material. It is mutually agreed and understood, without exception, that the contract prices shall include all royalties or costs arising from the use of such design, device or materials, in any way involved in the work. The Contractor and/or his sureties shall indemnify and save harmless the Owner of the project from any and all claims for infringement by reason of the use of such patented or copyrighted design, device or materials or any trademark or copyright in connection with work agreed to be performed under this contract and shall indemnify the Owner for any cost, expense or damage it may be obliged to pay by reason of such infringement at any time during the prosecution of the work or after completion of the work.

ARTICLE 1.7 - PREFERENCE FOR AMERICAN AND MISSOURI PRODUCTS AND SERVICES

A. By virtue of statutory authority a preference will be given to Missouri labor and to products of mines, forests and quarries of the state of Missouri when they are found in marketable quantities in the state, and all such materials shall be of the best quality and suitable character that can be obtained at reasonable market prices, all as provided for in Section 8.280, Missouri Revised Statutes and Cumulative Supplements.

B. Furthermore, pursuant to Section 34.076 Missouri Revised Statutes and Cumulative Supplements, a preference shall be given to those persons doing business as Missouri firms, corporations, or individuals, or which maintain Missouri offices or places of business, when the quality of performance promised is equal or better and the price quoted is the same or less. In addition, in order for a non-domiciliary bidder to be successful, his bid must be that same percentage lower than a domiciliary Missouri bidder's bid, as would be required for a Missouri bidder to successfully bid in the non-domiciliary state.

C In accordance with the Missouri Domestic Products Procurement Act Section 34.350 RSMo and Cumulative Supplements any manufactured goods or commodities used or supplied in the performance of this contract or any subcontract thereto shall be manufactured, assembled or produced in the United States, unless the specified products are not manufactured, assembled or produced in the United States in sufficient quantities to meet the agency's requirements or cannot be manufactured, assembled or produced in the United States within the necessary time in sufficient quantities to meet the contract requirements, or if obtaining the specified products manufactured, assembled or produced in the United States would increase the cost of this contract for purchase of the product by more than ten percent.

ARTICLE 1.8 - COMMUNICATIONS

A. All notices, requests, instructions, approvals and claims must be in writing and shall be delivered to the Designer and copied to the Construction Representative for the project except as required by Article 1.12 Disputes and Disagreements, or as otherwise specified by the Owner in writing as stated in Section 012600. Any such notice shall be deemed to have been given as of the time of actual receipt.

B. The Contractor shall attend on-site progress and coordination meetings, as scheduled by the Construction Representative, no less than once a month.

C. The Contractor shall ensure that major subcontractors and suppliers shall attend monthly progress meetings as necessary to coordinate the work, and as specifically requested by the Construction Representative.

ARTICLE 1.9 - SEPARATE CONTRACTS AND COOPERATION

A. The Owner reserves the right to let other contracts in connection with this work. The Contractor shall afford other contractors reasonable opportunity for the introduction and storage of their materials and the execution of their work and shall properly connect and coordinate his work with theirs.

B. The Contractor shall consult the drawings for all other contractors in connection with this work. Any work conflicting with the above shall be brought to the attention of the Owner's Representative before the work is performed. If the Contractor fails to do this, and constructs any work which interferes with the work of another contractor, the Contractor shall remove any part so conflicting and rebuild same, as directed by the Owner's Representative at no additional cost to the Owner.

C. Each contractor shall be required to coordinate his work with other contractors so as to afford others reasonable opportunity for execution of their work. No contractor shall delay any other contractor by neglecting to perform contract work at the proper time. If any contractor causes delay to another, they shall be liable directly to that contractor for such delay in addition to any liquidated damages which might be due the Owner.

D. Should the Contractor or project associated subcontractors refuse to cooperate with the instructions and reasonable requests of other Contractors or other subcontractors in the overall

coordinating of the work, the Owner may take such appropriate action and issue directions, as required, to avoid unnecessary and unwarranted delays.

E. Each Contractor shall be responsible for damage done to Owner's or other Contractor's property by him/her or workers in his employ through their fault or negligence.

F. Should a Contractor sustain any damage through any act or omission of any other Contractor having a contract with the Owner, the Contractor so damaged shall have no claim or cause of action against the Owner for such damage, but shall have a claim or cause of action against the other Contractor to recover any and all damages sustained by reason of the acts or omissions of such Contractor. The phrase "acts or omissions" as used in this section shall be defined to include, but not be limited to, any unreasonable delay on the part of any such contractors.

ARTICLE 1.10 - ASSIGNMENT OF CONTRACT

A. No assignment by Contractor of any amount or any part of this contract or of the funds to be received there under will be recognized unless such assignment has had the written approval of the Director and the surety has been given due notice of such assignment and has furnished written consent thereto. In addition to the usual recitals in assignment contracts, the following language must be set forth: "It is agreed that the funds to be paid to the assignee under this assignment are subject to performance by the Contractor of this contract and to claims or liens for services rendered or materials supplied for the performance of the work called for in said contract in favor of all persons, firms or corporations rendering such services or supplying such materials."

ARTICLE 1.11 - INDEMNIFICATION

A. Contractor agrees to indemnify and save harmless Owner and its respective commissioners, officers, officials, agents, consultants and employees and Designer, their agents, servants and employees, from and against any and all liability for damage arising from injuries to persons or damage to property occasioned by any acts or omissions of Contractor, any subcontractors, agents, servants or employees, including any and all expense, legal or otherwise, which may be incurred by Owner or Designer, its agents, servants or employees, in defense of any claim, action or suit.

B. The obligations of the Contractor under this paragraph shall not extend to the liability of the Designer, his agents or employees, arising out of (1) the preparation or approval of maps, drawings, opinions, reports, surveys, contract changes, design or specifications, or (2) giving of or the failure to give directions or instructions by the Designer, his agents or employees as required by this contract documents provided such giving or failure to give is the primary cause of the injury or damage.

ARTICLE 1.12 - DISPUTES AND DISAGREEMENTS

A. It is hereby expressly agreed and understood that in case any controversy or difference of opinion arises during construction, best efforts will be given to resolution at the field level. Should those efforts be unsuccessful, the Contractor has the right to appeal in writing, the decision of the Director's Designee to the Director at Room 730 Truman Building, P.O. Box 809, Jefferson City, Missouri 65102. The decision of the Director shall be final and binding on all parties.

ARTICLE 2 -- OWNER/DESIGNER RESPONSIBILITIES

A. The Owner shall give all orders and directions contemplated under this contract relative to the execution of the work. During progress of work the Owner will be represented at the project site by the Construction Representative and/or Designer, whose responsibilities are to see that this contract is properly fulfilled.

B. The Owner shall at all times have access to the work whenever it is in preparation or progress. The Contractors shall provide proper facilities for such access and for inspection and supervision.

C. All materials and workmanship used in the work shall be subject to the inspection of the Designer and Construction Representative, and any work which is deemed defective shall be removed, rebuilt or made good immediately upon notice. The cost of such correction shall be borne by the Contractor. Contractor shall not be entitled to an extension of the contract completion date in order to remedy defective work. All rejected materials shall be immediately removed from the site of the work.

D. If the Contractor fails to proceed at once with the correction of rejected defective materials or workmanship, the Owner may, by separate contract or otherwise, have the defects remedied or rejected. Materials removed from the site and charge the cost of the same against any monies which may be due the Contractor, without prejudice to any other rights or remedies of the Owner.

E. Failure or neglect on the part of Owner to observe faulty work, or work done which is not in accordance with the drawings and specifications shall not relieve the Contractor from responsibility

for correcting such work without additional compensation.

F. The Owner shall have the right to direct the Contractor to uncover any completed work.

1. If the Contractor fails to adequately notify the Construction Representative and/or Designer of an inspection as required by the Contract Documents, the Contractor shall, upon written request, uncover the work. The Contractor shall bear all costs associated with uncovering and again covering the work exposed.

2. If the Contractor is directed to uncover work, which was not otherwise required by the Contract Documents to be inspected, and the work is found to be defective in any respect, no compensation shall be allowed for this work. If, however, such work is found to meet the requirements of this contract, the actual cost of labor and material necessarily involved in the examination and replacement plus 10% shall be allowed the Contractor.

G. The Designer shall give all orders and directions contemplated under this contract relative to the scope of the work and shall give the initial interpretation of the contract documents.

H. The Owner may file a written notice to the Contractor to dismiss immediately any subcontractors, project managers, superintendents, foremen, workers, watchmen or other employees whom the Owner may deem incompetent, careless or a hindrance to proper or timely execution of the work. The Contractor shall comply with such notice as promptly as practicable without detriment to the work or its progress.

I. If in the Owner's judgment it becomes necessary at any time to accelerate work, when ordered by the Owner in writing, the Contractor shall redirect resources to such work items and execute such portions of the work as may be required to complete the work within the current approved contract schedule.

ARTICLE 3 -- CONTRACTOR RESPONSIBILITIES

ARTICLE 3.1 -- ACCEPTABLE SUBSTITUTIONS

A. The Contractor may request use of any article, device, product, material, fixture, form or type of construction which in the judgment of the Owner and Designer is equal in all respects to that named. Standard products of manufacturers other than those specified will be accepted when, prior to the ordering or use thereof, it is proven to the satisfaction of the Owner and Designer that they are equal in design, strength, durability, usefulness and convenience for the purpose intended.

B. Any changes required in the details and dimensions indicated on the drawings for the substitution of products other than those specified shall be properly made at the expense of the Contractor requesting the substitution or change.

C. The Contractor shall submit a request for such substitutions in writing to the Owner and Designer within twenty (20) working days after the date of the "Notice to Proceed." Thereafter no consideration will be given to alternate forms of accomplishing the work. This Article does not preclude the Owner from exercising the provisions of Article 4 hereof.

D. Any request for substitution by the Contractor shall be submitted in accordance with SECTION 002113 - INSTRUCTIONS TO BIDDERS.

E. When a material has been approved, no change in brand or make will be permitted unless:

1. Written verification is received from the manufacturer stating they cannot make delivery on the date previously agreed, or

2. Material delivered fails to comply with contract requirements.

ARTICLE 3.2 -- SUBMITTALS

A. The Contractor's submittals must be submitted with such promptness as to allow for review and approval so as not to cause delay in the work. The Contractor shall coordinate preparation and processing of submittals with performance of construction activities.

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

Submit four (4) copies to the Designer and additional copies as required for the subcontractors and material suppliers. Also provide copies to meet the requirements for maintenance manuals.

B. All subcontractors' shop drawings and schedules shall be submitted by the Contractor and shall bear evidence that Contractor has received, reviewed, and approved them. Any shop drawings and schedules submitted without this evidence will be returned to the Contractor for resubmission.

C. The Contractor shall include with the shop drawing, a letter indicating any and all deviations from the drawings and/or specifications. Failure to notify the Designer of such deviations will be grounds for subsequent rejection of the related work or materials. If, in the opinion of the Designer, the deviations are not acceptable, the Contractor will be required to furnish the item as specified and indicated on the drawings.

D. The Designer shall check shop drawings and schedules with reasonable promptness and approve them only if they conform to the design concept of the project and comply with the information given in the contract documents. The approval shall not relieve the Contractor from the responsibility to comply with the drawings and specifications, unless the Contractor has called the Designer's attention to the deviation, in writing, at the time of submission and the Designer has knowingly approved thereof. An approval of any such modification will be given only under the following conditions:

1. It is in the best interest of the Owner
2. It does not increase the contract sum and/or completion time
3. It does not deviate from the design intent
4. It is without prejudice to any and all rights under the surety bond.

E. No extension of time will be granted because of the Contractor's failure to submit shop drawings and schedules in ample time to allow for review, possible resubmission, and approval. Fabrication of work shall not commence until the Contractor has received approval. The Contractor shall furnish prints of approved shop drawings and schedules to all subcontractors whose work is in any way related to the work under this contract. Only prints bearing this approval will be allowed on the site of construction

F. The Contractor shall maintain a complete file on-site of approved shop drawings available for use by the Construction Representative.

ARTICLE 3.3 – AS-BUILT DRAWINGS

A. The Contractor shall update a complete set of the construction drawings, shop drawings and schedules of all work monthly by marking changes, and at the completion of their work (prior to submission of request for final payment) note all changes and turn the set over to the Construction Representative. The updates shall show all addenda, all field changes that were made to adapt to field conditions, changes resulting from contract changes or supplemental instructions, and all locations of structures, buried installations of piping, conduit, and utility services. All buried and concealed items both inside and outside shall be accurately located as to depth and referenced to permanent features such as interior or exterior wall faces and dimensions shall be given in a neat and legible manner in a contrasting colored pencil or ink. If approved by the Designer, an electronic file format may be provided.

ARTICLE 3.4 – GUARANTY AND WARRANTIES

A. General Guaranty

1. Neither the final certificate of payment nor any provision in the contract documents nor partial use or occupancy of the premises by the Owner shall constitute an acceptance of work not done in accordance with contract requirements.
2. The Contractor or surety shall remedy any defects in the work and pay for any damage to property resulting there from which shall appear within a period of one (1) year from the date of substantial completion unless a longer period is otherwise specified or a differing guaranty period has been established in the substantial completion certificate. The Owner will give notice of observed defects with reasonable promptness.
3. In case of default on the part of the Contractor in fulfilling this part of this contract, the Owner may correct the work or repair the damage and the cost and expense incurred in such event shall be paid by or recoverable from the Contractor or surety.
4. The work will be free from defects not inherent in the quality required or permitted, and that the Work will conform to the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. The Contractor's guaranty excludes remedy for damage or defect caused by abuse, modifications not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear under normal usage. If required by the Owner, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment

B. Extended Warranty

Manufacturer's certificates of warranty shall be obtained for all major equipment. Warranty shall be obtained for at least one year. Where a longer period is offered at no additional cost or called for in the specific equipment specifications, the longer period shall govern.

ARTICLE 3.5 -- OPERATION AND MAINTENANCE MANUALS

A. Immediately after equipment submittals are approved and no later than ten (10) working days prior to the substantial completion inspection, the Contractor shall provide to the Designer three (3)

copies of operating instructions and service manuals, containing the following:

1. Start-up and Shut-down Procedures: Provide a step-by-step write up of all major equipment. When manufacturer's printed start-up, trouble shooting and shut-down procedures are available; they may be incorporated into the operating manual for reference.
2. Operating Instructions: Written operating instructions shall be included for the efficient and safe operation of all equipment.
3. Equipment List: List of all major equipment as installed shall be prepared to include model number, capacities, flow rate, name place data, shop drawings and air and water balance reports.
4. Service Instructions: Provide the following information for all pieces of equipment.
   a. Recommended spare parts including catalog number and name of local supplier or factory representative.
   b. Belt sizes, types, and lengths.
   c. Wiring diagrams.
5. Manufacturer's Certificate of Warranty as described in Article 3.4.
6. Prior to the final payment, furnish to the Designer three (4) copies of parts catalogs for each piece of equipment furnished by him/her on the project with the components identified by number for replacement ordering.

B. Submission of operating instructions shall be done in the following manner.

1. Manuals shall be in quadruplicate, and all materials shall be bound into volumes of standard 8½" x 11" hard binders. Large drawings too bulky to be folded into 8½" x 11" shall be separately bound or folded and in envelopes, cross referenced and indexed with the manuals.
2. The manuals shall identify project name, project number, and include the name and address of the Contractor, subcontractors and manufacturers who were involved with the activity described in that particular manual.
3. Internally subdivide the binder contents with permanent page dividers, logically organized with tab titles clearly printed under reinforced laminated plastic tabs.
4. Contents: Prepare a Table of Contents for each volume, with each product or system description identified.

ARTICLE 3.6 – OTHER CONTRACTOR RESPONSIBILITIES

A. The Contractor shall keep on site, during progress of the work, a competent superintendent satisfactory to the Construction Representative. The superintendent shall represent the Contractor and all agreements made by the superintendent shall be binding. The superintendent shall carefully study and compare all drawings, specifications and other instructions and shall promptly notify the Construction Representative and Designer, in writing, any error, inconsistency or omission which may be discovered. The superintendent shall coordinate all work on the project. Any change of the superintendent shall be approved by the Construction Representative.

B. Contractor shall, at all times, enforce strict discipline and good order among his employees, and shall not employ on the work any unfit person or anyone not skilled in the work assigned to him/her.

C. The Contractor shall supply sufficient labor, material, plant and equipment and pay when due any laborer, subcontractor or supplier for supplies furnished and otherwise prosecute the work with diligence to prevent work stoppage and insure completion thereof within the time specified.

D. The Contractor and each of his subcontractors shall submit to the Construction Representative, through the Designer such schedules of quantities and costs, progress schedules, payrolls, reports, estimates, records and other data as the Owner may request concerning work performed or to be performed under this contract.

E. The Contractor, subcontractors, and material suppliers shall upon written request, give the Owner access to all time cards, material invoices, payrolls, estimates, profit and loss statements, and all other direct or indirect costs related to this work.

F. The Contractor shall be responsible for laying out all contract work such as layout of architectural, structural, mechanical and electrical work, which shall be coordinated with layouts of subcontractors for general construction work. The Contractor is also responsible for unloading, uncrating and handling of all materials and equipment to be erected or placed by him/her, whether furnished by Contractor or others. No extra charges or compensation will be allowed as a result of failure to verify dimensions before ordering materials or fabricating items.

G. The Contractor must notify the Construction Representative at least one working day before

placing concrete or burying underground utilities, pipelines, etc.

H. Contractors shall prearrange time with the Construction Representative for the interruption of any facility operation. Unless otherwise specified in these documents, all connections, alterations or relocations as well as all other portions of the work will be performed during normal working hours.

I. The Contractor shall coordinate all work so there will not be prolonged interruptions of existing equipment operation. Any existing plumbing, heating, ventilating, air conditioning or electrical disconnections necessary for the project, which affect portions of this construction or building or any other building must be scheduled with the Construction Representative to minimize or avoid any disruption of facility operations. In no case, unless previously approved in writing by the Construction Representative, shall utilities be left disconnected at the end of a work day or over a weekend. Any interruption of utilities either intentionally or accidentally shall not relieve the Contractor responsible for the interruption from the responsibility to repair and restore the utility to normal service. Repairs and restoration shall be made before the workers responsible for the repair and restoration leave the job.

J. Contractors shall limit operations and storage of materials to the area within the project, except as necessary to connect to existing utilities, and shall not encroach on neighboring property. The Contractor shall be responsible for repair of their damage to property on or off the project site occurring during construction of project. All such repairs shall be made to the satisfaction of the property owner.

K. Unless otherwise permitted, all materials shall be new and both workmanship and materials shall be of the best quality.

L. Unless otherwise provided and stipulated within these specifications, the Contractor shall furnish, construct, and/or install and pay for materials, devices, mechanisms, equipment, all necessary personnel, utilities including, but not limited to water, heat, light and electric power, transportation services, applicable taxes of every nature, and all other facilities necessary for the proper execution and completion of the work.

M. Contractor shall carefully examine the plans and drawings and shall be responsible for the proper fitting of his material, equipment and apparatus into the building.

N. The Contractor or subcontractors shall not overload, or permit others to overload, any part of any structure during the performance of this contract.

O. All temporary shoring, bracing, etc., required for the removal of existing work and/or for the installation of new work shall be included in this contract. The Contractor shall make good, at no cost to the Owner, any damage caused by improper support or failure of shoring in any respect. Each Contractor shall be responsible for shoring required to protect his work or adjacent property and improvements of Owner and shall be responsible for shoring or for giving written notice to adjacent property owners. Shoring shall be removed only after completion of permanent supports.

P. The Contractor shall provide at the proper time such material as is required for support of the work. If openings are required, whether shown on drawings or not, the Contractor shall see that they are properly constructed.

Q. During the performance of work the Contractor shall be responsible for providing and maintaining warning signs, lights, signal devices, barricades, guard rails, fences and other devices appropriately located on site which will give proper and understandable warning to all persons of danger of entry onto land, structure or equipment.

R. The Contractor shall be responsible for protection, including weather protection, and proper maintenance of all equipment and materials.

S. The Contractor shall be responsible for care of the finished work and shall protect same from damage or defacement until substantial completion by the Owner. If the work is damaged by any cause, the Contractor shall immediately begin to make repairs in accordance with the drawings and specifications. Contractor shall be liable for all damage or loss unless attributable to the acts or omissions of the Owner or Designer. Any claim for reimbursement shall be submitted in accordance with Article 4. After substantial completion the Contractor will only be responsible for damage resulting from acts or omissions of the Contractor or subcontractors through final warranty.

T. In the event the Contractor encounters an unforeseen hazardous material, the Contractor shall immediately stop work in the area affected and report the condition to the Owner and Designer in writing. The Contractor shall not be required, pursuant to Article 4, to perform, any work relating to hazardous materials.

U. In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury or loss. Additional compensation

or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 4.

V. Before commencing work, Contractors shall confer with the Construction Representative and facility representative and review any facility rules and regulations which may affect the conduct of the work.

W. Project signs will only be erected on major projects and only as described in the specifications. If no sign is specified, none shall be erected.

ARTICLE 3.7 -- SUBCONTRACTS

A. Subcontractor assignments as identified in the bid form shall not be changed without written approval of the Owner. The Owner will not approve changes of a listed subcontractor unless the Contractor documents, to the satisfaction of the Owner that the subcontractor cannot or will not perform the work as specified.

B. The Contractor is fully responsible to the Owner for the acts and omissions of all subcontractors and of persons either directly or indirectly employed by them.

C. Every subcontractor shall be bound by the applicable terms and provisions of these contract documents, but no contractual relationship shall exist between any subcontractor and the Owner unless the right of the Contractor to proceed with the work is suspended or this contract is terminated as herein provided, and the Owner in writing elects to assume the subcontract.

D. The Contractor shall upon receipt of "Notice to Proceed" and prior to submission of the first payment request, notify the Designer and Construction Representative in writing of the names of any subcontractors to be used in addition to those identified in the bid form and all major material suppliers proposed for all parts of the work.

ARTICLE 4 -- CHANGES IN THE WORK

4.1 CHANGES IN THE WORK

A. The Construction Representative, without giving notice to the surety and without invalidating this contract, may order extra work or make changes by altering, adding to or deducting from the work, this contract sum being adjusted accordingly. All such work shall be executed under the conditions of the original contract. A claim for extension of time caused by any change must be adjusted at the time of ordering such change. No future request for time will be considered.

B. Each Contract Change shall include all costs required to perform the work including all labor, material, equipment, overheads and profit, delay, disruptions, or other miscellaneous expenses. No subsequent requests for additional compensation including claims for delay, disruption, or reduced efficiency as a result of each change will be considered. Values from the Schedule of Values will not be binding as a basis for additions to or deductions from the contract price.

C. The amount of any adjustment in this contract price for authorized changes shall be agreed upon before such changes become effective and shall be determined, through submission of a request for proposal, as follows:

1. By an acceptable fixed price proposal from the Contractor. Breakdowns shall include all takeoff sheets of each Contractor and subcontractor. Breakdown shall include a listing of each item of material with unit prices and number of hours of labor for each task. Labor costs per hour shall be included with labor burden identified, which shall be not less than the prevailing wage rate, etc. Overhead and profit shall be shown separately for each subcontractor and the Contractor.

2. By a cost-plus-fixed-fee (time and material) basis with maximum price, total cost not to exceed said maximum. Breakdown shall include a listing of each item of material with unit prices and number of hours of labor for each task. Labor costs per hour shall be included with labor burden identified, which shall be not less than the prevailing wage rate, etc. Overhead and profit shall be shown separately for each subcontractor and the Contractor.

3. By unit prices contained in Contractor's original bid form and incorporated in the construction contract.

D. Overhead and Profit on Contract Changes shall be applied as follows:

1. The overhead and profit charge by the Contractor and all subcontractors shall be considered to include, but is not limited to: incidental job burdens, small truck (under 1 ton) expense, mileage, small hand tools, warranty costs, company benefits and general office overhead. Project supervision including field supervision and job site office expense shall be considered a part of overhead and profit unless a compensable time extension is granted.

2. The percentages for overhead and profit charged on Contract Changes shall be negotiated, and may vary according to the nature, extent, and complexity of the work

involved. However, the overhead and profit for the Contractor or subcontractor actually performing the work shall not exceed 14%. When one or more tiers of subcontractors are used, in no event shall any Contractor or subcontractor receive as overhead and profit more than 3% of the cost of the work performed by any of his subcontractors. In no case shall the total overhead and profit paid by the Owner on any Contract Changes exceed twenty percent (20%) of the cost of materials, labor and equipment (exclusive of Contractor or any Subcontractor overhead and profit) necessary to put the contract change work in place.

3. The Contractor will be allowed to add the cost of bonding and insurance to their cost of work. This bonding and insurance cost shall not exceed 2% and shall be allowed on the total cost of the added work, including overhead and profit.

4. On proposals covering both increases and decreases in the amount of this contract, the application of overhead and profit shall be on the net change in the cost of the work.

5. The percentage for overhead and profit to be credited to the Owner on Contract Changes that are solely decreases in the quantity of work or materials shall be negotiated, and may vary according to the nature, extent and complexity of the work involved, but in no case shall be less than ten percent (10%). If the percentage for overhead and profit charged for work added by Contract Changes for this contract has been negotiated to less than 10%, the negotiated rate shall then apply to credits as well.

E. No claim for an addition to this contract sum shall be valid unless authorized as aforesaid in writing by the Owner. In the event that none of the foregoing methods are agreed upon, the Owner may order the Contractor to perform work on a time and material basis. The cost of such work shall be determined by the Contractor's actual labor and material cost to perform the work plus overhead and profit as outlined herein. The Designer and Construction Representative shall approve the Contractor's daily time and material invoices for the work involved.

F. If the Contractor claims that any instructions involve extra cost under this contract, the Contractor shall give the Owner's Representative written notice thereof within a reasonable time after the receipt of such instructions, and in any event before proceeding to execute the work. No such claim shall be valid unless so made and authorized by the Owner, in writing.

G. In an emergency affecting the safety of life or of the structure or of adjoining property, the Contractor, without special instruction or authorization from the Construction Representative, is hereby permitted to act at their discretion to prevent such threatened loss or injury. The Contractor shall submit a claim for compensation for such emergency work in writing to the Owner's Representative.

ARTICLE 4.2 – CHANGES IN COMPLETION TIME

A. Extension of the number of work days stipulated in the Contract for completion of the work with compensation may be made when:

1. The contractor documents that proposed Changes in the work, as provided in Article 4.1, extends construction activities critical to contract completion date, OR

2. The Owner suspends all work for convenience of the Owner as provided in Article 7.3, OR

3. An Owner caused delay extends construction activities critical to contract completion (except as provided elsewhere in these General Conditions). The Contractor is to review the work activities yet to begin and evaluate the possibility of rescheduling the work to minimize the overall project delay.

B. Extension of the number of work days stipulated in the Contract for completion of the work <u>without</u> compensation may be made when:

1. Weather-related delays occur, subject to provisions for the inclusion of a specified number of "bad weather" days when provided for in Section 012100-Allowances, OR

2. Labor strikes or acts of God occur, OR

3. The work of the Contractor is delayed on account of conditions which were beyond the control of the Contractor, subcontractors or suppliers, and were not the result of their fault or negligence.

C. No time extension or compensation will be provided for delays caused by or within the control of the Contractor, subcontractors or suppliers and for concurrent delays caused by the Owner.

D. The Contractor shall notify the Owner promptly of any occurrence or conditions which in the Contractor's opinion results in a need for an extension of time. The notice shall be in writing and shall include all necessary supporting materials with details of any resultant costs and be submitted in time to permit full investigation and

evaluation of the Contractor's claim. The Owner shall promptly acknowledge the Contractor's notice and, after recommendation from the Owner's Representative and/or Designer, shall provide a decision to the Contractor. Failure on the part of the Contractor to provide such notice and to detail the costs shall constitute a waiver by the Contractor of any claim. Requests for extensions of time shall be for working days only.

ARTICLE 5 - CONSTRUCTION AND COMPLETION

ARTICLE 5.1 – CONSTRUCTION COMMENCEMENT

A. Upon receipt of the "Intent to Award" letter, the Contractor must submit the following properly executed instruments to the Owner:

1. Contract;
2. Performance/payment bond as described in Article 6.1;
3. Certificates of Insurance, or the actual policies themselves, showing that the Contractor has obtained the insurance coverage required by Article 6.2.
4. Written Affirmative Action Plans as required in Article 1.4.

Above referenced items must be received by the Owner within ten (10) working days after the effective date of the contract. If not received, the Owner may treat the failure to timely submit them as a refusal by the Contractor to accept a contract for this work and may retain as liquidated damages the Contractor's bid bond, cashier's check or certified check as provided in the Instructions to Bidders. Upon receipt the Owner will issue a "Notice to Proceed" with the work to the Contractor.

B. Within the time frame noted in Section 013200 - Schedules, following receipt of the "Notice to Proceed", the Contractor shall submit to the Owner a progress schedule and schedule of values, showing activities through the end of the contract period. Should the Contractor not receive written notification from the Owner of the disapproval of the schedule of values within fifteen (15) working days, the Contractor may consider it approved for purpose of determining when the first monthly Application and Certification for Payment may be submitted.

C. The Contractor may commence work upon receipt of the Division of Facilities Management, Design and Construction's "Notice to Proceed" letter. Contractor shall prosecute the work with faithfulness and energy, and shall complete the entire work on or before the completion time stated in the contract documents or pay to the Owner the damages resulting from the failure to timely complete the work as set out within Article 5.4.

ARTICLE 5.2 -- PROJECT CONSTRUCTION

A. Each Contractor shall submit for the Owner's approval, in reproducible form, a progress schedule showing the rate of progress and the order of the work proposed to carry on various phases of the project. The schedule shall be in conformance with the requirements outlined in Section 013200 – Schedules.

B. Contractor shall employ and supply a sufficient force of workers, material, and equipment and shall pay when due, any worker, subcontractor or supplier and otherwise prosecute the work with such diligence so as to maintain the rate of progress indicated on the progress schedule, prevent work stoppage, and insure completion of the project within the time specified.

ARTICLE 5.3 -- PROJECT COMPLETION

A. Substantial Completion. A Project is substantially complete when construction is essentially complete and work items remaining to be completed can be done without interfering with the Owner's ability to use the Project for its intended purpose.

1. Once the Contractor has reached what they believe is Substantial Completion, the Contractor shall notify the Designer and the Construction Representative of the following:
   a. That work is essentially complete with the exception of certain listed work items. The list shall be referred to as the "Contractor's Punch."
   b. That all Operation and Maintenance Manuals have been assembled and submitted in accordance with Article 3.5A.
   c. That the Work is ready for inspection by the Designer and Construction Representative. The Owner shall be entitled to a minimum of ten working days notice before the inspection shall be performed.
2. If the work is acceptable, the Owner shall issue a Certificate of Substantial Completion, which shall set forth the responsibilities of the Owner and the Contractor for utilities, security, maintenance, damage to the work and risk of loss. The Certificate shall also identify those remaining items of work to be

performed by the Contractor. All such work items shall be complete within 30 working days of the date of the Certificate, unless the Certificate specifies a different time. If the Contractor shall be required to perform tests that must be delayed due to climatic conditions, it is understood that such tests and affected equipment will be identified on the Certificate and shall be accomplished by the Contractor at the earliest possible date. Performance of the tests may not be required before Substantial Completion can be issued. The date of the issuance of the Certificate of Substantial Completion shall determine whether or not the work was completed within the contract time and whether or not Liquidated Damages are due.

3. If the work is not acceptable, and the Owner does not issue a Certificate of Substantial Completion, the Owner shall be entitled to charge the Contractor with the Designer's and Owner's costs of re-inspection, including time and travel.

B. Partial Occupancy. Contractor agrees that the Owner shall be permitted to occupy and use any completed or partially completed portions of the Project, when such occupancy and use is in the Owner's best interest. Owner shall notify Contractor of its desire and intention to take Partial Occupancy as soon as possible but at least ten (10) working days before the Owner intends to occupy. If the Contractor believes that the portion of the work the Owner intends to occupy is not ready for occupancy, the Contractor shall notify the Owner immediately. The Designer shall inspect the work in accordance with the procedures above. If the Contractor claims increased cost of the project or delay in completion as a result of the occupancy, he shall notify the Owner immediately but in all cases before occupancy occurs.

C. Final Completion. The Project is finally complete when the Certificate of Substantial Completion has been issued and all work items identified therein as incomplete have been completed, and when all administrative items required by the contract have been completed. Final Completion entitles the Contractor to payment of the outstanding balance of the contract amount including all change orders and retainage. Within five (5) working days of the date of the Certificate of Substantial Completion, the Contractor shall identify the cost to complete any outstanding items of work. The Designer shall review the Contractor's estimate and either approve it or provide an independent estimate for all such items. If the Contractor fails to complete the remaining items within the time specified in the Certificate, the Owner may terminate the contract and go to the surety for project completion in accordance with Article 7.2 or release the contract balance to the Contractor less 150% of the approved estimate to complete the outstanding items. Upon completion of the outstanding items, when a final cost has been established, any monies remaining shall be paid to the Contractor. Failure to complete items of work does not relieve the Contractor from the obligation to complete the administrative requirements of the contract, such as the provisions of Article 5.3 FAILURE TO COMPLETE ALL ITEMS OF WORK UNDER THE CONTRACT SHALL BE CONSIDERED A DEFAULT AND BE GROUNDS FOR CONTRACT TERMINATION AND DEBARMENT.

D. Liquidated Damages. Contractor agrees that the Owner may deduct from the contract price and retain as liquidated damages, and not as penalty or forfeiture, the sum stipulated in this contract for each work day after the Contract Completion Day on which work is not Substantially Complete. Assessment of Liquidated Damages shall not relieve the Contractor or the surety of any responsibility or obligation under the Contract. In addition, the Owner may, without prejudice to any other rights, claims, or remedies the Owner may have including the right to Liquidated Damages, charge the Contractor for all additional expenses incurred by the Owner and/or Designer as the result of the extended contract period through Final Completion. Additional Expenses shall include but not be limited to the costs of additional inspections.

E. Early Completion. The Contractor has the right to finish the work before the contract completion date; however, the Owner assumes no liability for any hindrances to the Contractor unless Owner caused delays result in a time extension to the contract completion date. The Contractor shall not be entitled to any claims for lost efficiencies or for delay if a Certificate of Substantial Completion is given on or before the Contract Completion Date.

ARTICLE 5.4 -- PAYMENT TO CONTRACTOR

A. Payments on account of this contract will be made monthly in proportion to the work which has been completed. Request for payment must be submitted on the Owner's forms. No other pay request will be processed. Supporting breakdowns must be in the same format as Owner's forms and must provide the same level of detail. The Designer will, within 5 working days from receipt of the contractor's request for payment either issue a Certificate for Payment to the Owner, for such amount as the Designer determines is properly due, or notify the Contractor in writing of reasons for withholding a Certificate. The Owner shall make

payment within 30 calendar days after the "Application and Certification for Payment" has been received and certified by the Designer. The following items are to be attached to the contractor's pay request:

1. Updated construction schedule
2. Certified payrolls consisting of name, occupation and craft, number of hours worked and actual wages paid for each individual employee, of the Contractor and all subcontractors working on the project

B. The Owner shall retain 5 percent of the amount of each such payment application, except as allowed by Article 5.4, until final completion and acceptance of all work covered by this contract.

C. Each payment made to Contractor shall be on account of the total amount payable to Contractor and all material and work covered by paid partial payment shall thereupon become the sole property of Owner. This provision shall not be construed as relieving Contractor from sole responsibility for care and protection of materials and work upon which payments have been made or restoration of any damaged work or as a waiver of the right of Owner to require fulfillment of all terms of this contract.

D. Materials delivered to the work site and not incorporated in the work will be allowed in the Application and Certification for Payment on the basis of one hundred (100%) percent of value, subject to the 5% retainage providing that they are suitably stored on the site or in an approved warehouse in accordance with the following requirements:

1. Material has previously been approved through submittal and acceptance of shop drawings conforming to requirements of Article 3.2 of General Conditions.
2. Delivery is made in accordance with the time frame on the approved schedule.
3. Materials, equipment, etc., are properly stored and protected from damage and deterioration and remain so - if not, previously approved amounts will be deleted from subsequent pay applications.
4. The payment request is accompanied by a breakdown identifying the material equipment, etc. in sufficient detail to establish quantity and value.

E. The Contractor shall be allowed to include in the Application and Certification for Payment, one hundred (100%) of the value, subject to retainage, of major equipment and material stored off the site if all of the following conditions are met:

1. The request for consideration of payment for materials stored off site is made at least 15 working days prior to submittal of the Application for Payment including such material. Only materials inspected will be considered for inclusion on Application for Payment requests.
2. Materials stored in one location off site are valued in excess of $25,000.
3. That a Certificate of Insurance is provided indicating adequate protection from loss, theft conversion or damage for materials stored off site. This Certificate shall show the State of Missouri as an additional insured for this loss.
4. The materials are stored in a facility approved and inspected, by the Construction Representative.
5. Contractor shall be responsible for, Owner costs to inspect out of state facilities, and any delays in the completion of the work caused by damage to the material or for any other failure of the Contractor to have access to this material for the execution of the work.

F. The Owner shall determine the amount, quality and acceptability of the work and materials which are to be paid for under this contract. In the event any questions shall arise between the parties, relative to this contract or specifications, determination or decision of the Owner or the Construction Representative and the Designer shall be a condition precedent to the right of the Contractor to receive any money or payment for work under this contract affected in any manner or to any extent by such question.

G. Payments Withheld: The Owner may withhold or nullify in whole or part any certificate to such extent as may be necessary to protect the Owner from loss on account of:

1. Defective work not remedied. When a notice of noncompliance is issued on an item or items, corrective action shall be undertaken immediately. Until corrective action is completed, no monies will be paid and no additional time will be allowed for the item or items. The cost of corrective action(s) shall be borne by the Contractor.
2. A reasonable doubt that this contract can be completed for the unpaid balance.
3. Failure of the Contractor to update as-built drawings monthly for review by the Construction Representative.
4. Failure of the Contractor to update the construction schedule.

When the Construction Representative is satisfied the Contractor has remedied above deficiencies, payment shall be released.

H. Final Payment: Upon receipt of written notice from the Contractor to the Designer and Project Representative that the work is ready for final inspection and acceptance, the Designer and Project Representative, with the Contractor, shall promptly make such inspection. If the work is acceptable and the contract fully performed, the Construction Representative shall complete a final acceptance report and the Contractor will be directed to submit a final Application and Certification for Payment. If the Owner approves the same, the entire balance shall be due and payable, with the exception of deductions as provided for under Article 5.4.

1. Where the specifications provide for the performance by the Contractor of (certain tests for the purpose of balancing and checking the air conditioning and heating equipment and the Contractor shall have furnished and installed all such equipment in accordance with the specifications, but said test cannot then be made because of climatic conditions, such test shall may be considered as required under the provisions of the specifications, Section 013300 and this contract may be substantial Full payment will not be made until the tests have been made and the equipment and system is finally accepted. If the tests are not completed when scheduled, the Owner may deduct 150% of the value of the tests from the final payment.

2. The final payment shall not become due until the Contractor delivers to the Construction Representative:
   a) A complete file of releases, on the standard form included in the contract documents as "Final Receipt of Payment and Release Form", from subcontractors and material suppliers evidencing payment in full for services, equipment and materials, as the case may require, if the Owner approves, or a consent from the Surety to final payment accepting liability for any unpaid amounts.
   b) An Affidavit of Compliance with Prevailing Wage Law, in the form as included in this contract specifications, properly executed by each subcontractor, and the Contractor
   c) Certified copies of all payrolls
   d) As-built drawings

3. If any claim remains unsatisfied after all payments are made, the Contractor shall refund to the Owner all monies that the latter may be compelled to pay in discharging such a claim including all costs and a reasonable attorney's fee.

4. Missouri statute requires prompt payment from the Owner to the Contractor within thirty calendar days and from the Contractor to his subcontractors within fifteen calendar days. Failure to make payments within the required time frame entitles the receiving party to charge interest at the rate of one and one half percent per month calculated from the expiration of the statutory time period until paid.

5. The value of all unused unit price allowances and/or 150% of the value of the outstanding work items, and/or liquidated damages may be deducted from the final pay request without executing a Contract Change. Any unit price items which exceed the number of units in the contract may be added by Contract Change.

ARTICLE 6 -- INSURANCE AND BONDS

ARTICLE 6.1 -- BOND

A. Contractor shall furnish a performance/payment bond in an amount equal to 100% of the contract price to guarantee faithful performance of the contract and 100% of the contract price to guarantee the payment of all persons performing labor on the project and furnishing materials in connection therewith under this contract as set forth in the standard form of performance and payment bond included in the contract documents. The surety on such bond shall be issued by a surety company authorized by the Missouri Department of Insurance to do business in the state of Missouri.

B. All Performance/Payment Bonds furnished in response to this provision shall be provided by a bonding company with a rating of B+ or higher as established by A.M. Best Company, Inc. in their most recent publication.

ARTICLE 6.2 – INSURANCE

A. The successful Contractor shall procure and maintain for the duration of the contract issued a policy or policies of insurance for the protection of both the Contractor and the Owner and their respective officers, officials, agents, consultants and employees. The Owner requires certification of insurance coverage from the Contractor prior to commencing work.

B. Minimum Scope and Extent of Coverage

1. General Liability

   Commercial General Liability, ISO coverage form number or equivalent CG 00 01 ("occurrence" basis), or I-SO coverage form number CG 00 02, or ISO equivalent.

   If ISO equivalent or manuscript general liability coverage forms are used, minimum coverage will be as follows: Premises/Operations;Independent Contractors; Products/Completed Operations; personal Injury; Broad Form Property Damage including Completed Operations; Broad Form Contractual Liability Coverage to include Contractor's obligations under Article 1.11 Indemnification and any other Special Hazards required by the work of the contract.

2. Automobile Liability

   Business Automobile Liability Insurance, ISO Coverage form number or equivalent CA 00 01 covering automobile liability, code 1 "ANY AUTO".

3. Workers' Compensation and Employer's Liability

   Statutory Workers' Compensation Insurance for Missouri and standard Employer's Liability Insurance, or the authorization to self-insure for such liability from the Missouri Division of Workers' Compensation.

4. Builder's Risk or Installation Floater Insurance

   Insurance upon the work and all materials, equipment, supplies, temporary structures and similar items which may be incident to the performance of the work and located at or adjacent to the site, against loss or damage from fire and such other casualties as are included in extended coverage in broad "All Risk" form, including coverage for Flood and Earthquake, in an amount not less than the replacement cost of the work or this contact price, whichever is greater, with loss payable to Contractor and Owner as their respective interests may appear.

   Contractor shall maintain sufficient insurance to cover the full value of the work and materials as the work progresses, and shall furnish Owner copies of all endorsements. If Builder's Risk Reporting- Form of Endorsement is used, Contractor shall make all reports as required therein so as to keep in force an amount of insurance which will equal the replacement cost of the work, materials, equipment, supplies, temporary structures, and other property covered thereby; and if, as a result of Contractor's failure to make any such report, the amount of insurance so recoverable shall be less than such replacement cost, Contractor's interest in the proceeds of such insurance, if any, shall be subordinated to Owner's interest to the end that Owner may receive full reimbursement for its loss.

C. Minimum Limits of Insurance

   1. General Liability

      Contractor

      $2,000,000 combined single limit per occurrence for bodily injury, personal injury, and property damage

      $2,000,000 annual aggregate

   2. Automobile Liability

      $2,000,000 combined single limit per occurrence for bodily injury and property damage

   3. Workers'Compensation and Employers Liability

      Workers' Compensation limits as required by applicable State Statutes (generally unlimited) and minimum of $1,000,000 limit per accident for Employer's Liability.

      General Liability and Automobile Liability insurance may be arranged under individual policies for the full limits required or by a combination of underlying policies with the balance provided by a form-following Excess or Umbrella Liability policy.

D. Deductibles and Self-Insured Retentions

   All deductibles, co-payment clauses, and self-insured retentions must be declared to and approved by the Owner. The Owner reserves the right to request the reduction or elimination of unacceptable deductibles or self-insured retentions, as they would apply to the Owner, and their respective officers, officials, agents, consultants and employees. Alternatively, the Owner may request Contractor to procure a bond guaranteeing payment of losses and related investigations, claims administration, and defense expenses.

E. Other Insurance Provisions and Requirements

   The respective insurance policies and coverage, as specified below, must contain, or be endorsed to contain the following conditions or provisions:

   1. General Liability

      The Owner, and its respective commissioners, officers, officials, agents, consultants and employees shall be endorsed as additional insured's by ISO form CG 20 26 Additional

Insured - Designated Person or Organization. As additional insured's, they shall be covered as to work performed by or on behalf of the Contractor or as to liability which arises out of Contractor's activities or resulting from the performance of services or the delivery of goods called for by the Contract.

Contractor's insurance coverage shall be primary with respect to all additional insured's. Insurance of self-insurance programs maintained by the designated additional -insured's shall be excess of the Contractor's insurance and shall not contribute with it.

Additionally, the Contractor and Contractor's general liability insurer shall agree to waive all rights of subrogation against the Owner and any of their respective officers, officials, agents, consultants or employees for claims, losses, or expenses which arise out of Contractor's activities or result from the performance of services or the delivery of goods called for by the Contract.

Contractor's failure to comply with the terms and conditions of these insurance policies shall not affect or abridge coverage for the Owner, or for any of their officers, officials, agents, consultants or employees.

2. Automobile Insurance

The Owner, and their respective officers, officials, agents, consultants and employees shall be endorsed as additional insured's by ISO form CG 20 26 - Additional Insured Designated Person or Organization. As additional insured's, they shall be covered as to work performed by or on behalf of the Contractor or as to liability which arises out of Contractor's activities or resulting from the performance of services or the delivery of goods called for by the Contract.

Contractor's insurance coverage shall be primary with respect to all additional insured's. Insurance or self-insurance programs maintained by the designated additional insured's shall be in excess of the Contractor's insurance and shall not contribute with it.

Additionally, the Contractor and Contractor's automobile insurer shall agree to waive all rights of subrogation against the Owner and any of their respective officers, officials, agents, consultants or employees for claims, losses, or expenses which arise out of Contractor's activities or result from the performance of services or the delivery of goods called for by the Contract.

Contractor's failure to comply with the terms and conditions of these insurance policies shall not affect or abridge coverage for the Owner or for any of its officers, officials, agents, consultants or employees.

3. Workers' Compensation/Employer's Liability

Contractor's workers' compensation insurance shall be endorsed with NCCI form WC 00 03 01 A - Alternative Employer Endorsement. The Alternative Employer Endorsement shall designate the Owner as "alternate employers."

4. All Coverages

Each insurance policy required by this section of the Contract shall contain a stipulation, endorsed if necessary, that the Owner will receive a minimum of a thirty (30) calendar day advance notice of any policy cancellation. Ten (10) calendar days advance notice is required for policy cancellation due to non-payment of premium.

F. Insurer Qualifications and Acceptability

Insurance required hereunder shall be issued by an A.M. Best, "B+" rated, Class IX insurance company approved to conduct insurance business in the state of Missouri.

G. Verification of Insurance Coverage

Prior to Owner issuing a Notice to Proceed, the Contractor-shall furnish the Owner with Certificate(s) of Insurance and with any applicable original endorsements evidencing the required insurance coverage. The insurance certificates and endorsements are to be signed by a person authorized by that insurer to bind coverage on its behalf. All certificates and endorsements received by the Owner are subject to review and approval by the Owner. The Owner reserves the right to require certified copies of all required policies at any time. If the scope of this contract will exceed one (1) year - or, if any of Contractor's applicable insurance coverage expires prior to completion of the work or services required under this contract - the Contractor will provide a renewal or replacement certificate before continuing work or services hereunder. If the Contractor fails to provide documentation of required insurance coverage, the Owner may issue a stop work order and no additional contract completion time and/or compensation shall be granted as a result thereof.

ARTICLE 7 – SUSPENSION OR TERMINATION OF CONTRACT

ARTICLE 7.1 - FOR SITE CONDITIONS

A. When conditions at the site of the proposed work are considered by the Owner to be unsatisfactory for prosecution of the work, the Contractor may be ordered in writing to suspend the work or any part thereof until reasonable conditions exist. When such suspension is not due to fault or negligence of the Contractor, time allowed for completion of such suspended work will be extended by a period of time equal to that lost due to delay occasioned by ordered suspension. This will be a no cost time extension.

ARTICLE 7.2 - FOR CAUSE

A. Termination or Suspension for Cause:

1. If the Contractor shall file for bankruptcy, or should make a general assignment for the benefit of the creditors, or if a receiver should be appointed on account of insolvency, or if the contractor should persistently or repeatedly refuse or fail to supply enough properly skilled workers or proper materials, or if the contractor should fail to make prompt payment to subcontractors or for material or labor, or persistently disregard laws, ordinances or the instructions of the Owner, or otherwise be guilty of a substantial violation of any provision of this contract, then the Owner may serve notice on the Contractor and the surety setting forth the violations and demanding compliance with this contract. Unless within ten (10) consecutive calendar days after serving such notice, such violations shall cease and satisfactory arrangements for correction be made, the Owner may suspend the Contractor's right to proceed with the work or terminate this contract.

2. In the event the Owner suspends Contractor's right to proceed with the work or terminates the contract, the Owner may demand that the Contractor's surety take over and complete the work on this contract, after the surety submits a written proposal to the Owner and receives written approval and upon the surety's failure or refusal to do so within ten (10) consecutive calendar days after demand therefore, the Owner may take over the work and prosecute the same to completion by bid or negotiated contract, or the Owner may elect to take possession of and utilize in completing the work such materials, supplies, appliances and plant as may be on the site of the work, and all subcontractors, if the Owner elects, shall be bound to perform their contracts.

B. The Contractor and its surety shall be and remain liable to the Owner for any excess cost or damages occasioned to the Owner as a result of the actions above set forth.

C. The Contractor in the event of such suspension or termination shall not be entitled to receive any further payments under this contract until the work is wholly finished. Then if the unpaid balance under this contract shall exceed all expenses of the Owner as certified by the Director, such excess shall be paid to the Contractor; but, if such expenses shall exceed the unpaid balance as certified by the Director, the Contractor and their surety shall be liable for and shall pay the difference and any damages to the Owner.

D. In exercising Owner's right to secure completion of the work under any of the provisions hereof, the Director shall have the right to exercise Owner's sole discretion as to the manner, methods and reasonableness of costs of completing the work.

E. The rights of the Owner to suspend or terminate as herein provided shall be cumulative and not exclusive and shall be in addition to any other remedy provided by law.

F. The Contractor in the event of such suspension or termination may be declared ineligible for Owner contracts for a minimal period of twelve (12) months. Further, no contract will be awarded to any Contractor who lists in their bid form any subcontractor whose prior performance has contributed, as determined by the Owner, to a breach of a contract. In order to be considered for state-awarded contracts after this period, the Contractor/subcontractor will be required to forward acceptance reports to the Owner regarding successful completion of non-state projects during the intervening twelve (12) months from the date of default. No contracts will be awarded to a subcontractor/Contractor until the ability to perform responsibly in the private sector has been proven to the Owner.

ARTICLE 7.3 -- FOR CONVENIENCE

A. The Owner may terminate or suspend the Contract or any portion of the Work without cause at any time, and at the Owner's convenience. Notification of a termination or suspension shall be in writing and shall be given to the Contractor and their surety. If the Contract is suspended, the notice will contain the anticipated duration of the suspension or the conditions under which work will be permitted to resume. If appropriate, the Contractor will be requested to demobilize and re-mobilize and will be reimbursed time and costs associated with the suspension.

B. Upon receipt of notification, the Contractor shall:

1. Cease operations when directed.
2. Take actions to protect the work and any stored materials.
3. Place no further subcontracts or orders for material, supplies, services or facilities except as may be necessary to complete the portion of the Contract that has not been terminated. No claim for payment of materials or supplies ordered after the termination date shall be considered.
4. Terminate all existing subcontracts, rentals, material, and equipment orders.
5. Settle all outstanding liabilities arising from termination with subcontractors and suppliers.
6. Transfer title and deliver to the Owner, work in progress, completed work, supplies and other material produced or acquire for the work terminated, and completed or partially completed plans, drawings information and other property that, if the Contract had been completed, would be required to be furnished to the Owner.

C. For termination without cause and at the Owner's convenience, in addition to payment for work completed prior to date of termination, the Contractor may be entitled to payment of other documented costs directly associated with the early termination of the contract. Payment for anticipated profit and unapplied overhead will not be allowed.

SECTION 007300 - SUPPLEMENTARY CONDITIONS

1.0 GENERAL:

A. These Supplementary General Conditions clarify, add, delete, or otherwise modify standard terms and conditions of DIVISION 0, BIDDING AND CONTRACTING REQUIREMENTS.

2.0 CONTACTS:

Designer:
Buddy Webb
Buddy Webb & Company, Inc.
3057 East Cairo
Springfield, Missouri 65802
Telephone: (417) 877-1385
Email: Buddy@webbarch.com

Project Manager /
Construction Representative:
Jeremy Newton
Missouri National Guard-CFMO Office
6819a North Boundary Road
Jefferson City, Missouri 65101
Telephone: 573-308-6894 Fax: 573-638-9746
Email: jeremy.l.newton.nfg@mail.mil

Contract Specialist:
Kelly Copeland
Division of Facilities Management, Design and Construction
301 West High Street, Room 730
Jefferson City, Missouri 65102
Telephone: 573-522-2283
Email: Kelly.copeland@oa.mo.gov

3.0 NOTICE: ALL BID MATERIALS ARE DUE AT THE TIME OF BID SUBMITTAL. THERE IS NO SECOND SUBMITTAL FOR THIS PROJECT.

4.0 FURNISHING CONSTRUCTION DOCUMENTS:

A. The Owner will furnish the Contractor with approximately 6 complete sets of drawings and specifications at no charge.
B. The Owner will furnish the Contractor with approximately 6 sets of explanatory or change drawings at no charge.
C. The Contractor may make copies of the documents as needed with no additional cost to the Owner.

5.0 ILLEGAL IMMIGRATION REFORM AND IMMIGRANT RESPONSIBILITY ACT

The Contractor understands and agrees that by signing a contract for this project, they certify the following:

A. The Contractor shall only utilize personnel authorized to work in the United States in accordance with applicable federal and state laws. This includes but is not limited to the Illegal Immigration Reform and Immigrant Responsibility Act (IIRIRA) and INA Section 274A.
B. If the Contractor is found to be in violation of this requirement or the applicable laws of the state, federal and local laws and regulations, and if the State of Missouri has reasonable cause to believe that the Contractor has knowingly employed individuals who are not eligible to work in the United States, the state shall have the right to cancel the contract immediately without penalty or recourse and suspend or debar the contractor from doing business with the state.
C. The Contractor agrees to fully cooperate with any audit or investigation from federal, state or local law enforcement agencies.

6.0 SAFETY REQUIREMENTS

Contractor and subcontractors at any tier shall comply with RSMo 292.675 and Article 1.3, E, of Section 007213, General Conditions.

7.0 ENVIRONMENTAL MANAGEMENT SYSTEM (eMS):

The Missouri Army National Guard (MOARNG) has implemented an Environmental Management System (eMS). One of the key components of the eMS is the establishment of an Environmental Policy that must be communicated to all persons working for or on behalf of the organization including all suppliers and contractors. This policy stresses commitment to compliance with accepted environmental practices, and meeting or exceeding applicable environmental requirements, legal and otherwise.

This policy also stresses commitment to waste minimization, pollution prevention, and management of personnel, processes, real property, and materials in a manner to reduce environmental impacts. The policy is available upon request to all parties by contacting the Environmental Management Office at (573) 638-9514.

8.0 OFF-SITE BORROW & SPOIL DEPOSIT SITES FOR FEDERALLY FUNDED PROJECTS:

All Federally funded projects which involve off-site borrow and/or off-site spoil deposit sites will require written certification that the site(s) are in compliance with the National Environmental Protection Act and all related applicable Federal and State laws and regulations. If the need for off-site borrow and/or spoil sites is stipulated in the Contract Documents, the following applies:

A. The Contractor is required to use only the designated site described in the Contract Documents. If another off-site area is proposed by the Contractor, the Contractor must provide written certification to the Division of Facilities Management, Design and Construction Project Representative that the proposed borrow or spoil site has been cleared of environmental concerns in accordance with all applicable Federal and State laws and regulations. These include but are not limited to the following: Clean Water Act; the Endangered Species Act; the National Historic Preservation Act (NHPA) (The site must have Section 106 Clearance); the Farmland Protection Act; Resource Conservation and Recovery Act; Comprehensive Environmental Response; Compensation and Liability Act; and RSMo Chapter 194, Section 194.400, Unmarked Human Burial Sites. Certifications shall include clearance letters and other evidence of coordination with the appropriate regulatory agencies. The Missouri Historic Preservation Office, PO Box 176 Jefferson City, MO 65102, may be contacted to provide assistance with the NHPA and cultural resource issues pertaining to the borrow and spoil site regulations. The Missouri State Historic Preservation Office can provide a list of qualified and certified archaeologists to assist in borrow and spoil site investigations.

B. If project conditions require off-site borrow or off-site deposit of spoils, the Contractor will be required to provide written certification to the Division of Facilities Management, Design and Construction Project Representative that the proposed borrow or spoil site has been cleared of environmental concerns in accordance with all applicable Federal and State laws and regulations. These include but are not limited to the following: Clean Water Act; the Endangered Species Act; the National Historic Preservation Act (NHPA) (The site must have Section 106 Clearance); the Farmland Protection Act; Resource Conservation and Recovery Act; Comprehensive Environmental Response; Compensation and Liability Act; and RSMo Chapter 194, Section 194.400, Unmarked Human Burial Sites. Certifications shall include clearance letters and other evidence of coordination with the appropriate regulatory agencies. The Missouri Historic Preservation Office, PO Box 176 Jefferson City, MO 65102, may be contacted to provide assistance with the NHPA and cultural resource issues pertaining to the borrow and spoil site regulations. The Missouri State Historic Preservation Office can provide a list of qualified and certified archaeologists to assist in borrow and spoil site investigations.

C. The Owner recognizes that additional time (beyond what is allowed in the Construction Contract) may be required in order to secure the aforementioned certifications and approvals. Should more time be required, the Owner will consider approval of a no-cost time extension contract change. The Contractor will be required to provide documentation that substantiates the need for the time extension.

Missouri
Division of Labor Standards
WAGE AND HOUR SECTION

MICHAEL L. PARSON, Governor

Annual Wage Order No. 27

Section 073
NEWTON COUNTY

In accordance with Section 290.262 RSMo 2000, within thirty (30) days after a certified copy of this Annual Wage Order has been filed with the Secretary of State as indicated below, any person who may be affected by this Annual Wage Order may object by filing an objection in triplicate with the Labor and Industrial Relations Commission, P.O. Box 599, Jefferson City, MO 65102-0599. Such objections must set forth in writing the specific grounds of objection. Each objection shall certify that a copy has been furnished to the Division of Labor Standards, P.O. Box 449, Jefferson City, MO 65102-0449 pursuant to 8 CSR 20-5.010(1). A certified copy of the Annual Wage Order has been filed with the Secretary of State of Missouri.

Original Signed by
Taylor Burks, Director
Division of Labor Standards

Filed With Secretary of State: **March 10, 2020**

Last Date Objections May Be Filed: **April 9, 2020**

Prepared by Missouri Department of Labor and Industrial Relations

OCCUPATIONAL TITLE	**Prevailing Hourly Rate
Asbestos Worker	*$23.92
Boilermaker	*$23.92
Bricklayer	*$23.92
Carpenter	**$30.15**
Lather	
Linoleum Layer	
Millwright	
Pile Driver	
Cement Mason	*$23.92
Plasterer	
Communications Technician	*$23.92
Electrician (Inside Wireman)	**$43.70**
Electrician Outside Lineman	*$23.92
Lineman Operator	
Lineman - Tree Trimmer	
Groundman	
Groundman - Tree Trimmer	
Elevator Constructor	*$23.92
Glazier	*$23.92
Ironworker	*$23.92
Laborer	$34.06
General Laborer	
First Semi-Skilled	
Second Semi-Skilled	
Mason	*$23.92
Marble Mason	
Marble Finisher	
Terrazzo Worker	
Terrazzo Finisher	
Tile Setter	
Tile Finisher	
Operating Engineer	$29.62
Group I	
Group II	
Group III	
Group III-A	
Group IV	
Group V	
Painter	*$23.92
Plumber	*$23.92
Pipe Fitter	
Roofer	**$37.46**
Sheet Metal Worker	$49.09
Sprinkler Fitter	*$23.92
Truck Driver	*$23.92
Truck Control Service Driver	
Group I	
Group II	
Group III	
Group IV	

*The Division of Labor Standards received less than 1,000 reportable hours for this occupational title.
Public works contracting minimum wage is established for this occupational title using data provided by Missouri Economic Research and Information Center.
**The Prevailing Hourly Rate includes any applicable fringe benefit amounts for each occupational title.

OCCUPATIONAL TITLE	**Prevailing Hourly Rate
Carpenter	$45.95
Millwright	
Pile Driver	
Electrician (Outside Lineman)	*$23.92
Lineman Operator	
Lineman - Tree Trimmer	
Groundman	
Groundman - Tree Trimmer	
Laborer	**$40.10**
General Laborer	
Skilled Laborer	
Operating Engineer	**$47.09**
Group I	
Group II	
Group III	
Group IV	
Truck Driver	*$23.92
Truck Control Service Driver	
Group I	
Group II	
Group III	
Group IV	

Use Heavy Construction Rates on Highway and Heavy construction in accordance with the classifications of construction work established in 8 CSR 30-3.040(3).

Use Building Construction Rates on Building construction in accordance with the classifications of construction work established in 8 CSR 30-3.040(2).

If a worker is performing work on a heavy construction project within an occupational title that is not listed on the Heavy Construction Rate Sheet, use the rate for that occupational title as shown on the Building Construction Rate Sheet.

*The Division of Labor Standards received less than 1,000 reportable hours for this occupational title.
Public works contracting minimum wage is established for this occupational title using data provided by Missouri Economic Research and Information Center.

**The Prevailing Hourly Rate includes any applicable fringe benefit amounts for each occupational title.

OVERTIME
and
HOLIDAYS

OVERTIME

For all work performed on a Sunday or a holiday, not less than twice (2x) the prevailing hourly rate of wages for work of a similar character in the locality in which the work is performed or the public works contracting minimum wage, whichever is applicable, shall be paid to all workers employed by or on behalf of any public body engaged in the construction of public works, exclusive of maintenance work.

For all overtime work performed, not less than one and one-half (1½) the prevailing hourly rate of wages for work of a similar character in the locality in which the work is performed or the public works contracting minimum wage, whichever is applicable, shall be paid to all workers employed by or on behalf of any public body engaged in the construction of public works, exclusive of maintenance work or contractual obligation. For purposes of this subdivision, **"overtime work"** shall include work that exceeds ten hours in one day and work in excess of forty hours in one calendar week; and

A thirty-minute lunch period on each calendar day shall be allowed for each worker on a public works project, provided that such time shall not be considered as time worked.

HOLIDAYS

January First;
The last Monday in May;
July Fourth;
The first Monday in September;
November Eleventh;
The fourth Thursday in November; and
December Twenty-Fifth;

If any holiday falls on a Sunday, the following Monday shall be considered a holiday.

SECTION 01 11 00

SUMMARY OF WORK

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 WORK COVERED BY CONTRACT DOCUMENTS

A. The Project consists of **CONSTRUCT 60 SOLDIER BARRACKS on the MISSOURI NATIONAL GUARD - CAMP CROWDER TRAINING SITE.**

1. Project Location: **MISSOURI NATIONAL GUARD - CAMP CROWDER TRAINING SITE, 890 RAY A CARVER DRIVE, NEOSHO, MISSOURI, 64850**.

2. Owner: State of Missouri, Office of Administration, Division of Facilities Management, Design and Construction, Harry S Truman State Office Building, Post Office Box 809, 301 West High Street, Jefferson City, Missouri 65102.

B. Contract Documents, dated **7/30/20** were prepared for the Project by **Buddy Webb & Company, 3057 East Cairo, Springfield, Missouri 65802**.

C. The Work consists of **new construction as indicated in Contract Documents.** The work includes but not limited to the following:

1. **Base Bid: Provide new 60 soldier barracks building construction with storm shelter in compliance with International Code Council (ICC) 500 National Storm Shelter Association (NSSA) requirements, including associated site development.**

2. **Alternate No. 1: Provide new concrete paving construction.**

3. **Alternate No. 2: Provide construction of new tornado resistant window systems and associated openings in storm shelter exterior building envelope in compliance with International Code Council (ICC) 500 National Storm Shelter Association (NSSA) requirements.**

4. **Alternate No. 3: Provide new lounge area building construction, including associated site development.**

D. The Work will be constructed under a single prime contract.

1.3 DESIGNER'S ESTIMATE OF CONSTRUCTION COSTS RANGE

A. The project designer has prepared this cost estimate range. The State of Missouri makes no guarantee regarding the accuracy of the values contained herein. The contractor should not rely on this estimate range in any way while preparing a bid for this project or otherwise.

Base Bid - Designers Estimate of Construction Cost Range:
$1,309,000 - $1,800,000

Alternate No. 1 – Designers Estimate of Construction Cost Range:
$40,000 - $55,000

Alternate No. 2 – Designers Estimate of Construction Cost Range:
$38,000 - $52,000

Alternate No. 3 – Designers Estimate of Construction Cost Range:
$280,000 - $384,000

1.4 WORK UNDER OTHER CONTRACTS

A. Separate Contract: The Owner may award a separate contract for performance of certain construction operations at the site. Those operations will be conducted simultaneously with work under this contract. The Contract includes the following:

1. Contract: A separate contract may be awarded to **CONSTRUCT FITNESS CENTER – PROJECT NO. T2027-01**.

B. Cooperate fully with separate contractors so that work under those contracts may be carried out smoothly, without interfering with or delaying work under this Contract.

1.5 WORK SEQUENCE

A. The Work will be conducted in single (1) phase. Work shall be substantially complete, ready for occupancy within Two Hundred (200) Working Days from Notice of Intent to Award.

1.6 CONTRACTOR USE OF PREMISES

A. Use of the Site: Limit use of the premises to work in areas indicated. Confine operations to areas within contract limits indicated. Do not disturb portions of the site beyond the areas in which the Work is indicated.

1. Owner Occupancy: Allow for Owner occupancy and use by the public of existing adjacent facilities.

2. Driveways and Entrances: Keep driveways and entrances serving the premises clear and available to the Owner, the Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

1.7 OCCUPANCY REQUIREMENTS

A. Full Owner Occupancy: The Owner will occupy the site and existing buildings during the entire construction period. Cooperate with the Owner during construction operations to minimize conflicts and facilitate owner usage. Perform the Work so as not to interfere with the Owner's operations.

1.8 OWNER-FURNISHED PRODUCTS

A. Refer to drawing Scope of Work Schedule for additional requirements. The Owner will furnish items indicated in Scope of Work Schedule, including all furnishings. The Work includes providing support systems to receive Owner's equipment, and mechanical and electrical connections.

1. The Owner will arrange for and deliver necessary shop drawings, product data, and samples to the Contractor.
2. The Owner will arrange and pay for delivery of Owner-furnished items according to the contractor's Construction Schedule.
3. The Contractor is responsible for receiving, unloading and handling Owner furnished items at the site.
4. Following delivery, the Contractor will inspect items delivered for damage. The Contractor shall not accept damaged items and shall notify the Owner of rejection of damaged items.
5. If Owner-furnished items are damaged, defective, or missing, the Owner will arrange for replacement.
6. The Owner will arrange for manufacturer's field services and for the delivery of manufacturer's warranties to the appropriate Contractor.
7. The Contractor shall designate delivery dates of Owner-furnished items in the Contractor's Construction Schedule.
8. The Contractor shall review shop drawings, product data and samples and return them to the Designer noting discrepancies or problems anticipated in use of the project.
9. The Contractor is responsible for protecting Owner-furnished items from damage, including damage from exposure to the elements. The Contractor shall repair or replace items damaged as a result of his operations.

END OF SECTION 01 11 00

SECTION 01 21 00

ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements governing allowances.

1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. If necessary, additional requirements will be issued by Change Order.

B. Types of allowances include the following:

1. Weather allowances.

C. Related Sections include the following:

1. Division 1 Section "Contract Modification Procedures" for procedures for submitting and handling Changes Orders for allowances.
2. Division 1 Section "Unit Prices" for procedures for using unit prices.

1.3 WEATHER ALLOWANCE

A. Included within the completion period for this project are a specified number of “bad weather” days (see Schedule of Allowances).

B. The Contractor’s progress schedule shall include an incorporate the total quantity of bad weather day allowance. In the event weather conditions preclude performance of critical work activities for 50% or more of the Contractor’s scheduled workday, that day shall be declared unavailable for work due to weather (a “bad weather” day) and charged against the above allowance. Critical work activities will be determined by review of the Contractor’s current progress schedule.

C. The Contractor’s Representative and the Construction Representative shall agree monthly on the number of “bad weather” days to be charged against the allowance. This determination will be documented in writing and be signed by the Contractor and the Construction Representatives. If there is a failure to agree on all or part of the “bad weather” days for a particular month, that disagreement shall be noted on this written document and signed by each party’s representative. Failure of the Contractor’s representative to sign the “bad weather” day documentation after it is presented, with or without the notes of disagreement, shall constitute agreement with the “bad weather” day determination contained in that document.

D. There will be no modification to the time of contract performance due solely to the failure to deplete the “bad weather” day allowance.

E. Once this allowance is depleted, a no cost Change Order time extension will be executed for "bad weather" days, as defined above, encountered during the remainder of the Project.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

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

3.3 SCHEDULE OF ALLOWANCES

A. Weather Allowance: Included within the completion period for this Project **Fifteen (15)** "bad weather" days.

END OF SECTION 01 21 00

SECTION 01 22 00

UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Quantities of Units to be included in the Base Bid are indicated in Section 01 22 00 – Unit Prices.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for Unit Prices.

B. Related Sections include the following:

1. Division 1 Section 01 21 00 – "Allowances" for procedures for using Unit Prices to adjust quantity allowances.
2. Division 1 Section 01 26 00 – "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
3. Division 31 Section 31 00 00 – "Earthwork" for procedures for measurement and payment for Unit Price Items No. 1 through Item No. 3.
4. Division 32 Section 32 13 13 – "Portland Cement Concrete Paving" for procedures for measurement and payment for Unit Price Item No. 4.

1.3 DEFINITIONS

A. Unit Price is **an amount proposed by bidders, stated on the Bid Form Attachment 00 41 13** a price per unit of measurement for materials or services added to or deducted from the Contract Sum by appropriate modification, if estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES

A. Unit Prices include all necessary material plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.

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

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

D. List of Unit Prices: A list of Unit Prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each Unit Price.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 LIST OF UNIT PRICES

A. Unit Price No. 1 – Mass Earth Excavation:

1. Description: Provide Work for mass earth excavation in addition to that required by the Construction Documents according to Division 31 Section 31 00 00 – Earthwork.
2. Unit of Measurement: Cubic Yard.
3. Base Bid Quantity: Three Thousand Two Hundred (3,200) units.
4. Alternate No. 3 Quantity: Three Thousand Six Hundred (3,600) units.

B. Unit Price No. 2 – Excavation Hauling and Disposal:

1. Description: Provide Work for excavation hauling and disposal in addition to that required by the Construction Documents according to Division 31 Section 31 00 00 – Earthwork.
2. Unit of Measurement: Cubic Yard.
3. Base Bid Quantity: Seven Thousand Two Hundred (7,200) units.
4. Alternate No. 3 Quantity: Eight Thousand Six Hundred (8,600) units.

C. Unit Price No. 3 – Mass Earth Backfill with Engineered Structural Fill:

1. Description: Provide Work for mass earth backfill with engineered structural fill in addition to that required by the Construction Documents according to Division 31 Section 31 00 00 – Earthwork.
2. Unit of Measurement: Cubic Yard.
3. Base Bid Quantity: Four Thousand (4,000) units.
4. Alternate No. 3 Quantity: Five Thousand (5,000) units.

D. Unit Price No. 4 – Portland Cement Concrete Paving:

1. Description: Provide Work for new reinforced concrete paving system in addition to that required by the Construction Documents according to Division 32, Section 32 13 13 – Portland Cement Concrete Paving and Drawing sheet C-501, Section 2/C-501.
2. Unit of Measurement: Square Feet.
3. Base Bid Quantity: Six Hundred (600) Square Feet**.**
4. Alternate No. 1 Quantity: Ten Thousand Five Hundred Sixty (10,560) Square Feet.

END OF SECTION 01 22 00

SECTION 01 23 00

ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements governing Alternates.

1.3 DEFINITIONS

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

1. The cost for each alternate is the net addition to the Contract Sum to incorporate the Alternate into the Work. No other adjustments are made to the Contract Sum.

B. No additional time will be allowed for alternate work unless the number of work days is so stated on the bid form.

1.4 PROCEDURES

A. Coordination: Modify or adjust affected adjacent Work as necessary to completely and fully integrate the Alternate Work into the Project.

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

B. Notification: The award of the Contract will indicate whether alternates have been accepted or rejected.

C. Execute accepted alternates under the same conditions as other Work of this Contract.

D. Schedule: A “Schedule of Alternates” is included at the end of this Section. Specification Sections referenced in the Schedule contain requirements for materials necessary to achieve the Work described under each alternate.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. **Alternate No. 1 (Concrete Paving):** Provide Work required to add new concrete paving construction in lieu of gravel at drive and parking area locations as indicated in Construction Documents. For primary Work requirements, refer to specifications contained in Sections 03 30 00, 32 13 13, and Drawings.

B. **Alternate No. 2 (Tornado Resistant Window Systems):** Provide Work pertaining to add construction of new tornado resistant window systems and associated openings in structural precast concrete tornado storm shelter exterior building envelope in compliance with International Code Council (ICC) 500 National Storm Shelter Association (NSSA) requirements at locations as indicated in Construction Documents. Provide window blinds at window opening. For primary Work requirements, refer to specifications contained in Sections 08 55 13, 08 80 00, 12 21 00, and Drawings.

C. **Alternate No. 3 (Lounge Area Building Construction):** Provide Work required to add new lounge area building construction, including associated site development, as indicated in Construction Documents. For primary Work requirements, refer to specifications contained in Divisions 03, 05, 06, 07, 08, 09, 10, 12, 21, 23, 26, 27, 28, 31, 32 and Drawings. If awarded, add fifteen (15) additional work days to the contract completion time.

END OF SECTION 01 23 00

SECTION 01 26 00

CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for handling and processing Contract Modifications.

B. Related Sections include the following:

1. Division 1, Section 01 21 00 "Allowances" for procedural requirements for handling and processing Allowances.
2. Division 1, Section 01 22 00 "Unit Prices" for administrative requirements for using Unit Prices.
3. Division 1, Section 01 31 15 “Project Management Communications” for administrative requirements for communications.
4. Division 0, Section 00 72 13, Article 3.1 "Acceptable Substitutions" for administrative procedures for handling Requests for Substitutions made after Contract award.
5. Division 0, Section 00 72 13, Article 4.0 "Changes in the Work" for Change Order requirements.

1.3 REQUESTS FOR INFORMATION

A. In the event that the Contractor or Subcontractor, at any tier, determines that some portion of the Drawings, Specifications, or other Contract Documents requires clarification or interpretation, the Contractor shall submit a “Request for Information” (RFI) in writing to the Designer. A RFI may only be submitted by the Contractor and shall only be submitted on the RFI forms provided by the Owner. The Contractor shall clearly and concisely set forth the issue for which clarification or interpretation is sought and why a response is needed. In the RFI, the Contractor shall set forth an interpretation or understanding of the requirement along with reasons why such an understanding was reached.

B. Responses to RFI shall be issued within ten (10) working days of receipt of the Request from the Contractor unless the Designer determines that a longer time is necessary to provide an adequate response. If a longer time is determined necessary by the Designer, the Designer will, within five (5) working days of receipt of the request, notify the Contractor of the anticipated response time. If the Contactor submits a RFI on a time sensitive activity on the current project schedule, the Contractor shall not be entitled to any time extension due to the time it takes the Designer to respond to the request provided that the Designer responds within the ten (10) working days set forth above.

C. Responses from the Designer will not change any requirement of the Contract Documents. In the event the Contractor believes that a response to a RFI will cause a change to the requirements of the Contract Document, the Contractor shall give written notice to the Designer requesting a Change Order for the work. Failure to give such written notice within ten (10) working days, shall waive the Contractor's right to seek additional time or cost under Article 4, "Changes in the Work" of the General Conditions.

1.4 MINOR CHANGES IN THE WORK

A. Designer will issue supplemental instructions authorizing Minor Changes in the Work, not involving adjustment to the Contract Amount or the Contract Time, on "Designer's Supplemental Instructions" (DSI).

1.5 PROPOSAL REQUESTS

A. The Designer or Owner Representative will issue a detailed description of proposed Changes in the Work that may require adjustment to the Contract Amount or the Contract Time. The proposed Change Description will be issued using the "Request for Proposal" (RFP) form. If necessary, the description will include supplemental or revised Drawings and Specifications.

1. Proposal Requests issued by the Designer or Owner Representative are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.

2. Within ten (10) working days after receipt of Proposal Request, submit a proposal for the cost adjustments to the Contract Amount and the Contract Time necessary to execute the Change. The Contractor shall submit his proposal on the appropriate Change Order Detailed Breakdown form. Subcontractors may use the appropriate Change Order Detailed Breakdown form or submit their proposal on their letterhead provided the same level of detail is included. All proposals shall include:

a. A detailed breakdown of costs per Article 4.1 of the General Conditions.

b. If requesting additional time per Article 4.2 of the General Conditions, include an updated Contractor's Construction Schedule that indicates the effect of the Change including, but not limited to, changes in activity duration, start and finish times, and activity relationship.

1.6 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Proposal Request, the Designer or Owner Representative will issue a Change Order for signatures of Owner and Contractor on the "Change Order" form.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

SECTION 01 31 00

COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative provisions for coordinating construction operations on Projects including, but not limited to, the following:

1. Coordination Drawings.
2. Administrative and supervisory personnel.
3. Project meetings.

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

C. Related Sections include the following:

1. Division 1, Section 01 32 00 "Schedules" for preparing and submitting Contractor's Construction Schedule.
2. Articles 1.8.B and 1.8.C of Section 00 72 13 "General Conditions" for coordinating meetings onsite.
3. Article 5.4.H of Section 00 72 13 "General Conditions" for coordinating Closeout of the Contract.

1.3 COORDINATION

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections, which depend on each other for proper installation, connection, and operation.

B. Coordination: Each Contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each Contractor shall coordinate its operations with operations included in different Sections that depend on each other for proper installation, connection, and operation.

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

4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components including mechanical and electrical.

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

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

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

1. Preparation of Contractor's Construction Schedule.

2. Preparation of the Schedule of Values.

3. Installation and removal of temporary facilities and controls.

4. Delivery and processing of submittals.

5. Progress meetings.

6. Preinstallation conferences.

7. Startup and adjustment of systems.

8. Project Closeout activities.

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

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

1.4 SUBMITTALS

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

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

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

1.5 PROJECT MEETINGS

A. The Owner's Construction Representative will schedule a Pre-Construction Meeting prior to beginning of construction. The date, time, and exact place of this meeting will be determined after Contract Award and notification of all interested parties. The Contractor shall arrange to have the Job Superintendent and all prime Subcontractors present at the meeting. During the Pre-Construction Meeting, the construction procedures and information necessary for submitting payment requests will be discussed and materials distributed along with any other pertinent information.

1. Minutes: Designer will record and distribute meeting minutes.

B. Progress Meetings: The Owner's Construction Representative will conduct Monthly Progress Meetings as stated in Articles 1.8.B and 1.8.C of Section 00 72 13 "General Conditions".

1. Minutes: Designer will record and distribute to Contractor the meeting minutes.

C. Preinstallation Conferences: Contractor shall conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of Manufacturers and Fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Designer and Construction Representative of scheduled meeting dates.

2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration including requirements for the following:

a. Contract Documents

b. Options

c. Related RFIs

d. Related Contract Changes

e. Purchases

f. Deliveries

g. Submittals

h. Review of mockups

i. Possible conflicts

j. Compatibility problems

k. Time schedules

l. Weather limitations

m. Manufacturer's written recommendations

n. Warranty requirements

o. Compatibility of materials

p. Acceptability of substrates

q. Temporary facilities and controls

r. Space and access limitations

s. Regulations of authorities having jurisdiction

t. Testing and inspecting requirements

u. Installation procedures

v. Coordination with other Work

w. Required performance results

x. Protection of adjacent Work

y. Protection of construction and personnel

3. Contractor shall record significant conference discussions, agreements, and disagreements including required corrective measures and actions.

4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.

5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

6. Revise paragraph below if Project requires holding progress meetings at different intervals. Insert special intervals such as "every third Tuesday" to suit special circumstances.

7. Project name

8. Name and address of Contractor

9. Name and address of Designer

10. RFI number including RFIs that were dropped and not submitted

11. RFI description

12. Date the RFI was submitted

13. Date Designer's response was received

14. Identification of related DSI or Proposal Request, as appropriate

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 31 00

SECTION 01 31 15

PROJECT MANAGEMENT COMMUNICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Division 1, Section 01 33 00 - Submittals

C. Division 1, Section 01 26 00 – Contract Modification Procedures

1.2 SUMMARY

A. Project Management Communications: The Contractor shall use the Internet web based project management communications tool, E-Builder® ASP software, and protocols included in that software during this project. The use of project management communications as herein described does not replace or change any contractual responsibilities of the participants.
   1. Project management communications is available through E-Builder® as provided by "e-Builder®" in the form and manner required by the Owner.
   2. The project communications database is on-line and fully functional. User registration, electronic and computer equipment, and Internet connections are the responsibility of each project participant. The sharing of user accounts is prohibited

B. Support: E-Builder® will provide on-going support through on-line help files.

C. Copyrights and Ownership: Nothing in this specification or the subsequent communications supersedes the parties' obligations and rights for copyright or document ownership as established by the Contract Documents. The use of CAD files, processes or design information distributed in this system is intended only for the project specified herein.

D. Purpose: The intent of using E-Builder® is to improve project work efforts by promoting timely initial communications and responses. Secondly, to reduce the number of paper documents while providing improved record keeping by creation of electronic document files

E. Authorized Users: Access to the web site will be by individuals who are authorized users.

1. Individuals shall complete the E-Builder New Company/User Request Form located at the following web site: https://oa.mo.gov/facilities/vendor-links/contractor-forms. Completed forms shall be emailed to the following email address: OA.FMDCE-BuilderSupport@oa.mo.gov.
2. Authorized users will be contacted directly and assigned a temporary user password.
3. Individuals shall be responsible for the proper use of their passwords and access to data as agents of the company in which they are employed.

F. Administrative Users: Administrative users have access and control of user licenses and all posted items. DO NOT POST PRIVATE OR YOUR COMPANY CONFIDENTIAL ITEMS IN THE DATABASE! Improper or abusive language toward any party or repeated posting of items intended to deceive or disrupt the work of the project will not be tolerated and will result in deletion of the offensive items and revocation of user license at the sole discretion of the Administrative User(s).

G. Communications: The use of fax, email and courier communication for this project is discouraged in favor of using E-Builder® to send messages. Communication functions are as follows:
1. Document Integrity and Revisions:
   a. Documents, comments, drawings and other records posted to the system shall remain for the project record. The authorship time and date shall be recorded for each document submitted to the system. Submitting a new document or record with a unique ID, authorship, and time stamp shall be the method used to make modifications or corrections.
   b. The system shall make it easy to identify revised or superseded documents and their predecessors.
   c. Server or Client side software enhancements during the life of the project shall not alter or restrict the content of data published by the system. System upgrades shall not affect access to older documents or software.
2. Document Security:
   a. The system shall provide a method for communication of documents. Documents shall allow security group assignment to respect the contractual parties communication except for Administrative Users. DO NOT POST PRIVATE OR YOUR COMPANY CONFIDENTIAL ITEMS IN THE DATABASE!
3. Document Integration:
   a. Documents of various types shall be logically related to one another and discoverable. For example, requests for information, daily field reports, supplemental sketches and photographs shall be capable of reference as related records.
4. Reporting:
   a. The system shall be capable of generating reports for work in progress, and logs for each document type. Summary reports generated by the system shall be available for team members.
5. Notifications and Distribution:

a. Document distribution to project members shall be accomplished both within the extranet system and via email as appropriate. Project document distribution to parties outside of the project communication system shall be accomplished by secure email of outgoing documents and attachments, readable by a standard email client.

6. Required Document Types:
   a. RFI, Request for Information.
   b. Submittals, including record numbering by drawing and specification section.
   c. Transmittals, including record of documents and materials delivered in hard copy.
   d. Meeting Minutes.
   e. Application for Payments (Draft or Pencil).
   f. Review Comments.
   g. Field Reports.
   h. Construction Photographs.
   i. Drawings.
   j. Supplemental Sketches.
   k. Schedules.
   l. Specifications.
   m. Request for Proposals
   n. Designer's Supplemental Instructions
   o. Punch Lists

H. Record Keeping: Except for paper documents, which require original signatures and large format documents (greater than 8½ x 11 inches), all other 8½ x 11 inches documents shall be submitted by transmission in electronic form to the E-Builder® web site by licensed users.
   a. The Owner and his representatives, the Designer and his consultants, and the Contractor and his Sub Contractors and suppliers at every tier shall respond to documents received in electronic form on the web site, and consider them as if received in paper document form.
   b. The Owner and his representatives, the Designer and his consultants, and the Contractor and his Sub Contractors and suppliers at every tier reserves the right to and shall reply or respond by transmissions in electronic form on the web site to documents actually received in paper document form.
   c. The Owner and his representatives, the Designer and his consultants, and the Contractor and his Sub Contractors and suppliers at every tier reserves the right to and shall copy any paper document into electronic form and make same available on the web site.

I. Minimum Equipment and Internet Connection: In addition to other requirements specified in this Section, the Owner and his representatives, the Construction Manager and his representatives, the Architect and his consultants, and the Contractor and his sub-contractors and suppliers at every tier required to have a user license(s) shall be responsible for the following:

1. Providing suitable computer systems for each licensed user at the users normal work location[1] with high-speed Internet access, i.e. DSL, local cable company's Internet connection, or T1 connection.
2. Each of the above referenced computer systems shall have the following minimum system[2] and software requirements:
    a. Desktop configuration (Laptop configurations are similar and should be equal to or exceed desktop system.)
        1) Operating System: Windows XP or newer
        2) Internet Browser: Internet Explorer 6.01SP2+ (Recommend IE7.0+)
        3) Minimum Recommend Connection Speed: 256K or above
        4) Processor Speed: 1 Gigahertz and above
        5) RAM: 512 mb
        6) Operating system and software shall be properly licensed.
        7) Internet Explorer version 7 (current version is a free distribution for download). This specification is not intended to restrict the host server or client computers provided that industry standard HTTP clients may access the published content.
        8) Adobe Acrobat Reader (current version is a free distribution for download).
        9) Users should have the standard Microsoft Office Suite (current version must be purchased) or the equivalent.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable.)

END OF SECTION 01 31 15

[1] The normal work location is the place where the user is assigned for more than one-half of his time working on this project.
[2] The minimum system herein will <u>not be sufficient</u> for many tasks and may not be able to process all documents and files stored in the E-Builder® Documents area.

SECTION 01 32 00

SCHEDULE – BAR CHART

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes requirements for a Bar Chart Schedule for the project construction activities, schedule of submittals, and schedule for testing.

PART 2 - PRODUCTS – (Not Applicable)

PART 3 - EXECUTION

3.1 SUBMITTAL PROCEDURES

A. The Contractor shall submit to the Designer, within ten (10) working days following the Notice to Proceed, a Progress Schedule including Schedule of Values showing the rate of progress the Contractor agrees to maintain and the order in which he proposed to carry out the various phases of Work. No payments shall be made to the Contractor until the Progress Schedule has been approved by the Owner.

B. The Contractor shall submit an updated Schedule for presentation at each Monthly Progress Meeting. The Schedule shall be updated by the Contractor as necessary to reflect the current Schedule and its relationship to the original Schedule. The updated Schedule shall reflect any changes in the logic, sequence, durations, or completion date. Payments to the Contractor shall be suspended if the Progress Schedule is not adequately updated to reflect actual conditions.

C. The Contractor shall submit Progress Schedules to Subcontractors to permit coordinating their Progress Schedules to the general construction Work. The Contractor shall coordinate preparation and processing of Schedules and reports with performance of other construction activities.

3.2 CONSTRUCTION PROGRESS SCHEDULE – BAR CHART SCHEDULE

A. Bar-Chart Schedule: The Contractor shall prepare a comprehensive, fully developed, horizontal bar chart-type Contractor's Construction Schedule. The Contractor for general construction shall prepare the Construction Schedule for the entire Project. The Schedule shall show the percentage of work to be completed at any time, anticipated monthly payments by Owner, as well as significant dates (such as completion of excavation, concrete foundation work, underground lines, superstructure, rough-ins, enclosure, hanging of fixtures, etc.) which shall serve as check points to determine compliance with the approved Schedule. The Schedule shall also include an activity for the number of "bad" weather days specified in Section 01 21 00 – Allowances.

1. The Contractor shall provide a separate time bar for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week.

    a. If practical, use the same Schedule of Values breakdown for schedule time bars.

2. The Contractor shall provide a base activity time bar showing duration for each construction activity. Each bar is to indicate start and completion dates for the activity. The Contractor is to place a contrasting bar below each original schedule activity time for indicating actual progress and planned remaining duration for the activity.

3. The Contractor shall prepare the Schedule on a minimal number of separate sheets to readily show the data for the entire construction period.

4. Secure time commitments for performing critical elements of the Work from parties involved. Coordinate each element on schedule with other construction activities. Include minor elements involved in the overall sequence of the Work. Show each activity in proper sequence. Indicate graphically the sequences necessary for completion of related portions of the Work.

5. Coordinate the Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittal Schedule, progress reports, payment requests, and other required schedules and reports.

6. Indicate the Intent to Award and the Contract Substantial Completion dates on the schedule.

B. Phasing: Provide notations on the schedule to show how the sequence of the Work is affected by the following:

1. Requirement for Phased completion
2. Work by separate Contractors
3. Work by the Owner
4. Pre-purchased materials
5. Coordination with existing construction
6. Limitations of continued occupancies
7. Un-interruptible services
8. Partial Occupancy prior to Substantial Completion
9. Site restrictions
10. Provisions for future construction
11. Seasonal variations
12. Environmental control

C. Work Stages: Use crosshatched bars to indicate important stages of construction for each major portion of the Work. Such stages include, but are not necessarily limited to, the following:

1. Subcontract awards
2. Submittals
3. Purchases

4. Mockups
5. Fabrication
6. Sample testing
7. Deliveries
8. Installation
9. Testing
10. Adjusting
11. Curing
12. Startup and placement into final use and operation

D. Area Separations: Provide a separate time bar to identify each major area of construction for each major portion of the Work. For the purposes of this Article, a "major area" is a story of construction, a separate building, or a similar significant construction element.

1. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:

a. Structural completion.
b. Permanent space enclosure
c. Completion of mechanical installation
d. Completion of the electrical portion of the Work
e. Substantial Completion

3.3 SCHEDULE OF SUBMITTALS

A. Upon acceptance of the Construction Progress Schedule, prepare and submit a complete schedule of submittals. Coordinate the submittal schedule with Section 01 33 00 SUBMITTALS, the approved Construction Progress Schedule, list of subcontracts, Schedule of Values and the list of products.

B. Prepare the schedule in chronological order. Provide the following information

1. Scheduled date for the first submittal
2. Related Section number
3. Submittal category
4. Name of the Subcontractor
5. Description of the part of the Work covered
6. Scheduled date for resubmittal
7. Scheduled date for the Designer's final release or approval

C. Distribution: Following the Designer's response to the initial submittal schedule, print and distribute copies to the Designer, Owner, subcontractors, and other parties required to comply with submittal dates indicated.

1. Post copies in the Project meeting room and temporary field office.

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

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

3.4 SCHEDULE OF INSPECTIONS AND TESTS

A. Prepare a schedule of inspections, tests, and similar services required by the Contract Documents. Submit the schedule with (15) days of the date established for commencement of the Contract Work. The Contractor is to notify the testing agency at least (5) working days in advance of the required tests unless otherwise specified.

B. Form: This schedule shall be in tabular form and shall include, but not be limited to, the following:

1. Specification Section number
2. Description of the test
3. Identification of applicable standards
4. Identification of test methods
5. Number of tests required
6. Time schedule or time span for tests
7. Entity responsible for performing tests
8. Requirements for taking samples
9. Unique characteristics of each service

C. Distribution: Distribute the schedule to the Owner, Architect, and each party involved in performance of portions of the Work where inspections and tests are required.

END OF SECTION 01 32 00

SECTION 01 33 00

SUBMITTALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Division 1, Section 01 31 15 "Project Management Communications" for administrative requirements for communications.

1.2 SUMMARY

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

1. Shop Drawings
2. Product Data
3. Samples
4. Quality Assurance Submittals
5. Construction Photographs
6. Operating and Maintenance Manuals
7. Warranties

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

1. Construction Progress Schedule including Schedule of Values
2. Performance and Payment Bonds
3. Insurance Certificates
4. Applications for Payment
5. Certified Payroll Reports
6. Partial and Final Receipt of Payment and Release Forms
7. Affidavit – Compliance with Prevailing Wage Law
8. Record Drawings
9. Notifications, Permits, etc.

C. The Contractor is obliged and responsible to check all shop drawings and schedules to assure compliance with contract plans and specifications. The Contractor is responsible for the content of the shop drawings and coordination with other contract work. Shop drawings and schedules shall indicate, in detail, all parts of an Item or Work including erection and setting instructions and integration with the Work of other trades.

D. The Contractor shall at all times make a copy, of all approved submittals, available on site to the Construction Representative.

1.3 SUBMITTAL PROCEDURES

A. The Contractor shall comply with the General and Supplementary Conditions and other applicable sections of the Contract Documents. The Contractor shall submit, with such promptness as to cause no delay in his work or in that of any other contractors, all required submittals indicated in Part 3.1 of this section and elsewhere in the Contract Documents. Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.

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

2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.

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

B. Each drawing and/or series of drawings submitted must be accompanied by a letter of transmittal giving a list of the titles and numbers of the drawings. Each series shall be numbered consecutively for ready reference and each drawing shall be marked with the following information:

1. Date of Submission
2. Name of Project
3. Location
4. Section Number of Specification
5. State Project Number
6. Name of Submitting Contractor
7. Name of Subcontractor
8. Indicate if Item is submitted as specified or as a substitution

1.4 SHOP DRAWINGS

A. Comply with the General Conditions, Article 3.2.

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

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

1. Dimensions
2. Identification of products and materials included by sheet and detail number

3. Compliance with specified standards

4. Notation of coordination requirements

5. Notation of dimensions established by field measurement

6. Sheet Size: Except for templates, patterns and similar full-size Drawings, submit Shop Drawings on sheets at least 8½”x11” but no larger than 36”x48”.

1.5 PRODUCT DATA

A. The Contractor shall comply with the General Conditions, Article 3.2.

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

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

   a. Manufacturer’s printed recommendations

   b. Compliance with Trade Association standards

   c. Compliance with recognized Testing Agency standards

   d. Application of Testing Agency labels and seals

   e. Notation of dimensions verified by field measurement

   f. Notation of coordination requirements

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

1.6 SAMPLES

A. The Contractor shall comply with the General Conditions, Article 3.2.

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

1. The Contractor shall mount or display samples in the manner to facilitate review of qualities indicated. Prepare samples to match the Designer’s sample including the following:

   a. Specification Section number and reference

   b. Generic description of the Sample

   c. Sample source

   d. Product name or name of the Manufacturer

   e. Compliance with recognized standards

   f. Availability and delivery time

2. The Contractor shall submit samples for review of size, kind, color, pattern, and texture. Submit samples for a final check of these characteristics with other

elements and a comparison of these characteristics between the final submittal and the actual component as delivered and installed.

a. Where variation in color, pattern, texture, or other characteristic is inherent in the material or product represented, submit at least three (3) multiple units that show approximate limits of the variations.

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

c. Refer to other Sections for samples to be returned to the Contractor for incorporation in the Work. Such samples must be undamaged at time of use. On the transmittal, indicate special requests regarding disposition of sample submittals.

d. Samples not incorporated into the Work, or otherwise designated as the Owner's property, are the property of the Contractor and shall be removed from the site prior to Substantial Completion.

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

a. The Contractor shall comply with submittal requirements to the fullest extent possible. The Contractor shall process transmittal forms to provide a record of activity.

1.7 QUALITY ASSURANCE DOCUMENTS

A. The Contractor shall comply with the General Conditions, Article 3.2

B. The Contractor shall submit quality control submittals including design data, certifications, manufacturer's instructions, manufacturer's field reports, and other quality-control submittals as required under other Sections of the Specifications.

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

1. Signature: Certification shall be signed by an officer of the Manufacturer or other individual authorized to contractually bind the Company.

D. Inspection and Test Reports: The Contractor shall submit the required inspection and test reports from independent testing agencies as specified in this Section and in other Sections of the Contract Documents.

E. Construction Photographs: The Contractor shall submit record construction photographs as specified in this Section and in other Sections of the Contract Documents.

1. The Contractor shall submit digital photographs. The Construction Administrator shall determine the quantity and naming convention at the preconstruction meeting.

2. The Contractor shall identify each photograph with project name, location, number, date, time, and orientation.

3. The Contractor shall submit progress photographs monthly unless specified otherwise. Photographs shall be taken one (1) week prior to submitting.

4. The Contractor shall take four (4) site photographs from differing directions and a minimum of five (5) interior photographs indicating the relative progress of the Work.

1.8 OPERATING AND MAINTENANCE MANUALS AND WARRANTIES

A. The Contractor shall submit all required manufacturer's operating instructions, maintenance/service manuals, and warranties in accordance with the General Conditions, Article 3.5, and Supplementary Conditions along with this and other Sections of the Contract Documents.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 REQUIRED SUBMITTALS

A. Contractor shall submit the following information for materials and equipment to be provided under this contract.

		TYPE OF SUBMITTAL											
SECTION	**DESCRIPTION**	**Shop Drawings**	**Product Data**	**Sample**	**Certifications**	**Manufacturer' s Instruc-**	**Test report**	**Inspection Report**	**Wiring Diagrams**	**Record Photographs**	**Maintenance Data**	**Operating Instruction**	**Warranty**
01 31 00	**Coordination** Items 1.3.D, 1.4.A, and 1.4.B											**X**	
01 32 00	**Schedules – Bar Chart** Items 3.1.A, 3.2.A, 3.3.A and 3.4.A											**X**	
01 33 00	**Submittals** Items 1.2.B											**X**	
01 50 00	**Construction Facilities and Temporary Controls**						**X**						
01 57 00	**Erosion Control / Storm Water Pollution Prevention**				**X**							**X**	
03 30 00	**Cast-In-Place Concrete**	**X**	**X**		**X**								
03 41 00	**Structural Precast Concrete**	**X**	**X**	**X**	**X**	**X**							
04 20 00	**Unit Masonry**		**X**		**X**	**X**							

05 40 00	**Cold-Form Metal Framing**	X	X										
05 50 00	**Metal Fabrications**	X											
06 10 00	**Rough Carpentry**		X										
06 61 16	**Solid Surfacing Fabrications**	X	X	X								X	X
07 19 00	**Water Repellents**		X			X							X
07 21 00	**Building Insulation**		X										
07 54 23	**Single-Ply Membrane Roofing (TPO)**	X	X	X	X	X	X	X			X		X
07 60 00	**Flashing & Sheet Metal**	X	X	X			X						
07 72 00	**Roof Accessories**		X										X
07 84 00	**Firestopping**	X	X		X		X						
07 92 00	**Joint Sealants**		X	X									
08 11 19	**Steel Doors and Frames**	X	X		X								X
08 71 00	**Door Hardware**	X	X		X							X	
08 80 00	**Glazing**		X		X		X						
09 21 16	**Gypsum Board Assemblies**		X	X									
09 51 00	**Acoustical Tile Ceiling**	X	X	X									
09 67 23	**Resinous Flooring**		X	X	X	X							X
09 90 00	**Painting**		X	X									X
10 21 13	**Toilet Compartments**	X	X	X									X
10 28 13	**Toilet Accessories**	X	X										
10 80 00	**Miscellaneous Specialties**		X										
12 21 00	**Window Blinds**		X	X									
21 13 13	**Wet Fire Sprinkler Systems**	X	X		X		X		X				X
22 05 29	**Hangers and Supports for Plumbing Piping and Equipment**		X		X								
22 07 19	**Plumbing Piping Insulation**		X		X	X							
22 11 16	**Domestic Water Piping**		X		X		X						
22 13 16	**Sanitary Waste and Vent Piping**		X		X		X						
22 14 00	**Plumbing Fixtures**		X		X		X					X	X
22 14 23	**Drainage Piping Specialties**		X		X		X						
22 31 16	**Commercial Domestic Water Softeners**		X		X	X			X		X	X	X
22 34 36	**Commercial Gas Domestic Water Heaters**		X		X	X			X		X	X	X

23 05 29	**Hangers and Supports for HVAC Piping and Equipment**		**X**		**X**								
23 05 93	**Testing, Adjusting, and Balancing for HVAC**						**X**					**X**	
23 07 13	**Duct Insulation**		**X**		**X**	**X**							
23 07 19	**HVAC Piping Insulation**		**X**		**X**	**X**							
23 23 00	**Refrigerant Piping**		**X**		**X**		**X**						
23 31 13	**Metal Ducts**		**X**		**X**								
23 33 00	**Air Duct Accessories**		**X**		**X**	**X**						**X**	
23 54 00	**Furnaces**		**X**		**X**	**X**			**X**		**X**	**X**	**X**
23 81 26	**Split-System Air-Conditioners**		**X**		**X**	**X**			**X**		**X**	**X**	**X**
26 05 19	**Low-Voltage Electrical Power Conductors and Cables**		**X**		**X**								
26 05 26	**Grounding and Bonding for Electrical Systems**		**X**		**X**		**X**						
26 05 29	**Hangers and Supports for Electrical Systems**	**X**	**X**		**X**								
26 05 33	**Raceways and Boxes for Electrical Systems**		**X**		**X**								
26 05 53	**Identification for Electrical Systems**	**X**	**X**										
26 09 23	**Lighting Control Devices**		**X**		**X**				**X**			**X**	
26 24 16	**Panelboards**	**X**	**X**		**X**								
26 27 26	**Wiring Devices**		**X**		**X**								
26 28 13	**Fuses**		**X**		**X**							**X**	
26 28 16	**Enclosed Switches and Circuit Breakers**		**X**		**X**							**X**	
26 51 00	**Interior Lighting**		**X**		**X**								
26 56 00	**Exterior Lighting**		**X**		**X**								**X**
27 10 00	**Communications Systems Structured Cabling**	**X**	**X**		**X**		**X**						**X**
28 46 00	**Fire Detection and Alarm**	**X**	**X**		**X**		**X**		**X**			**X**	**X**
31 00 00	**Earthwork**		**X**										
32 30 00	**Site Improvements**		**X**										
32 90 00	**Landscaping**		**X**										
33 00 00	**Site Utilities**		**X**										
33 40 00	**Storm Drainage Systems**		**X**										

	ALTERNATE NO. 2												
08 55 13	**Tornado Resistant Windows**	**X**	**X**	**X**	**X**	**X**	**X**				**X**		**X**
08 80 00	**Glazing**		**X**	**X**	**X**		**X**						**X**
12 21 00	**Window Blinds**	**X**	**X**	**X**									**X**
	ALTERNATE NO. 3												
07 42 93	**Soffit Panels**		**X**	**X**									
08 41 13	**Aluminum Entrances and Storefronts**	**X**	**X**	**X**									**X**
08 80 00	**Glazing**		**X**	**X**	**X**		**X**						**X**

END OF SECTION 01 33 00

SECTION 01 35 13.28

SITE SECURITY AND HEALTH REQUIREMENTS (MONG)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUBMITTALS

A. List of required submittals:

1. Materials Safety Data Sheets for all hazardous materials to be brought onsite.

2. Schedule of proposed shutdowns, if applicable.

3. A list of the names of all employees who will submit fingerprints for a background check, and the signed privacy documents identified below for each employee.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 ACCESS TO THE SITE

A. The Contractor shall arrange with Facility Representatives to establish procedures for the controlled entry of workers and materials into the work areas at the Facility.

B. The Contractor shall establish regular working hours with Facility Representatives. The Contractor must report changes in working hours or overtime to Facility Representatives and obtain approval twenty-four (24) hours ahead of time. The Contractor shall report emergency overtime to Facility Representatives as soon as it is evident that overtime is needed. The Contractor must obtain approval from Facility Representatives for all work performed after dark.

C. The Contractor shall provide the name and phone number of the Contractor's employee or agent who is in charge onsite; this individual must be able to be contacted in case of emergency. The Contractor must be able to furnish names and address of all employees upon request.

D. All construction personnel shall visibly display issued identification cards.

3.2 FIRE PROTECTION, SAFETY, AND HEALTH CONTROLS

A. The Contractor shall take all necessary precautions to guard against and eliminate possible fire hazards.

1. Onsite burning is prohibited.

2. The Contractor shall store all flammable or hazardous materials in proper containers located outside the buildings or offsite, if possible.

3. The Contractor shall provide and maintain, in good order, during construction fire extinguishers as required by the National Fire Protection Association. In areas of flammable liquids, asphalt, or electrical hazards, 15-pound carbon dioxide or 20-pound dry chemical extinguishers shall be provided.

B. The Contractor shall not obstruct streets or walks without permission from the Owner's Construction Representative and Facility Representatives.

C. The Contractor's personnel shall not exceed the speed limit of 15 mph while at the Facility unless otherwise posted.

D. The Contractor shall take all necessary, reasonable measures to reduce air and water pollution by any material or equipment used during construction. The Contractor shall keep volatile wastes in covered containers, and shall not dispose of volatile wastes or oils in storm or sanitary drains.

E. The Contractor shall keep the project site neat, orderly, and in a safe condition at all times. The Contractor shall immediately remove all hazardous waste, and shall not allow rubbish to accumulate. The Contractor shall provide onsite containers for collection of rubbish and shall dispose of it at frequent intervals during the progress of the Work.

F. Fire exits, alarm systems, and sprinkler systems shall remain fully operational at all times, unless written approval is received from the Owner's Construction Representative and the appropriate Facility Representative at least twenty-four (24) hours in advance. The Contractor shall submit a written time schedule for any proposed shutdowns.

G. For all hazardous materials brought onsite, Material Safety Data Sheets shall be on site and readily available upon request at least a day before delivery.

H. Alcoholic beverages or illegal substances shall not be brought upon the Facility premises. The Contractor's workers shall not be under the influence of any intoxicating substances while on the Facility premises.

3.3 SECURITY CLEARANCES AND RESTRICTIONS

A. FMDC REQUIRED FINGERPRINTING FOR CRIMINAL BACKGROUND AND WARRANTS CHECK

1. All employees of the Contractor are required to submit fingerprints to the Missouri State Highway Patrol to enable the Office of Administration, Division of Facilities Management, Design and Construction (FMDC) to receive state and national criminal background checks on such employees. FMDC reserves the right to prohibit any employee of the Contractor from performing work in or on the premises of any facility owned, operated, or utilized by the State of Missouri for any reason.

2. The Contractor shall ensure all of its employees submit fingerprints to the Missouri State Highway Patrol and pay for the cost of such background checks. The Contractor shall submit to FMDC via email to FMDCSecurity@oa.mo.gov a list of the names of the Contractor's employees who will be fingerprinted and a signed Missouri Applicant Fingerprint Privacy Notice, Applicant Privacy Rights and Privacy Act Statement for each employee. All employees of the Contractor approved by FMDC to work at a State facility must obtain a contractor ID badge from FMDC prior to beginning work on-site, unless the Director of FMDC, at the

Director's discretion, waives the requirement for a contractor ID badge. The Contractor and its employees must comply with the process for background checks and contractor ID badges found on FMDC's website at: https://oa.mo.gov/fmdc-contractor-id-badges.

3. Pursuant to section 43.540, RSMo, FMDC participates in the Missouri Rap Back and National Rap Back programs as of August 28, 2018. This means that the Missouri State Highway Patrol, Central Records Repository, and the Federal Bureau of Investigation will retain the fingerprints submitted by each of the Contractor's employees, and those fingerprints will be searched against other fingerprints on file, including latent fingerprints. While retained, an employee's fingerprints may continue to be compared against other fingerprints submitted or retained by the Federal Bureau of Investigation, including latent fingerprints.

4. As part of the Missouri and National Rap Back programs, FMDC will receive notification if a new arrest is reported for an employee whose fingerprints have been submitted for FMDC after August 28, 2018. If the employee is performing work on a State contract at the time of the arrest notification, FMDC will request and receive the employee's updated criminal history records. If the employee is no longer performing work on a State contract, FMDC will not obtain updated criminal records.

5. Pursuant to section 43.540, RSMo, the Missouri State Highway Patrol will provide the results of the employee's background check directly to FMDC. FMDC may NOT release the results of a background check to the Contractor or provide the Contractor any information obtained from a background check, either verbally or in writing. FMDC will notify the Contractor only whether an employee is approved to work on State property.

6. Each employee who submits fingerprints to the Missouri State Highway Patrol has a right to obtain a copy of the results of his or her background check. The employee may challenge the accuracy and completeness of the information contained in a background check report and obtain a determination from the Missouri State Highway Patrol and/or the FBI regarding the validity of such challenge prior to FMDC making a final decision about his or her eligibility to perform work under a State contract.

7. The Contractor shall notify FMDC via email to FMDCSecurity@oa.mo.gov if an employee is terminated or resigns from employment with the Contractor. If the Contractor does not anticipate performing work on a State contract in the future, the Contractor may request that FMDC remove its employees from the Rap Back programs. However, if removed from the Rap Back programs, employees will be required to submit new fingerprints should the contractor be awarded another State contract.

8. Upon award of a Contract, the Contractor should contact FMDC at FMDCSecurity@oa.mo.gov to determine if its employees need to provide a new background check. If a Contractor's employee has previously submitted a fingerprint background check to FMDC as part of the Missouri and National Rap Back programs, the employee may not need to submit another fingerprint search for a period of three to six years, depending upon the circumstances. The Contractor understands and agrees that FMDC may require more frequent background checks without providing any explanation to the Contractor. The fact

that an additional background check is requested by FMDC does not indicate that the employee has a criminal record.

3.4 DISRUPTION OF UTILITIES

A. The Contractor shall give a minimum of seventy-two (72) hours written notice to the Construction Representative and the Facility Representative before disconnecting electric, gas, water, fire protection, or sewer service to any building.

B. The Contractor shall give a minimum of seventy-two (72) hours written notice to the Construction Representative and Facility Representative before closing any access drives, and shall make temporary access available, if possible. The Contractor shall not obstruct streets, walks, or parking.

END OF SECTION 01 35 13.28

SECTION 01 45 33

SPECIAL INSPECTIONS AND PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes administrative and procedural requirements required for compliance with the International Building Code, Chapter 17, Structural Tests and Special Inspections.
   1. Exceptions: Portions of special inspections shall not be required where the fabricator is approved in accordance with building code requirements and agencies having jurisdiction.

B. Structural testing and special inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve contractor of responsibility for compliance with other construction document requirements.
   1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
   2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and control procedures that facilitate compliance with the construction document requirements.
   3. Requirements for contractor to provide quality-assurance and control services required by architect, owner, or authorities having jurisdiction are not limited by provisions of this section.

C. The Owner will engage one or more qualified special inspectors and / or testing agencies to conduct structural tests and special inspections specified in this section and related sections and as maybe specified in other divisions of these specifications.

D. Related Sections include but are not limited to the following:
   1. 03 33 00 CAST-IN-PLACE CONCRETE
   2. 03 41 00 STRUCTURAL PRECAST CONCRETE
   3. 04 20 00 UNIT MASONRY
   4. 05 40 00 COLD-FORMED METAL FRAMING
   5. 07 84 00 FIRESTOPPING
   6. 08 11 19 STEEL DOORS & FRAMES
   7. 08 55 13 TORNADO RESISTANT WINDOWS
   8. 23 33 00 AIR DUCT ACCESSORIES
   9. 31 00 00 EARTHWORK

1.03 DEFINITIONS

A. Approved Agency: An established and recognized agency regularly engaged in conducting tests or furnishing inspection services, when such agency has been approved by the building official.

B. Approved Fabricator: An established and qualified person, firm or corporation approved by the building official pursuant to applicable building code requirements. Fabricator shall be registered and approved to perform work on the premises of the fabricator without special inspection as defined in the applicable building code. Approval shall be based upon review of fabricator's written procedural and quality control manuals and periodic auditing of fabrication practices by an approved special inspection agency. Fabricator shall submit certificate of compliance upon request.

C. Construction Documents: Written, graphic and pictorial documents prepared or assembled for describing the design, location and physical characteristics of the elements of a project necessary for obtaining a building permit. Construction Documents include all supplemental instructions, sketches, addenda, and revisions to the drawings and specifications issued by the registered design professional beyond those issued for a building permit.

D. Shop Drawings / Submittal Data: Written, graphic and pictorial documents prepared and / or assembled by the contractor based on the Construction Documents.

E. Structural Observation: Visual observation of the structural system by a representative of the registered design professional's office for general conformance to the approved construction documents. Structural observations are not considered part of the structural tests and special inspections and do not replace inspections and testing by the testing agency or special inspector.

F. Special Inspector: A qualified person who demonstrating competence, to the satisfaction of the code enforcement official and registered design professional in responsible charge, for inspection of the particular type of construction or operation requiring special inspection. The special inspector shall be a licensed professional engineer or engineering intern or a qualified representative from the testing agency.

G. Special Inspection, Continuous: The full-time observation of work requiring special inspection by an approved special inspector who is present in the area where the work is being performed.

H. Special Inspection, Periodic: The part-time or intermittent observation of work requiring special inspection by an approved special inspector who is present in the area where the work has been or is being performed and at the completion of the work.

I. Testing Agency: A qualified materials testing laboratory under the responsible charge of a licensed professional engineer, approved by the code enforcement official and the registered design professional in responsible charge, to measure, examine, test, calibrate, or otherwise determine the characteristics or performance of construction materials and verify confirmation with construction documents.

1.04 QUALITY ASSURANCE

A. Testing Agency Qualifications:
   1. Minimum qualifications of inspection and testing agencies and their personnel shall comply with ASTM E329-03 Standard Specification for Agencies in the Testing and / or Inspection of Materials Used in Construction.

a. Inspectors and individuals performing tests shall be certified for the work being performed as outlined in the appendix of the ASTM E329. Certification by organizations other than those listed must be submitted to the building official for consideration before proceeding with work.

2. In addition to these requirements, local jurisdiction may have additional requirements. It is the responsibility of the testing and inspection agencies to meet local requirements and comply with local procedures.

1.05 CONFLICTING REQUIREMENTS, REPORTS, AND TEST RESULTS

A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to the registered design professional in responsible charge for a decision before proceeding.

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

C. The special inspector's reports and testing agencies results shall have precedence over reports and test results provided by the contractor.

D. Where a conflict exists between the construction documents and approved shop drawings / submittal data, the construction documents shall govern unless the shop drawings / submittal data are more restrictive. All conflicts shall be brought to the attention of the registered design professional in responsible charge.

1.06 SUBMITTALS BY SPECIAL INSPECTOR AND / OR TESTING AGENCY

A. Special inspectors shall keep and distribute records of inspections. The special inspector shall furnish inspection reports to the building official, and to the registered design professional in responsible charge, contractor, architect, and owner. Reports shall indicate that work inspected was done in conformance to approved construction documents. Discrepancies shall be brought to the immediate attention of the contractor for correction. If the discrepancies are not corrected, the discrepancies shall be brought to the attention of the building official and to the registered design professional in responsible charge prior to the completion of that phase of the work. A final report documenting required special inspections and correction of any discrepancies noted in the inspections shall be submitted at a point in time agreed upon by the permit applicant and the building official prior to the start of work.

1. Special inspection reports and test results shall include, but not be limited to, the following:
   a. Date of inspection.
   b. Description of inspections or tests performed including location (reference grid lines, floors, elevations, etc.).
   c. Statement noting that the work, material, and / or product conforms or does not conform to the construction document requirements.

1) Name and signature of contractor's representative who was notified of work, material, and / or products that do not meet the construction document requirements.

d. Name and signature of special inspector and / or testing agency representative performing the work.

B. Schedule of Non-Compliant Work: Each agent shall maintain a log of work that does not meet the requirements of the construction documents. Include reference to original inspection / test report and subsequent dates of re-inspection / retesting.

C. Reports and tests shall be submitted within 1 week of inspection or test. Schedule of Non-Compliant Work shall be updated daily and submitted at monthly intervals.

D. Final Report of Special Inspections. Submitted by each agent listed in the schedule of Structural Testing and Special Inspections.

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION

3.01 CONTRACTOR'S RESPONSIBILITY

A. The contractor shall coordinate the inspection and testing services with the progress of the work. The contractor shall provide sufficient notice to allow proper scheduling of all personnel. The contractor shall provide safe access for performing inspection and on site testing.

B. The contractor shall submit schedules to the owner, registered design professionals and testing and inspecting agencies. Schedules will note milestones and durations of time for materials requiring structural tests and special inspections.

C. Each contractor responsible for the construction of a seismic-force-resisting system, designated seismic system, or component listed in the quality assurance plan shall submit a written contractor's statement of responsibility to the building official and to the owner prior to the commencement of work on the system or component. The contractor's statement of responsibility shall contain the following:

1. Acknowledgment of awareness of the special requirements contained in the quality assurance plan.
2. Acknowledgment that control will be exercised to obtain conformance with the construction documents approved by the building official.
3. Procedures for exercising control within the contractor's organization, the method and frequency of reporting and the distribution of the reports.
4. Identification and qualifications of the person(s) exercising such control and their position(s) in the organization.

D. Each contractor responsible for the construction of a main wind force-resisting system or a wind-resisting component listed in the quality assurance plan shall submit a written statement of responsibility to the building official and the owner prior to the commencement of work on the system or component. The contractor's statement of responsibility shall contain the following:

1. Acknowledgment of awareness of the special requirements contained in the quality assurance plan.

2. Acknowledgment that control will be exercised to obtain conformance with the construction documents approved by the building official.
3. Procedures for exercising control within the contractor's organization, the method and frequency of reporting and the distribution of the reports.
4. Identification and qualifications of the person(s) exercising such control and their position(s) in the organization.

E. The contractor shall repair and / or replace work that does not meet the requirements of the construction documents.
1. Contractor shall engage an engineer / architect to prepare repair and / or replacement procedures.
2. Engineer / architect shall be registered in the state in which the project is located. Engineer shall be acceptable to the registered design professional in responsible charge, code enforcement official, and owner.
3. Procedures shall be submitted for review and acceptance by the registered design professional in responsible charge, code enforcement official, and owner before proceeding with corrective action.

F. The contractor shall be responsible for costs of:
1. Re-testing and re-inspection of materials, work, and / or products that do not meet the requirements of the construction documents and shop drawings / submittal data.
2. Review of proposed repair and / or replacement procedures by the registered design professional in responsible charge and the inspectors and testing agencies.
3. Repair or replacement of work that does not meet the requirements of the construction documents.

3.02 STRUCTURAL OBSERVATIONS

A. Structural observations may be made periodically as determined by the registered design professional in responsible charge.

3.03 TESTING AND INSPECTION

A. Testing and inspection shall be in accordance with the Schedule of Special Inspections.

B. Reference related specifications for the minimum level of inspections and testing. Provide additional inspections and testing as necessary to determine compliance with the construction drawings.

PART 4 - SCHEDULES AND FORMS

4.01 SCHEDULE OF SPECIAL INSPECTIONS

A. Refer to Section 01 45 33.10 - Statement of Special Inspections.

B. Refer to drawings Scope of Work Schedule for Owner's designated testing agency responsible for special inspections.

4.02 FINAL REPORT OF SPECIAL INSPECTIONS

A. Final report of special inspections shall be submitted by Owner's designated testing agency on forms and in format acceptable to Owner.

END OF SECTION

Section 01 45 33.10

Statement of Special Inspections

Project: *60 Soldier Barracks Building T2018-01*

Location: *Camp Crowder Training Site 890 Ray A Carver Drive Neosho, MO*

Owner: *Missouri Army National Guard*

Design Professional in Responsible Charge: *Aaron D. Smith, P.E.*

This *Statement of Special Inspections* is submitted as a condition for permit issuance in accordance with the Special Inspection and Structural Testing requirements of the Building Code. It includes a schedule of Special Inspection services applicable to this project as well as the name of the Special Inspection Coordinator and the identity of other approved agencies to be retained for conducting these inspections and tests. This *Statement of Special Inspections* encompass the following disciplines:

☒ Structural ☒ Mechanical/Electrical/Plumbing
☐ Architectural ☐ Other: _____

The Special Inspection Coordinator shall keep records of all inspections and shall furnish inspection reports to the Building Official and the Registered Design Professional in Responsible Charge. Discovered discrepancies shall be brought to the immediate attention of the Contractor for correction. If such discrepancies are not corrected, the discrepancies shall be brought to the attention of the Building Official and the Registered Design Professional in Responsible Charge. The Special Inspection program does not relieve the Contractor of his or her responsibilities.

Interim reports shall be submitted to the Building Official and the Registered Design Professional in Responsible Charge.

A *Final Report of Special Inspections* documenting completion of all required Special Inspections, testing and correction of any discrepancies noted in the inspections shall be submitted prior to issuance of a Certificate of Use and Occupancy.

Job site safety and means and methods of construction are solely the responsibility of the Contractor.

Interim Report Frequency: *Present reports at end of construction* or ☐ per attached schedule.

Prepared by:

Aaron D. Smith, P.E.
(type or print name)

Signature Date

Design Professional Seal

Schedule of Inspection and Testing Agencies

This Statement of Special Inspections / Quality Assurance Plan includes the following building systems:

- ☒ Soils and Foundations
- ☒ Cast-in-Place Concrete
- ☐ Precast Concrete
- ☒ Masonry
- ☐ Structural Steel
- ☒ Cold-Formed Steel Framing
- ☐ Spray Fire Resistant Material
- ☐ Wood Construction
- ☐ Exterior Insulation and Finish System
- ☒ Mechanical & Electrical Systems
- ☐ Architectural Systems
- ☒ Special Cases

Special Inspection Agencies	Firm	Address, Telephone, e-mail
1. **Special Inspection Coordinator**		
2. Inspector		
3. Inspector		
4. Testing Agency		
5. Testing Agency		
6. Other		

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

Soils and Foundations

Item	Scope
1. Shallow Foundations	*Inspect soils below footings for adequate bearing capacity and consistency with geotechnical report.* *Inspect removal of all unsuitable material and preparation of subgrade prior to placement of controlled fill.* *Ensure that subgrade is prepared as necessary to reduce potential settlement and potential vertical movement to one inch or less.*
2. Controlled Structural Fill	*Perform sieve tests and Proctor tests of each source of fill material as required.* *Inspect placement, lift thickness and compaction of controlled fill.* *Test density of each lift of fill by nuclear methods (ASTM D2922)* *Verify extent and slope of fill placement.*
3. Deep Foundations	*Not Applicable.*
4. Load Testing	*Not Applicable.*
4. Other:	*Not Applicable.*

Cast-in-Place Concrete

Item	Scope
1. Mix Design	*Review concrete batch tickets and verify compliance with approved mix design. Verify that no water is added to concrete at the site.*
2. Material Certification	*Confirm compliance with Project Manual.*
3. Reinforcement Installation	*Inspect size, spacing, cover, positioning and grade of reinforcing steel. Verify that reinforcing bars are free of form oil or other deleterious materials. Inspect bar laps and mechanical splices. Verify that bars are adequately tied and supported on chairs or bolsters*
4. Post-Tensioning Operations	*Not applicable.*
5. Welding of Reinforcing	*Not applicable.*
6. Anchor Rods	*Inspect size, positioning and embedment of anchor rods. Inspect concrete placement and consolidation around anchors.*
7. Concrete Placement	*Inspect placement of concrete. Verify that concrete conveyance and depositing avoids segregation or contamination. Verify that concrete is properly consolidated.*
8. Sampling and Testing of Concrete	*Test concrete compressive strength (ASTM C31 & C39), slump (ASTM C143), air-content (ASTM C231 or C173) and temperature (ASTM C1064).*
9. Curing and Protection	*Inspect curing, cold weather protection and hot weather protection procedures.*
10. Other:	

Masonry

Required Inspection Level: ☒ **1** ☐ **2**

Item	Scope
1. Material Certification	*Confirm compliance with Project Manual.*
2. Mixing of Mortar and Grout	*Inspect proportioning, mixing and retempering of mortar and grout.*
3. Installation of Masonry	*Inspect size, layout bonding and placement of masonry units.*
4. Mortar Joints	*Inspect construction of mortar joints including tooling and filling of head joints.*
5. Reinforcement Installation	*Inspect placement, positioning and lapping of reinforcing steel.*
6. Adhesive Anchors Into Grouted Masonry	*Inspect installation of adhesive anchors for conformance to adhesive manufacturer's recommendations.*
7. Grouting Operations	*Inspect placement and consolidation of grout. Inspect masonry clean-outs for high-lift grouting.*
7. Weather Protection	*Inspect cold weather protection and hot weather protection procedures. Verify that wall cavities are protected against precipitation.*
9. Evaluation of Masonry Strength	*Test compressive strength of mortar and grout cube samples (ASTM C780).* *Test compressive strength of masonry prisms (ASTM C1314).*
10. Anchors and Ties	*Inspect size, location, spacing and embedment of dowels, anchors and ties.*
11. Other:	

Cold-Formed Steel Framing

Item	Scope
1. Member Sizes	*Inspect structural members to confirm that sizes and gauge thicknesses conform to Construction Documents.*
2. Material Properties	*Confirm that material properties, yield strengths, etc. are in compliance with Project Manual.*
3. Mechanical Connections and Framing Details	*Inspect connections for conformance to framing details.*
4. Welding	*Inspect all welds for quality and for conformance to Construction Documents.*
5. Other:	
9. Other:	

Mechanical & Electrical Systems

Item	Scope
1. Mechanical, HVAC & Piping	*Inspect installation and anchorage of mechanical and electrical equipment for automatic fire sprinkler system. Inspect anchorage of gas piping if applicable.*
:	

Special Cases

Item	Scope
1. Shelter Component Anchorage	*Verify anchors post-installed in pre-cast concrete conform to component manufacturer's specifications and pre-cast supplier's allowable locations for anchorage for shelter components forming a part of the shelter enclosure. Refer to ICC 500-2014 section 106.3 (note 3).*
2. Shelter Foundation Anchorage	*Verify pre-cast structure is doweled and grouted to cast-in-place concrete foundation per pre-cast supplier documents. Refer to ICC 500-2014 section 106.3 (note 3).*
:	

SECTION 01 50 00

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes requirements for construction facilities and temporary controls including temporary utilities, support facilities, security, and protection.

B. Temporary utilities include, but are not limited to, the following:

1. Water service and distribution
2. Temporary electric power and light
3. Temporary heat
4. Ventilation
5. Telephone service
6. Sanitary facilities, including drinking water
7. Storm and sanitary sewer

C. Support facilities include, but are not limited to, the following:

1. Field offices and storage sheds
2. Dewatering facilities and drains
3. Temporary enclosures
4. Hoists and cranes
5. Temporary project identification signs and bulletin boards
6. Waste disposal services
7. Rodent and pest control
8. Construction aids and miscellaneous services and facilities

D. Security and protection facilities include, but are not limited to, to following:

1. Temporary fire protection
2. Barricades, warning signs, and lights
3. Sidewalk bridge or enclosure fence for the site
4. Environmental protection

1.3 SUBMITTALS

A. Temporary Utilities: Submit reports of tests, inspections, meter readings, and similar procedures performed on temporary utilities.

B. Implementation and Termination Schedule: Within (15) days of the date established for commencement of the Work, submit a schedule indicating implementation and termination of each temporary utility.

1.4 QUALITY ASSURANCE

A. Regulations: Comply with industry standards and applicable laws and regulations including, but not limited to, the following:

1. Building code requirements
2. Health and safety regulations
3. Utility company regulations
4. Police, fire department, and rescue squad rules
5. Environmental protection regulations

B. Standards: Comply with NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations". ANSI A10 Series standards for "Safety Requirements for Construction and Demolition", and NECA Electrical Design Library "Temporary Electrical Facilities".

1. Electrical Service: Comply with NEMA, NECA, and UL standards and regulations for temporary electric service. Install service in compliance with NFPA 70 "National Electric Code".

C. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

1.5 PROJECT CONDITIONS

A. Temporary Utilities: Prepare a schedule indicating dates for implementation and termination of each temporary utility. At the earliest feasible time, when acceptable to the Owner, change over from use of temporary service to use of permanent service.

B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Relocate temporary services and facilities as the Work progresses. Do not overload facilities or permit them to interfere with progress. Take necessary fire-prevention measures. Do not allow hazardous, dangerous, or unsanitary conditions, or public nuisances to develop or persist onsite.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide new materials. If acceptable to the Designer, the Contractor may use undamaged, previously used materials in serviceable condition. Provide materials suitable for use intended.

B. Lumber and Plywood: Comply with requirements in Division 6 Section “Rough Carpentry”.

1. For job-built temporary office, shops, and sheds within the construction area, provide UL-labeled, fire-treated lumber and plywood for framing, sheathing, and siding.

2. For signs and directory boards, provide exterior-type, Grade B-B high-density concrete form overlay plywood of sized and thicknesses indicated.

3. For fences and vision barriers, provide minimum 3/9” (9.5mm) thick exterior plywood.

4. For safety barriers, sidewalk bridges, and similar uses, provide minimum 5/8” (16mm) thick exterior plywood.

C. Gypsum Wallboard: Provide gypsum wallboard on interior walls of temporary offices.

D. Roofing Materials: Provide UL Class A standard-weight asphalt shingles or UL Class C mineral-surfaced roll roofing on roofs of job-built temporary office, shops, and shed.

E. Paint: Comply with requirements of Division 9 Section “Painting”.

1. For job-built temporary offices, shops, sheds, fences, and other exposed lumber and plywood, provide exterior-grade acrylic-latex emulsion over exterior primer.

2. For sign panels and applying graphics, provide exterior-grade alkyd gloss enamel over exterior primer.

3. For interior walls of temporary offices, provide two (2) quarts interior latex-flat wall paint.

F. Tarpaulins: Provide waterproof, fire-resistant, UL-labeled tarpaulins with flame-spread rating of (15) or less. For temporary enclosures, provide translucent, nylon-reinforced laminated polyethylene or polyvinyl chloride, fire-retardant tarpaulins.

G. Water: Provide potable water approved by local health authorities.

H. Open-Mesh Fencing: Provide 0.120” (3mm) thick, galvanized 2” (50mm) chainlink fabric fencing 6’ (2m) high with galvanized steel pipe posts, 1½” (38mm) ID for line posts and 2½” (64mm) ID for corner posts.

2.2 EQUIPMENT

A. General: Provide new equipment. If acceptable to the Designer, the Contractor may use undamaged, previously used equipment in serviceable condition. Provide equipment suitable for use intended.

B. Water Hoses: Provide ¾” (19mm), heavy-duty, abrasion-resistant, flexible rubber hoses 100’ (30m) long, with pressure rating greater than the maximum pressure of the water distribution system. Provide adjustable shutoff nozzles at hose discharge.

C. Electrical Outlets: Provide properly configured, NEMA-polarized outlets to prevent insertion of 110 to 120V plugs into higher voltage outlets. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button, and pilot light for connection of power tools and equipment.

D. Electrical Power Cords: Provide grounded extension cords. Use hard-service cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage rating.

E. Lamps and Light Fixtures: Provide general service incandescent lamps of wattage required for adequate illumination. Provide guard cages or tempered-glass enclosures where exposed to breakage. Provide exterior fixture where exposed to moisture.

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

G. Temporary Offices: Provide prefabricated or mobile units or similar job-built construction with lockable entrances, operable windows, and serviceable finishes. Provide heated and air-conditioned units on foundations adequate for normal loading.

H. Temporary Toilet Units: Provide self-contained, single-occupant toilet units of the chemical, aerated re-circulation, or combustion type. Provide units properly vented and fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.

I. Fire Extinguishers: Provide hand-carried, portable, UL-rated, Class A fire extinguishers for temporary offices and similar spaces. In other locations, provide hand-carried, portable, UL-rated, Class ABC, dry-chemical extinguishers, or a combination of extinguishers of NFPA-recommended classes for the exposures.

1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.

B. Provide each Facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Engage the appropriate local utility company to install temporary service or connect to existing service. Where company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with company recommendations.

1. Arrange with company and existing users for a time when service can be interrupted, if necessary, to make connections for temporary services.

2. Provide adequate capacity at each stage of construction. Prior to temporary utility availability, provide trucked-in services.

3. Obtain easements to bring temporary utilities to the site where the Owner’s easements cannot be used for that purpose.

4. Use Charges: Cost or use charges for temporary facilities are not chargeable to the Owner or Designer. Neither the Owner nor Designer will accept cost or use charges as a basis of claims for Change Order.

B. Temporary Water Service: Install water service and distribution piping of sizes and pressures adequate for construction until permanent water service is in use.

1. Sterilization: Sterilize temporary water piping prior to use.

C. Temporary Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload-protected disconnects, automatic ground-fault interrupters, and main distribution switch gear.

1. Install electric power service underground, except where overhead service must be used.

2. Power Distribution System: Install wiring overhead and rise vertically where least exposed to damage. Where permitted, wiring circuits not exceeding 125V, AC 20ampere rating, and lighting circuits may be nonmetallic sheathed cable where overhead and exposed for surveillance.

D. Temporary Lighting: When overhead floor or roof deck has been installed, provide temporary lighting with local switching.

1. Install and operate temporary lighting that will fulfill security and protection requirements without operating the entire system. Provide temporary lighting that will provide adequate illumination for construction operations and traffic conditions.

E. Temporary Heating: Provide temporary heat required by construction activities for curing or drying of completed installations or for protection of installed construction from adverse effects of low temperatures or high humidity. Select safe equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce the ambient condition required and minimize consumption of energy.

1. Heating Facilities: Except where the Owner authorizes use of the permanent system, provide vented, self-contained, LP gas or fuel-oil heaters with individual space thermostatic control.

2. Use of gasoline-burning space heaters, open flame, or salamander heating units is prohibited.

F. Temporary Telephones: Provide temporary telephone service throughout the construction period for all personnel engaged in construction activities.

1. Telephone Lines: Provide telephone lines for the following:

a. Where an office has more than two (2) occupants, install a telephone for each additional occupant or pair of occupants.

b. Provide a dedicated telephone for a fax machine in the field office.

c. Provide a separate line for the Owner’s use.

2. At each telephone, post a list of important telephone numbers.

G. Temporary Toilets: Install self-contained toilet units. Use of pit-type privies will not be permitted. Comply with regulations and health codes for the type, number, location,

operation, and maintenance of fixtures and facilities. Install where facilities will best serve the Project's needs.

1. Shield toilets to ensure privacy.
2. Provide separate facilities for male and female personnel.
3. Provide toilet tissue materials for each facility.

H. Wash Facilities: Install wash facilities supplied with potable water at convenient locations for personnel involved in handling materials that require wash-up for a health and sanitary condition. Dispose of drainage properly. Supply cleaning compounds appropriate for each condition.

1. Provide paper towels or similar disposable materials for each facility.
2. Provide covered waste containers for used material.
3. Provide safety showers, eyewash fountains, and similar facilities for convenience, safety, and sanitation of personnel.

I. Drinking-Water Facilities: Provide drinking-water fountains where indicated, including paper cup supply.

J. Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of storm water from heavy rains.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Locate field offices, storage sheds, and other temporary construction and support facilities for easy access.

1. Maintain support facilities until near Substantial Completion. Remove prior to Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the Owner.

B. Field Offices: Provide insulated, weathertight temporary offices of sufficient size to accommodate required office personnel at the Project site. Keep the office clean and orderly for use for small progress meetings. Furnish and equip office as follows:

1. Furnish with a desk and chairs, a 4-drawer file cabinet, plan table, plan rack, and a 6-shelf bookcase.
2. Equip with a water cooler and private toilet complete with water closet, lavatory, and medicine cabinet unit with a mirror.

C. Storage Facilities: Install storage sheds sized, furnished, and equipped to accommodate materials and equipment involved, including temporary utility service. Sheds may be open shelters or fully enclosed spaces within the building or elsewhere onsite.

D. Construction Parking: Parking at the site will be provided in the areas designated at the Pre-Construction Meeting.

E. Dewatering Facilities and Drains: For temporary drainage and dewatering facilities and operations not directly associated with construction activities included under individual Sections, comply with dewatering requirements of applicable Division 2 Sections.

Where feasible, utilize the same facilities. Maintain the site, excavations, and construction free of water.

F. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities.

1. Where heat is needed and the permanent building enclosure is not complete, provide temporary enclosures where there is no other provision for containment of heat. Coordinate enclosure with ventilating and materials drying or curing requirements to avoid dangerous conditions and effects.

2. Install tarpaulins securely with incombustible wood framing and other materials. Close openings of 25SqFt (2.3SqM) or less with plywood or similar materials.

3. Close openings through floor or roof decks and horizontal surfaces with load-bearing, wood-framed construction.

4. Where temporary wood or plywood enclosure exceeds 100SqFt (9.2SqM) in area, use UL-labeled, fire-retardant-treated material for framing and main sheathing.

G. Temporary Lifts and Hoists: Provide facilities for hoisting materials and employees. Truck cranes and similar devices used for hoisting materials are considered “tools and equipment” and not temporary facilities.

H. Project Identification and Temporary Signs: Prepare project identification and other signs of size indicated. Install signs where indicated to inform the public and persons seeking entrance to the Project. Support on posts or framing of preservative-treated wood or steel. Do not permit installation of unauthorized signs.

1. Project Identification Signs: Engage an experienced sign painter to apply graphics. Comply with details indicated.

2. Temporary Signs: Prepare signs to provide directional information to construction personnel and visitors.

I. Temporary Exterior Lighting: Install exterior yard and sign lights so signs are visible when Work is being performed.

J. Collection and Disposal of Waste: Collect waste from construction areas and elsewhere daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Do not hold materials more than seven (7) days during normal weather or three (3) days when the temperature is expected to rise above 80°F (27°C). Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material lawfully.

K. Rodent Pest Control: Before deep foundation work has been completed, retain a local exterminator or pest control company to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests. Employ this service to perform extermination and control procedures are regular intervals so the Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Except for use of permanent fire protection as soon as available, do not change over from use of temporary security and protection facilities to permanent facilities until Substantial Completion, or longer, as requested by the Designer.

B. Temporary Fire Protection: Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of the types needed to protect against reasonable predictable and controllable fire losses. Comply with NFPA 10 "Standard for Portable Fire Extinguishers" and NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations".

1. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one (1) extinguisher on each floor at or near each usable stairwell.

2. Store combustible materials in containers in fire-safe locations.

3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for fighting fires. Prohibit smoking in hazardous fire-exposure areas.

4. Provide supervision of welding operations, combustion-type temporary heating units, and similar sources of fire ignition.

C. Permanent Fire Protection: At the earliest feasible date in each area of the Project complete installation of the permanent fire-protection facility including connected services and place into operation and use. Instruct key personnel on use of facilities.

D. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erection of structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and the public of the hazard being protected against. Where appropriate and needed, provide lighting including flashing red or amber lights.

E. Enclosure Fence: Before excavation begins, install an enclosure fence with lockable entrance gates. Locate where indicated, or enclose the entire site or the portion determined sufficient to accommodate construction operations. Install in a manner that will prevent people, dogs, and other animals from easily entering the site, except by the entrance gates.

1. Provide open-mesh, chainlink fencing with posts set in a compacted mixture of gravel and earth.

2. Provide plywood fence, 8' (2.5m) high, framed with (4) 2"x4" (50mm x 100mm) rails, and preservative-treated wood posts spaced not more than 8' (2.5m) apart.

F. Security Enclosure and Lockup: Install substantial temporary enclosure of partially completed areas of construction. Provide locking entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.

1. Storage: Where materials and equipment must be stored and are of value or attractive for theft, provide a secure lockup. Enforce discipline in connection with the installation and release of material to minimize the opportunity for theft and vandalism.

G. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and

minimize the possibility that air, waterways, and subsoil might be contaminated or polluted or that other undesirable effects might result. Avoid use of tools and equipment that produce harmful noise. Restrict use of noisemaking tools and equipment to hours that will minimize complaints from persons or firms near the site.

3.5 OPERATION, TERMINATION AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.

B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage by freezing temperatures and similar elements.

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

2. Protection: Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.

C. Termination and Removal: Unless the Designer requests that it be maintained longer, remove each temporary facility when the need has ended, when replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with the temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are the Contractor's property. The Owner reserves the right to take possession of project identification signs.

2. Remove temporary paving not intended for or acceptable for integration into permanent paving. Where the area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil in the area. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at the temporary entrances as required by the governing authority.

3. At Substantial Completion, clean and renovate permanent facilities used during the construction period including, but not limited to, the following:

a. Replace air filters and clean inside of ductwork and housing.

b. Replace significantly worn parts and parts subject to unusual operating conditions.

c. Replace lamps burned out or noticeably dimmed by hours of use.

END OF SECTION 01 50 00

SECTION 01 57 00

EROSION CONTROL / STORM WATER POLLUTION PREVENTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Installation of temporary water pollution control measures to prevent discharge of pollutants such as chemicals, fuels, lubricants, bitumen, raw sewage, or other harmful material from the project.

B. Other related documents.

1.2 GENERAL

A. The Contractor shall manage his operations to control water pollution in accordance with this specification and applicable State regulations. Construction of permanent drainage facilities and other contract work, contributing to control of erosion, shall be scheduled at the earliest practicable time.

B. The Contractor shall furnish, install, maintain, and remove temporary erosion control measures. The Contractor shall prevent silt or polluted storm water discharge from the site.

C. The Owner's Representative may require installation of additional erosion control facilities, by the Contractor, if in the sole opinion of the Owner's Representative, the Contractor's efforts are inadequate.

1.3 DEFINITIONS

A. General Permit: The General Permit for storm water discharges associated with construction activity (Land Disturbance General Permit No. MO-R100038) issued to FMDC as a blanket permit by the Missouri Department of Natural Resources, Water Pollution Program.

B. Storm Water Pollution Prevention Plan (SWPPP): A plan required by the General Permit that includes site map(s), an identification of construction/contractor activities that could cause pollutants in the storm water, and a description of measures or practices to control these pollutants.

C. Best Management Practice (BMP): Any program, technology, process, siting criteria, operating method, measure, or device that controls, prevents, removes, or reduces pollution.

D. Temporary Berm: A temporary ridge of compacted soil, with or without a shallow ditch, constructed at the top of slopes or transverse to the centerline of a slope. The berm diverts storm runoff to temporary outlets to discharge water with minimal erosion.

E. Temporary Slope Drain: A temporary facility used to carry water down a slope.

F. Ditch Check: An obstruction placed at frequent intervals across ditches, creating small ponds to cause sediment to settle and be contained.

G. Sediment Basin: An excavated or dammed storage area to trap and store sediment and prevent the discharge of silt.

H. Temporary Seeding and Mulching: Placement of a quick ground cover to reduce erosion in areas expected to be re-disturbed.

I. Straw Bales: Standard agricultural bales used to filter the flow of water, trap, deposit sediment, and/or divert water.

J. Silt Fence: A geotextile barrier fence to contain sediment by removing suspended particles from water passing through the fence.

K. Temporary Pipe: Conduit utilized to carry water under haul roads, silt fences, etc., and prevent equipment from direct contact with water when crossing an active or intermittent stream.

L. Sediment Removal: Removal of accumulated sediment to restore the efficiency of sediment control features.

1.4 SUBMITTALS

A. The Contractor shall review the Storm Water Pollution Prevention Plan (SWPPP) provided by the Designer, make appropriate field corrections to the document, and submit final corrected copies of the SWPPP to the Owner and facility.

1.5 RELATED SECTIONS

A. Section 31 00 00 – Earthwork

PART 2 - PRODUCTS

2.1 MATERIALS

A. Temporary slope drains: Stone, concrete or asphalt gutters, half-round pipe, metal pipe, plastic pipe or flexible rubber pipe.

B. Ditch Checks:

1. Rock ditch checks: 2" to 3" clean gravel or limestone.
2. Straw bale ditch checks: Rectangular wheat straw bales in good condition. Other foliage may be substituted for straw in accordance with MoDOT 802.2.1.
3. Silt fence ditch checks: Geotextile meeting the requirements of this specification.

C. Riprap for Temporary Erosion Control: Type 1 Rock Blanket conforming to MoDOT 611.32.

D. Pipe: Corrugated metal (16 Ga.) or ADS N12 Corrugated Plastic.

E. Temporary Seeding:

1. December 1 to March 1: 50 lbs oats/acre.
2. March 1 to December 1: 50 lbs cereal rye or wheat.
3. Mulch shall be wheat straw.

F. Wire Supported and Self Supporting Silt Fence:

1. Geotextile Fabric

a. Fibers used in geotextiles shall consist of longchain synthetic polymers, composed of at least 85 percent by weight polyolefins, polyesters, or polyamides. They shall be formed into a network such that the filaments or yarns retain dimensional stability relative to each other, including selvages.
b. The geotextile shall be free of any treatment or coating which might adversely alter its physical properties after installation.
c. Geotextile shall be furnished in 36" width rolls.
d. Geotextile rolls shall be furnished with suitable wrapping for protection against moisture and extended ultraviolet exposure.
e. Each roll shall be labeled or tagged to provide product identification sufficient for inventory.
f. Rolls shall be stored in a manner, which protects them from the elements.
g. Geotextile shall conform to the following:

TABLE 1

PHYSICAL REQUIREMENTS[1] FOR

TEMPORARY SILT FENCE GEOTEXTILES

Property	Test Method	Wire Fence Supported Requirements	Self Supported Requirements
Tensile Strength, Lbs.	ASTM D4632	90 Minimum[2]	90 Minimum[2]
Elongation at 50% Minimum Tensile Strength (45 Lbs.)	ASTM D4632	N/A	50 Maximum
Filtering Efficiency, %	VTM-51[3]	75	75
Flow Rate gal/ft/min	VTM-51[3]	0.3	0.3
Ultraviolet Degradation at 500 hrs.	ASTM D4355	Minimum 70% Strength Retained	Minimum 70% Strength Retained

Notes: 1. All numerical values represent minimum average roll value.

A. When tested in any principal direction.

B. Virginia DOT test method.

2. Posts: Wood, steel or synthetic posts may be used. Posts shall have a minimum length of 36" plus embedment depth (24" min.). Posts shall have sufficient strength to resist damage during installation and to support applied loads.
3. Support Fence: Wire or other support fence shall be at least 24" high and strong enough to support applied loads.
4. Prefabricated Fence: Prefabricated fence systems may be used provided they meet all of the above material requirements.

2.2 CERTIFICATION AND SAMPLING:

A. The Contractor shall furnish a manufacturer's certification, stating the material conforms to the requirements of these specifications.

B. The certification shall include, or have attached, typical results of tests for the specified properties, representative of the materials supplied.

C. The Owner's Representative reserves the right to sample and test any material offered for use.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. The Owner's Representative may limit the surface area of erodible earth material exposed by clearing and grubbing, excavation, borrow, or fill operations.

B. The Owner's Representative may direct the Contractor to provide immediate permanent or temporary pollution control measures to prevent contamination of adjacent streams, other watercourses, lakes, ponds, or other areas of water impoundment. Work may involve the construction of temporary berms, dikes, dams, sediment basins, slope drains, use of temporary mulches, seeding or other control devices or methods to control erosion.

C. The Contractor shall incorporate permanent erosion control features at the earliest practicable time.

D. The Contractor at no additional cost shall provide temporary pollution control measures needed to control erosion during normal construction practices to the Owner.

E. Contractor shall designate trained and knowledgable personnel to coordinate all SWPPP activities, and identify these personnel to the Owner's Representative during construction. Missouri Department of Natural Resources offers training classes in Erosion Control free of charge in Jefferson City. Contact for training: David Goggins at (573) 751-2556.

F. The SWPPP is a living document. As the conditions of the site changes, the SWPPP should be updated by the Contractor.

G. The SWPPP is subject to random inspection by the Owner. The SWPPP should be kept up to date by the Contractor and available for inspection at any time.

H. If Contractor determines that any BMP should need modification, the changes shall be dated and documented, and all necessary field changes performed.

3.2 LIMITATION OF AREA DISTURBED:

A. The Contractor's operations shall be scheduled to install permanent erosion control features immediately after clearing and grubbing, and grading.

B. The surface area of erodible earth material exposed at one time by clearing and grubbing, excavating, fill, or borrow shall not exceed 200,000 square feet without written approval of the Owner's Representative.

C. The Owner's Representative may limit the area of clearing and grubbing, excavation, borrow, and embankment operations commensurate with the Contractor's capability and progress in completing the finish grading, mulching, seeding, and other such permanent pollution control measures current.

D. The Contractor shall respond to seasonal variations. If required by weather, temporary erosion control measures shall be taken immediately.

3.3 RIVERS, STREAMS, AND IMPOUNDMENTS:

A. Construction operations in rivers, streams, and impoundments shall be restricted to areas, which must be entered for the construction of temporary or permanent structures.

B. Rivers, streams, and impoundments shall be promptly cleared of falsework, piling, debris, or other obstructions as soon as practical.

C. Frequent fording of live streams with construction equipment will not be permitted.

D. Temporary bridges or other structures shall be used when the Contractor's operations include cycling of equipment across streams, rivers, or impoundments.

E. Mechanized equipment shall not be operated in flowing streams except as required to construct channel changes and temporary or permanent structures.

3.4 BORROW AND WASTE AREAS

A. Material pits other than commercially operated sources and material spoil areas shall be subject to pollution control measures of this specification. An offsite location does not relieve the Contractor of his contractual obligation to prevent the introduction of silt or other pollutants into receiving waterways.

3.5 CONFLICT WITH FEDERAL, STATE OR LOCAL LAWS, RULES OR REGULATIONS

A. In case of conflict between these requirements and pollution control laws, rules, or regulations or other Federal, State or local agencies, the more restrictive laws, rules, or regulations shall apply.

3.6 TEMPORARY BERMS

A. Temporary berms shall be constructed at the top of newly constructed slopes and / or transverse to grade to divert runoff and prevent erosion until permanent controls are installed and / or slopes are stabilized. Two types of temporary berms will be utilized under conditions listed below:

1. Type “A” Berm: At the end of each day’s operations on embankments.
2. Type “B” Berm: At shut down of embankment operations for the winter season or discontinuation of work at the direction of, or with concurrence of the Owner’s Representative.

B. Interceptor berms transverse to centerline may be used when temporary berms are installed on grades in excess of 1 percent and at locations where water is to be carried down the fill slope by temporary or permanent slope drains.

C. Construction Requirements:

1. Type A Berms shall be constructed to the approximate dimensions indicated on the drawings. Berms shall be machine compacted with a minimum of one pass over the entire width with a bulldozer tread, grader wheel, or other approved method.
2. Type “B” Berms shall be constructed to the approximate dimensions indicated on the drawings. These berms shall be machine compacted with a minimum of three passes over the entire width with a bulldozer tread, grader wheel, or other approved method.
3. Type “A” and Type “B” Berms must drain to a compacted outlet at a slope drain. The top width of these berms may be wider and the side slopes flatter on transverse berms to allow equipment to pass over these berms with a minimal disruption.

3.7 TEMPORARY SLOPE DRAINS

A. General:

1. Temporary slope drains are required to concentrate water flowing down a slope prior to installation of permanent facilities. Slope drains shall be placed at approximately 500-foot intervals or as directed by the Owner’s Representative.

B. General Requirements

1. The Contractor shall install a temporary silt fence in locations shown on the drawings, around inlets that accept flow carrying silt, and other locations necessary to prevent the discharge of silt from the site.
2. Installation shall conform to the drawing detail.
3. Fence construction shall be adequate to handle the stress from hydraulic and sediment loading.

C. Construction Requirements:

1. Temporary slope drains shall be anchored to prevent disruption by the force of the water flowing in the drain.
2. The inlet end shall be constructed to channel water into the drain.
3. The outlet ends of these temporary slope drains shall have some means of dissipating the energy of this water to reduce erosion downstream.
4. Unless otherwise directed by the Owner's Representative, temporary slope drains shall be removed when no longer necessary and the site restored to match the surroundings.

3.8 DITCH CHECKS

A. General:

1. Rock ditch checks may be used on ditches with grades of 4 percent or less.
2. Straw bale ditch checks may be used on all ditches.

    a. The silt fence fabric may be eliminated for grades of 2 percent or less.

3. Silt fence ditch check may be used on all ditches.
4. A straw bale ditch check or a silt fence ditch check may be used in lieu of a sediment basin for drainage areas less than two acres. The basin shall have a volume of 1,815 CF per acre of contributing drainage area.

B. Construction Requirements:

1. Construct rock ditch checks in accordance with the drawing detail.

    a. Achieve complete coverage of the ditch or swale and insure the center of the check is lower than the edges.

2. Construct straw bale ditch checks in accordance with the drawing detail.
3. Construct silt fence ditch checks in accordance with the drawing detail.

C. Maintenance:

1. Inspect ditch checks for sediment accumulation after each rainfall.
2. Sediment shall be removed when it reaches one-half of the original height.

    a. Regular inspections shall insure that the center of a rock check is lower than the edges. Correct erosion caused by high flows around the edges of the check immediately.

3.9 SEDIMENT BASIN

A. General

1. Sediment basins are used for drainage areas of two (2) to five (5) acres or for a roadway ditch exceeding 1,000 consecutive feet in length. Break larger drainage areas or longer ditches into smaller areas.

B. Construction Requirements:

1. The area where a sediment basin is to be constructed shall be cleared of vegetation.
2. Construct the inlets of sediment basins with a wide cross-section and a minimum grade to prevent turbulence and allow deposition of soil particles.

    a. The minimum depth is 2'; the maximum depth is 6'.
    b. The minimum width is 5'; the maximum width is 20'.
    c. The minimum length is 25'; the maximum length is 200'.
    d. The minimum volume shall be 1,815 CF per acre of drainage area.

3. Sediment basins shall remain in service until all disturbed areas draining into the structure have been stabilized.
4. When use of sediment basin is discontinued, backfill all excavations and compact fill. Fill material shall be removed and the existing ground restored to the original or plan grade.
5. Maintenance
6. When the depth of sediment reaches 1/3 of the depth of structure in any part of the pool, all accumulation shall be removed.
7. Removed sediment shall be disposed of in locations that the sediment will not erode into the construction areas or into natural waterways. The same holds true for excavated material removed during construction of the sediment basin.

3.10 TEMPORARY SEEDING AND MULCHING

A. General

1. This item is applicable to all projects.
2. Seeding and/or mulching shall be a continuous operation on all cut slopes, fill slopes, and borrow pits during the construction process. All disturbed areas shall be seeded and mulched within five (5) working days after the last construction activity in all locations where necessary to eliminate erosion.

B. Construction Requirements:

1. Permanent seeding and mulching following temporary seeding will be performed during the favorable seeding seasons only.
2. Temporary seeding mixtures and planting season:

    a. December 1 to March 1: 50 lbs. oat grain per acre
    b. March 1 to December 1: 50 lbs. (cereal rye or wheat) per acre

3. Temporary mulch, fertilizer, and lime for seeding:

    a. Fertilizer and mulch for temporary seed mixtures shall be applied in accordance with Section 02921.
    b. Fertilizer shall be applied at the rate specified for permanent seeding.
    c. Lime will not be required for temporary seeding.

3.11 STRAW BALES

A. General

1. Install at the bottom of embankment slopes less than 10' high to divert runoff from sheet flow and intercept some of the sediment in the sheet flow.
2. Install as ditch checks in small ditches and drainage areas.
3. Install on the lower side of cleared areas to catch sediment from sheet flow.

B. Construction Requirements:

1. Bales of straw shall be utilized to control erosion, trap sediment, and divert runoff.
2. Bales must be adequately braced from behind.

3.12 SILT FENCE

A. General

1. Install along the toe of fills over 10' in height, along the right-of-way line, parallel to streams or around an inlet to prevent sediment from entering the pipe system.

B. General Requirements:

1. The Contractor shall install a temporary silt fence in locations shown on the drawings, around inlets that accept flows containing silt, and other locations necessary to prevent the discharge of silt from the site.
2. Installation shall conform to the detail at the end of this section.
3. Fence construction shall be adequate to handle the stress from hydraulic and sediment loading.

C. Installation

1. Geotextile at the bottom of the fence shall be buried as indicated on the detail.
2. The trench shall be backfilled and the soil compacted over the geotextile. The geotextile shall be spliced together as indicated on the detail.
3. Post Installation

    a. Post spacing shall not exceed 8' for wire support fence installation or 5' for self supported installations.
    b. Posts shall be driven a minimum of 24" into the ground. Where rock is encountered, posts shall be installed in a manner approved by the Owner’s Representative.
    c. Closer spacing, greater embedment depth and/or wider posts shall be used in low areas, soft, or swampy ground to ensure adequate resistance to applied loads.
4. When support fence is used, the mesh shall be fastened securely to the upstream side of the post.

    a. The mesh shall extend into the trench a minimum of 2" and extend a maximum of 36" above the original ground surface.

5. When self-supported fence is used, the geotextile shall be securely fastened to fence posts.

6. Maintenance

   a. The Contractor shall maintain the integrity of silt fences as long as they are necessary to contain sediment runoff.
   b. The Contractor shall inspect all temporary silt fences immediately after each rainfall and at least daily, during prolonged rainfall.
   c. The Contractor shall immediately correct deficiencies.
   d. The Contractor shall make a daily review of the location of silt fences in areas where construction activities have changed the natural contour and drainage runoff to ensure that the silt fences are properly located for effectiveness.
   e. Where a single fence is not adequate to handle the volume of silt or flows are not completely intercepted, additional silt fences shall be installed.

7. The Contractor shall remove and dispose of sediment deposits when the deposit approaches one-half the height of the fence.
8. The silt fence shall remain in place until the upstream surface is stabilized. Upon removal, the Contractor shall remove the silt fence, dispose of excess silt, and restore the disturbed area in accordance with Section 02921.

3.13 TEMPORARY PIPE

A. General:

1. The Contractor shall install temporary pipes and fill at locations, to be crossed by the Contractor's equipment, which carry a concentrated flow during rain events.

B. Construction Requirements:

1. All temporary pipes shall be installed in the same manner as permanent pipe is installed on the project to assure that the water does not cause erosion around the pipe.
2. Material to backfill the pipe should be placed in 6" lifts and mechanically compacted. Compaction testing will not be required.

3.14 SEDIMENT REMOVAL

A. General

1. Sediment deposits shall be removed when:

   a. The deposits reach approximately one-half the height of a ditch check, straw bale barrier or silt fence.
   b. The sediments have reduced the ponded volume of sediment basins to one-third of the original volume.
   c. Requested by the Owner's Representative.

B. Sediment removed from erosion control features shall be deposited in a location where it will not erode into construction areas or watercourses.

END OF SECTION 01 57 00

SECTION 01 74 00

CLEANING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for cleaning during the Project.

B. Environmental Requirements: Conduct cleaning and waste-disposal operations in compliance with local laws and ordinances. Comply fully with federal and local environmental and anti-pollution regulations.

1. Do not dispose of volatile wastes, such as mineral spirits, oil, or paint thinner, in storm or sanitary drains.
2. Burning or burying of debris, rubbish, or other waste material on the premises is not permitted.

PART 2 - PRODUCTS

2.1 MATERIALS

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

PART 3 - EXECUTION

3.1 PROGRESS CLEANING

A. General

1. Retain all stored items in an orderly arrangement allowing maximum access, not impending drainage or traffic, and providing the required protection of materials.
2. Do not allow the accumulation of scrap, debris, waste material, and other items not required for construction of this Work.
3. At least **twice** each month, and more often if necessary, completely remove all scrap, debris, and waste material from the job site.
4. Provide adequate storage for all items awaiting removal from the job site, observing all requirements for fire protection and protection of the ecology.

B. Site:

1. Daily, inspect the site and pick up all scrap, debris, and waste material. Remove all such items to the place designated for their storage.

2. Weekly, inspect all arrangements of materials stored on the site. Re-stack, tidy, or otherwise service all material arrangements.

3. Maintain the site in a neat and orderly condition at all times.

C. Structures:

1. Daily, inspect the structure and pick up all scrap, debris, and waste material. Remove all such items to the place designated for their storage.

2. Weekly, sweep all interior spaces clean. "Clean," for the purposes of this paragraph, shall be interpreted as meaning free from dust and other material capable of being removed by use of reasonable effort and handheld broom.

3. In preparation for installation of succeeding materials, clean the structures or pertinent portions thereof to the degree of cleanliness recommended by the manufacturer of the succeeding material, using all equipment and materials required to achieve the required cleanliness.

4. Following the installation of finish materials, clean the area daily while work is being performed in the space in which materials have been installed. "Clean," for the purposes of this subparagraph, shall be interpreted as meaning free from all foreign material which, in the opinion of the Construction Representative, may be injurious to the finish of the finish material.

3.2 FINAL CLEANING

A. General: Provide final cleaning operations when indicated. Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit of Work to the condition expected from a commercial building cleaning and maintenance program. Comply with manufacturer's instructions.

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

1. Clean the Project Site, yard and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and foreign substances.

2. Sweep paved areas broom clean. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.

3. Remove petrochemical spills, stains, and other foreign deposits.

4. Remove tools, construction equipment, machinery, and surplus material from the site.

5. Remove snow and ice to provide safe access to the building.

6. Clean exposed exterior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.

7. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.

8. Broom clean concrete floors in unoccupied spaces.

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

10. Remove labels that are not permanent labels.

11. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.

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

12. Wipe surfaces of mechanical and electrical equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.

13. Clean plumbing fixtures to a sanitary condition free of stains, including stains resulting from water exposure.

14. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.

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

16. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs and defective and noisy starters in fluorescent and mercury vapor fixtures.

17. Leave the Project clean and ready for occupancy.

18. Magnet sweep areas subject to roofing activities to remove debris that may cause harm to public or damage to vehicles or maintenance equipment.

C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid the Project of rodents, insects, and other pests. Comply with regulations of local authorities.

D. Removal of Protection: Remove temporary protection and facilities installed during construction to protect previously completed installations during the remainder of the construction period.

E. Compliances: Comply with governing regulations and safety standards for cleaning operations. Remove waste materials from the site and dispose of lawfully.

1. Where extra materials of value remain after Final Acceptance by the Owner, they become the Owner's property.

END OF SECTION 01 74 00

SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:
   1. Recycling nonhazardous demolition and construction waste.
   2. Disposing of nonhazardous demolition and construction waste.

B. Related Requirements:

   1. All applicable specification sections.

1.3 DEFINITIONS

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

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

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

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

1.4 PERFORMANCE REQUIREMENTS

A. General: Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials**,** including the following:

   1. Demolition Waste:

      a. Concrete.
      b. Concrete reinforcing steel.
      c. Brick.
      d. Concrete masonry units.
      e. Metal Roofing.
      f. Windows.
      g. Electrical conduit.
      h. Copper wiring.

2. Construction Waste:

   a. Masonry and CMU.
   b. Metals.
   c. Metal Roofing.
   d. Insulation.
   e. Piping.
   f. Electrical conduit.
   g. Packaging: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:

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

1.5 QUALITY ASSURANCE

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

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

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

1.6 WASTE MANAGEMENT PLAN

A. General: Develop a waste management plan according to ASTM E 1609 and requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

B. Waste Identification: Indicate anticipated types and quantities of demolition and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.

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

1. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept.
2. Disposed Materials: Indicate how and where materials will be disposed of.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

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

1. Comply with operation, termination, and removal requirements in Section 015000 "Temporary Facilities and Controls."

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

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

1. Distribute waste management plan to everyone concerned within 10 days of submittal return.
2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

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

1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, or disposed of.
2. Comply with Section 015000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 DISPOSAL OF WASTE

A. General: Presidential Executive Order 13514 “Federal Leadership in Environmental, Energy, and Economic Performance”, 8 October, 2009 previously required the diversion of at least 50% by weight of all construction and demolition materials and debris by the end of fiscal year 2015. Therefore, the Contractor shall make all reasonable efforts to recycle and recover Construction and Demolition (C&D) waste from this project. Records shall be maintained to document the quantity of waste generated, the quantity of waste diverted through sale, reuse, or recycling, and the quantity of waste disposed of by landfill or incineration.

1. All records must be provided to the project manager upon project completion.

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

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

C. Burning: Do not burn waste materials.

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

END OF SECTION 017419

SECTION 02 41 00

DEMOLITION

PART 1 - GENERAL

1.01 SUMMARY

A. Provide demolition work of existing conditions, complete, as indicated, specified, and required for new work, including removal and legal disposal of demolished materials.

B. Selective Site Demolition: (Where indicated.)
   1. Demolition of site improvements including paving, gravel, curbing, and utility structures.
   2. Demolition of below-grade foundations and site improvements to depth to avoid conflict with new construction or site work.
   3. Removal of hollow items or items which could collapse.
   4. Protection of site work and adjacent structures.
   5. Disconnection, capping, and removal of utilities.
   6. Removal and legal disposal of materials.

1.02 SUBMITTALS

A. Comply with Section 01 33 00.

B. Upon request, submit documentation of proper disposal of demolition materials and terminating utilities.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations for demolition of structure, safety of adjacent structures, dust control, service utilities, discovered hazards, and environmental requirements. Use experienced workers.

1.04 PROJECT CONDITIONS

A. Immediate areas of work will not be occupied during demolition. Adjacent areas may be occupied by the public.

PART 2 - PRODUCTS - Not Applicable To This Section

PART 3 - EXECUTION

3.01 DEMOLITION

A. Do not damage building elements and improvements indicated to remain. Items of salvage value, not included on schedule of salvage items to be returned to Owner, shall be removed from structure. Storage or sale of items at project site is prohibited.

B. Do not close or obstruct streets, walks, drives or other occupied or used spaces or facilities without the written permission of the Owner and the authorities having jurisdiction. Do not

interrupt utilities serving occupied or used facilities without the written permission of the Owner and authorities having jurisdiction. If necessary, provide temporary utilities.

C. Cease operations if public safety or remaining structures are endangered. Perform temporary corrective measures until operations can be continued properly.

D. Provide adequate protection against accidental trespassing. Secure project after work hours.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE-CONCRETE

PART 1 – GENERAL

1.01 SUMMARY

A. Provide cast-in-place concrete for general building construction where indicated on drawings and specifications:
   1. Footings, foundations, piers and retaining walls (where indicated).
   2. Building slabs on ground supported concrete foundation systems (where indicated).
   3. Requirements (materials, mixes, finishes) apply to concrete work specified in other sections; refer to individual sections for reference.

1.02 SUBMITTALS

A. Comply with Section 01 33 00.

B. Product Data: Submit manufacturer's data and installation instructions for the following items when used:
   1. Concrete admixtures.
   2. Curing, sealers, hardeners and densifiers.
   3. Miscellaneous materials.

C. Shop Drawings: Submit concrete reinforcement fabrication, bending and placement. Comply with ACI 315 showing bar schedules, stirrup spacing, diagrams of bent bars, and arrangement of concrete reinforcement.

D. Concrete Mix Design: Submit concrete mix design for each strength or composition of concrete to be used.

E. Installer Qualifications: Submit personnel and supervisor ACI certifications.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

B. Standards: Comply with the provisions of the following specifications and standards, except as otherwise noted or specified, or as accepted or directed by the Architect.
   1. ACI 211, Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
   2. ACI 301, Specifications for Structural Concrete.
   3. ACI 305.1, Standard Specifications for Hot Weather Concreting.
   4. ACI 306.1, Standard Specifications for Cold Weather Concreting.
   5. ACI 318, Building Code Requirements for Structural Concrete and Commentary.

6. ASTM A615, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
7. ASTM A1046, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain, and Deformed, for Concrete.
8. ASTM C31, Standard Practice for Making and Curing Concrete Test Specimens in the Field.
9. ASTM C33, Standard Specification for Concrete Aggregates.
10. ASTM C42, Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
11. ASTM C94, Standard Specification for Ready-Mixed Concrete.
12. ASTM C114, Standard Test Methods for Chemical Analysis of Hydraulic Cement.
13. ASTM C171, Standard Specification for Sheet Materials for Curing Concrete.
14. ASTM C150, Standard Specification for Portland Cement.
15. ASTM C138, Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
16. ASTM C143, Standard Test Method for Slump of Hydraulic-Cement Concrete.
17. ASTM C173, Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
18. ASTM C231, Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
19. ASTM C260, Standard Specification for Air-Entraining Admixtures for Concrete.
20. ASTM C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
21. ASTM C494, Standard Specification for Chemical Admixtures for Concrete.
22. ASTM C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
23. ASTM C1293, Standard Test Method for Determination of Length Change of Concrete Due to Alkali-Silica Reaction.
24. ASTM C1315, Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
25. ASTM C1602, Standard Specification for Mixing Water Used in Production of Hydraulic Cement Concrete.
26. ASTM D1751, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
27. ASTM E1155, Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers.
28. ASTM E1745, Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.
29. Concrete Reinforcing Steel Institute, Manual of Standard Practice.
30. Environmental Protection Agency (EPA) volatile organic compound (VOC) evaporation requirements.

C. Concrete Installer Qualifications:
1. A qualified installer who employs Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
2. Assign experienced mechanics from previous applications including lead mechanic. These personnel shall be on site at all times while work is being performed.

D. Pre-Installation Conference:
   1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
      a. Contractor's superintendent.
      b. Independent testing agency responsible for concrete design mixtures.
      c. Ready-mix concrete manufacturer.
      d. Concrete Subcontractor.
      e. Joint filling contractor.
   2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semi-rigid joint fillers, forms and form removal limitations, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, methods for achieving specified floor and slab flatness and levelness, floor and slab flatness and levelness measurement, concrete curing procedures, concrete repair procedures, and concrete protection plan.
   3. Minutes of the meeting shall be recorded, typed and printed by the contractor and distributed by him to all parties concerned within 5 days of the meeting. One copy of the minutes shall also be transmitted to the following for information purposes: Owner's representative, Architect, and Structural Engineer.
   4. The minutes shall include a statement by the concrete contractor indicating that the proposed mix design(s), and placing, finishing and curing procedures can produce the concrete quality required by these specifications

E. Carbon Monoxide / Carbon Dioxide Exposure: General Contractor shall be responsible for monitoring interior concrete floor exposure to excessive exhaust gases containing carbon dioxide (CO2) or carbon monoxide (CO). To minimize potential damage to interior concrete floor during slab placement and curing periods, maximum CO2 levels shall be 4,500 parts per million and maximum CO levels shall be 15 parts per million at concrete surface within 5 feet of any source of exhaust gases. Unvented combustion heaters shall not be in operation during concrete placement and equipment inside the building during concrete placement shall be limited to the equipment necessary to place and finish concrete. Only two concrete trucks shall be in the building at any given time and under no circumstance shall there be any earth moving equipment, dump trucks, grading equipment, or any other motorized equipment in operation until after the interior concrete floor is placed and protected by specified curing method. Carbon Monoxide and Carbon Dioxide shall be checked using an appropriate meter and results documented.

1.04 FIELD SAMPLING AND TESTING

A. Comply with Section 01 45 33 – Special Inspections and Procedures.

B. Testing Laboratory and Reporting: Owner shall employ a qualified independent testing laboratory to perform material evaluations of sampling and testing specified. Submit test results within 7 days of obtaining data. Laboratory Strength Test reports shall contain the following information:
   3. Batch plant identification.
   4. Project identification.

5. Date of testing.
6. Sample identification and location within construction.
7. Design mix used including materials, water / cement ratio, admixtures, and recorded slump.
8. Compressive strength results, developed at 7 days and 28 days.

C. Samples:
1. Field samples shall be made and cured in accordance with ASTM C31, for each concrete strength, at the rate of minimum 3 test cylinders and one slump test for each 40 cubic yards or fraction thereof, from each day's pour and record locations for report.
2. Test slump in accordance with ASTM C143.
3. Test density in accordance with ASTM C138.
4. Test temperature in accordance with ASTM C1064.
5. Test air content in accordance with ASTM C173 Volumetric Method, or ASTM C231 Pressure Method. Test air content each time test cylinders are made.
6. Test compression strength in accordance with ASTM C39.
7. Test cylinders (6in. X 12 in.) shall be as follows: One (1) at 7 days, two (2) at 28 days, and reserve the remaining for testing after a longer period as required by the Owner if the 28 day test does not meet the required strength. If test cylinders (4 in. X 8 in.) are cast then One (1) at 7 days, three (3) at 28 days, with no reserve for testing after a longer period. Either coring may be performed or an additional three (3) cylinders may be requested by the Owner for the resolution of 28 day test cylinders that do not meet the required strength.
8. When early form removal is requested, field cure cylinders tested at 7 or less days to determine sufficient strength.
9. Additionally, test slump every 25 cu. yd., recording locations and data for report.
10. The taking of samples from small pours of 10 cubic yards or less may be omitted at the discretion of the Architect.

D. Testing:
1. Where strength of any group of 3 cylinders falls below minimum compressive strength specified, the Owner shall have the right to require that test specimens be cut from the structure. Specimens shall be selected by Owner from location in structure represented by test specimen or specimens which failed.
2. Specimens shall be secured, prepared, and tested in accordance with ASTM C42, within a period of 60 days after placing concrete.
3. Concrete shall be considered to meet the strength requirements of this specification if the following are satisfied:
   a. Every arithmetic average of any three consecutive strength tests equals or exceeds fc'.
   b. No strength test falls below fc' by more than 500 psi if fc' is 5000 psi or less, or by more than 0.10fc' if fc' exceeds 5000 psi.
4. Should laboratory analysis indicate that the proper concrete mix has not been used by the Contractor, all such concrete poured using the improper mix shall be subject to rejection.
5. The cost of coring specimens from the structure, patching the resulting holes, and making the laboratory analysis shall be borne by the Contractor.
6. The holes from which the cored samples are taken shall be packed solid with no slump concrete proportioned with the same design strength as the specified concrete.

7. If any of the specimens cut from the structure fail to meet the requirements outlined in ACI 318. The Owner shall have the right to require any and all defective concrete to be replaced and all cost resulting therefrom shall be borne by the Contractor.
8. Additional Sampling: In addition to the slump tests specified above, the Contractor shall keep a cone (mold) and rod apparatus on the job site for random testing of batches. When concrete does not meet the specified slump requirements, and when directed by the Architect, immediately perform a slump test in accordance with ASTM C143. Concrete not meeting the slump requirements shall be removed from the job site.

PART 2 – PRODUCTS

2.01 FORM MATERIALS

A. Form Materials:
   1. For Exposed Finish Concrete: Plywood, metal or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces.
   2. For Unexposed Finish Concrete: Use plywood, lumber, metal, or other acceptable material. If lumber is used, it must be dressed on at least 2 edges and 2 sides for a tight fit.

B. Form Release: Commercial formulated release coating that will not bond with, stain, nor adversely affect concrete surfaces, will not impair subsequent treatments or finishes requiring bond or adhesion, nor impede wetting of concrete surfaces by water or curing compound. Comply with Environmental Protection Agency (EPA) volatile organic compound (VOC) evaporation requirements.

2.02 REINFORCEMENT MATERIALS

A. Steel Reinforcement:
   1. Refer to drawings for reinforcement sizes and spacing.
   2. Reinforcing Bars: ASTM A615(S1), Grade 60, deformed billet steel bars of grades as indicated on the drawings, free from loose rust, scale and other coatings that may reduce bond.
   3. Mesh or Fabric Reinforcement: ASTM A1064, welded wire reinforcement.
   4. Tie Wires: Soft annealed iron wire not smaller than 18 gauge.
   5. Fiber Reinforcement: (<u>NOT PERMITTED</u>).

B. Accessories: Include all spacers, chairs, ties, and other devices necessary for properly spacing and fastening reinforcement in place. Use plastic protected reinforcing bar supports conforming to CRSI Class 1 specification for exposed finish concrete.

2.03 CONCRETE MATERIALS

A. Concrete Materials:
   1. Portland Cement: ASTM C150, Type I or Type I/II, color gray unless otherwise indicated.
   2. Supplementary Cementitious Materials: (Note: Fly ash and silica fume are not permitted for exposed exterior surfaces where finish appearance is an important factor. White silica fume may be used.)

a. Fly Ash Admixture: Use of quality fly ash by weight will be permitted as a cement reducing admixture by 20% maximum. Provide fly ash meeting requirements of ASTM C618, Class C or Class F with the following special requirements. Loss on ignition in Table I shall not exceed 3%. Compliance to Table IA shall apply. Amount retained on the 325 sieve in Table 2 shall not exceed 20%. Chemical analysis of the fly ash shall be reported in accordance with ASTM C114. Submit report indicating for a 6 month period immediately prior to submittal date, weekly test and tests results performed on concrete with fly ash admixture. Fly ash shall not be permitted in concrete to receive dry shake hardeners.
a. Silica Fume: ASTM C1240.
b. Slag Cement: ASTM C989.
c. Metakaolin: ASTM C618, Class N.

3. Normal Weight Concrete Aggregates: ASTM C33, Class 4S, and the following:
   a. Fine Aggregate: Clean, sharp, natural or manufacturer sand, free from loam, clay, lumps, or other deleterious substances.
   b. Coarse Aggregate: Clean, uncoated, processed, locally available, non-reactive aggregate, containing no clay, mud, loam, or foreign matter; maximum size 1-1/2".
   c. Combined aggregate gradation for slabs and other designated concrete shall be 8% - 18% for large top size aggregates (1½ in.) or 8% - 22% for smaller top size aggregates (1 in. or ¾ in.) retained on each sieve below the top size and above the No. 100.
4. Mixing Water: ASTM C1602. Clean, free from oil, acid, salt, injurious amounts of vegetable matter, alkalies, and other impurities; potable.

B. Admixtures:
2. Air Entrained Admixture:
   a. ASTM C260.
   b. Manufacturers:
      i. Euclid: Aea Series.
      ii. Master Builders: MasterAir Series.
      iii. W.R. Grace: Dorex AEA.
      iv. Sika Chemical: Sika Aer.
3. Water-Reducing Admixture:
   a. ASTM C494, Type A.
   b. Manufacturers:
      i. Euclid: Eucon or Plastol Series.
      ii. Master Builders: MasterPozzolith , MasterPolyheed Series.
      iii. W.R. Grace: WRDA, Daracem, Mira, Zyla, or Adva Series.
      iv. Sika Chemical: Plastiment, Plastocrete, ViscoCrete, Sikaplast, or Sikament Series.
4. Retarding or Water-Reducing and Retarding Admixture:
   a. ASTM C494, Type B or D.
   b. Manufacturers:
      i. Euclid: Eucon Retarder 75.
      ii. Master Builders: MasterSet R Series or MasterSet DELVO Series.
      iii. W.R. Grace: Recover or Daratard 17.
      iv. Sika Chemical: Plastiment or Plastocrete Series.
5. Accelerating or Water-Reducing and Accelerating Admixture:
   a. ASTM C494, Type C or E. (Non-Corrosive, Non-Chloride only permitted)

b. Manufacturers:
   i. Euclid: Accelguard Series.
   ii. Master Builders: MasterSet FP 20 or MasterSet AC 534.
   iii. W.R. Grace: Daraset, Daracel, Lubricon, Polarset, or DCI Series.
   iv. Sika Chemical: Plastocrete 161 FL, Plastocrete 161 HE, Sikaset NC, Sika Rapid 1, or Sikaset HE.

6. High-Range Water-Reducing or High-Range Water-Reducing and Retarding Admixture (Super Plasticizer):
   a. ASTM C494, Type F or G.
   b. Manufacturers:
      i. Euclid: Eucon Series.
      ii. Master Builders: Master Rheobuild 1000 or MasterGlenium Series.
      iii. W.R. Grace: ADVA Series.
      iv. Sika Chemical: Sikament or ViscoCrete Series.
7. Workability-Enhancing Admixture:
   a. ASTM C494, Type S. Shall retain concrete workability without affecting time of setting or early-age strength development.
   b. Manufacturers:
      i. Euclid:
      ii. Master Builders: MasterSure Z 60.
      iii. W.R. Grace:
      iv. Sika Chemical:
8. Alkali-Silica Reactivity Inhibitor:
   a. ASTM C494, Type S. Formulated lithium nitrate admixture containing a nominal content of 30% for the prevention of alkali-silica reactivity (ASR) in concrete.
   b. Manufacturers:
      i. Euclid: Eucon Integral ARC.
      ii. Master Builders: MasterLife ASR 30.
      iii. W.R. Grace: RASir.
9. Corrosion-Inhibiting Admixtures: Shall be a nominal 30 percent solution of calcium nitrite or an amine ester-based organic corrosion-inhibiting admixture.
      i. Euclid:
      ii. Master Builders: MasterLife CI 30 or MasterLife CI 222.
      iii. W.R. Grace:
      iv. Sika Chemical:
10. Permeability-Reducing Admixture:
   a. ASTM C494, Type S.
   b. Manufacturers:
      i. Euclid:
      ii. Master Builders: MasterLife 300 Series.
      iii. W.R. Grace:
      iv. Sika Chemical:
11. Viscosity-Modifying Admixture:
   a. ASTM C494, Type F or G.
   b. Manufacturers:
      i. Euclid:
      ii. Master Builders: MasterMatrix VMA Series.
      iii. W.R. Grace:
      iv. Sika Chemical:

12. Prohibited Admixtures: Calcium chloride, thiocyanates or admixtures containing intentionally added chloride ions. Upon request provide admixture manufacturer's written certification that chloride ion content complies with specified requirements.
13. Other Admixtures: Do not use other admixtures unless accepted in writing by Architect.

2.04 PROPORTIONING OF MIXES, BATCHING AND MIXING

A. Concrete Mix Design:
   1. Prepare design mixes for each type of concrete, in accordance with ACI 301 and ACI 318, except as otherwise specified.
   2. Proportion design mixes by weight for class of concrete required, complying with ACI 211, except as otherwise specified.
   3. Proposed mix designs shall be accompanied by complete standard deviation analysis or trial mixture test data. Submit written reports to the Architect for design mix at least 15 calendar days prior to the start of work. If trial batches are used, gross weight and yield per cu. yd. of trial mixtures. Proposed mix design shall list the following information.
      a. Batch plant identification and location.
      b. Concrete materials and water-cementitious materials ratios.
      c. Strength. Compressive strength at 7 days and 28 days.
      d. Measured slump.
      e. Air content range.
      f. Admixtures used.

B. Compressive Strength: Minimum concrete strength shall be 3,500 psi at 28 days in accordance with ASTM C94, unless otherwise noted on drawings.

C. Water-Cementitious Materials Ratio:
   1. Concrete subject to freezing and thawing shall have a maximum water-cementitious material ratio of 0.48 by weight (4,000 psi at 28 days).
   2. All concrete subjected to deicers and/or required to be watertight shall have a maximum water-cementitious material ratio of 0.40 (5000 psi at 28 days or more).
   3. All reinforced concrete subjected to brackish water, salt spray or deicers shall have a maximum water-cementitious ratio of 0.40 (5000 psi at 28 days or more).
   4. All trowel finished interior slabs, subjected to vehicular traffic, shall have a maximum water-cementitious ration of 0.53.
   5. <u>No water shall be added to ready-mix concrete at the job site.</u>

D. Air-Entrainment: Use air-entrained admixture in strict compliance with manufacturer's directions.
   1. All concrete exposed to freezing and thawing shall have an air content of 4.5% to 7.5%.
   2. All interior slabs and slabs to receive dry shake hardeners shall have an air content of 3% maximum.

E. Admixture Usage: Use admixtures in strict compliance with manufacturer's directions.
   1. All admixtures shall be plant batched and mixed, ready for placement upon arrival to job site. No field batching and mixing permitted without written authorization from the Architect.

2. Concrete for interior floor slabs must contain specified mid-range or high range water-reducing admixture (superplasticizer).
3. All Concrete less than 8 inches thick, and slabs placed at air temperatures below 50° F shall contain specified non-corrosive non-chloride accelerator.
4. Concrete required to be air entrained shall contain an approved air-entraining admixture.
5. Pumped concrete, architectural concrete, concrete required to be watertight, and concrete with water-cementitious materials ratio below 0.50 shall contain specified high-range water- reducing admixture (superplasticizer).

F. Slump Limits:
1. Concrete containing no water-reducing admixture shall have slump of 4", plus or minus 1".
2. Concrete containing mid-range water-reducing admixture shall have a maximum slump of 6", plus or minus 1".
3. Concrete containing high-range water-reducing admixture shall have a maximum slump of 8", plus or minus 1".
4. Concrete receiving a "dry shake" harder shall have a maximum slump of 3" to 4".

G. Batching and Mixing: Concrete shall be ready-mixed in accordance with ACI 318. No hand mixing allowed.

2.05 CURING MATERALS

A. General:
1. Provide products compatible with finish flooring materials or special finish systems. Refer to drawing finish schedule for types and locations.
2. Comply with Environmental Protection Agency (EPA) volatile organic compound (VOC) evaporation requirements.
3. Reactive silicate based products are prohibited for use as curing compounds.

B. Water: Potable.

C. Absorptive Cover: AASHTO M182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

D. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.

E. Evaporation Retarder:
1. Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
2. Coverage Rate: Per manufacturer's recommendations.
3. Manufacturers: Master Builders "MasterKure ER 50", Euclid "EUCOBAR", W.R. Meadows "EVAPRE", or approved equal.

F. Curing Materials: (Used on freshly placed interior concrete surfaces to receive tile, resilient flooring, or additional surface treatments and finishing which ALLOW proper dissipation of curing material.)

1. Dissipating resin curing compound, ASTM C309, Type I, with fugitive dye. Film must chemically break down within 30 day period when exposed to UV conditions.
2. Coverage Rate: Per manufacturer's recommendations, but not less than 300 sq. ft. per gallon.
3. Manufacturers: Euclid "Kurex DR 100", L&M "Cure R", ChemMasters "Spray-Cure Clear", Sierra TK Products "TK-2519 DC WB", or approved equal.

G. Curing and Sealing Materials: (Used on exterior exposed concrete surfaces of slabs, curbs, sidewalks, and interior concrete surfaces NOT subject to additional surface treatments and finishing.)
1. High solids curing and sealing compound, ASTM C1315, transparent, acrylic, solvent-based, 30% minimum solids content, moisture loss of not more than 0.40 kg/sq. meter. when applied at coverage rate of 300 sq. ft. per gallon.
2. Coverage Rate: Per manufacturer's recommendations, but not less than 300 sq. ft. per gallon minimum.
3. Manufacturers: Euclid "Super Aqua-Cure VOX", BASF "Kure-N-Seal 30", L&M "Dress & Seal WB30", or approved equal.

2.06 LIQUID FLOOR TREATMENTS

A. Additional Surface Treatments and Finishing Materials:
1. Liquid Densifier Treatment Materials: (Used on interior concrete as an exposed finish.)
a. Penetrating concrete densifier, odorless, colorless, non-yellowing sodium silicate solution designed to harden, dustproof and protect concrete floors.
b. Coverage Rate: Per manufacturer's recommendations, but not more than 225 sf. ft. per gallon minimum.
c. Manufacturers: Curecrete Distribution "Ashford Formula", Euclid "Eucosil", L&M "Sealhard", Prosoco "Consolideck Blended Densifier", or approved equal.

2.07 MISCELLANEOUS MATERIALS

A. Accessories:
1. Connectors: Provide all metal connectors required for placement in cast-in-place concrete, for the attachment of structural and non-structural members.
2. Reglets: Fabricated reglets of not less than 0.022 inch thick, galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

B. Expansion and Isolation Joint Filler Strips:
1. ASTM D1751, non-extruding premoulded material, ½" thick, unless otherwise noted, composed of fiberboard impregnated with asphalt, except use ASTM D1752, Type II, resin-bound cork for walks and other exposed areas.
2. Manufacturers: Sonneborn "Sonoflex F" closed cell polyurethane foam expansion joint filler or approved equal.

C. Semi-rigid Joint Filler:
1. Comply with Section 07 92 00.

2. Two-component, semirigid, 100 percent solids, epoxy resin with Shore A durometer hardness of 80 in accordance with ASTM D2240.

D. Vapor Barrier:
1. Sheet type conforming with ASTM E1745, Class A, tensile strength 45 lbf/in, puncture resistance 2200 grams, polyethylene film, .010" thick minimum with manufacturer's recommended adhesive or pressure-sensitive tape.
2. Manufacturers: Fortifiber Building Systems Group, Grace, Poly-America, Visqueen, W.R. Meadows, or approved equal.

E. Non-Shrink Grout: CRD-C 621, factory pre-mixed grout.
1. Manufacturers (Metallic): Master Builders "Embeco 885", Euclid "High Flow Grout", or L&M "Ferrogrout".
2. Manufacturers (Non-Metallic): Master Builders "Construction Grout", Euclid "Eucon-NS", L&M "Crystex", or approved equal.

F. Bonding Agent:
1. ASTM C1059, Type II, nonredispersible, acrylic emulsion or styrene butadiene.
2. Manufacturers: W.R. Grace "Daraweld C", Larsen "Weldcrete", Euclid "Eucoweld", L&M "Everbond", or approved equal.

G. Epoxy Bonding Adhesive:
1. ASTM C881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, or class sutable for application temperature and of grade to suit requirements.
2. Manufacturers: BASF "MasterEmaco ADH" or approved equal.

H. Patching Mortar: Free-flowing, polymer-modified cementitous coating; Master Builders "MBT Underlayment – Self leveling", Euclid "TAMMSPATCH II", or Sika Chemical "Sikatop 120.

PART 3 – EXECUTION

3.01 TOLERANCES:

A. ACI Standards shall govern concrete work except where specified differently.

B. Floor flatness and levelness tolerances: Subfloors Under Materials Such As Vinyl, Tile, Paint and Carpet: ASTM E1155, floor flatness (Ff) of 40, floor levelness (Fl) of 40.

C. Variation from plumb:
1. 0 to 10 feet: ¼" maximum.
2. 20 feet or more: 3/8" maximum.

D. Variation in thickness:
1. Footings: 5%
2. Slabs: +3/8" and -1/4"

E. Variation in grade:
1. 0 to 10 feet: ¼" standard, 1/8" for floor slabs.

2. 10 to 20 feet: 3/8” standard, ¼” for floor slabs.
3. 40 feet or more: ¾” standard, 3/8” for floor slabs.

F. Variation in plan:
1. 0 to 20 feet: ½”.
2. 40 feet or more: ¾” standard, plus ½” for footings.

G. Variation in eccentricity: 2% for footings.

H. Variation in openings:
1. Size: plus 1/8”.
2. Location: ¼”.

I. Variation in stairs & landings:
1. Consecutive steps:
   a. Treads: 1/8”.
   b. Risers: 1/16”.
2. Flight of Stairs:
   a. Treads: ¼”.
   b. Risers: 1/8”.

3.02 FORM WORK INSTALLATION

A. Design, erect, support, brace and maintain formwork to support vertical and lateral loads that might be applied until such loads can be supported by the concrete structure. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation and position.

B. Construct forms per ACI 347 guide, to sizes and shapes, lines, and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, molding, rustications, reglets, chambers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in work. Solidly butt joints and provide back up at joints to prevent leakage of cement paste.

C. Fabricate forms for easy removal without hammering or prying against the concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces.

D. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings on forms at inconspicuous location.

E. Chamfer exposed corners and edges ¾” unless otherwise indicated. Where applicable use wood, metal, PVC or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

F. Form Ties: Factory-fabricated, adjustable-length, removable or snap-off metal form ties, designed to prevent form deflection, and to prevent spalling concrete surfaces upon removal.

G. Preparation of Form Surfaces: Coat the contact surfaces of forms with a form-coating compound where applicable before reinforcement is placed.

H. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such ties. Accurately place and securely support items built in to form.

I. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is placed. Retighten forms after concrete placement, if required, to eliminate mortar leaks.

3.03 VAPOR BARRIER-RETARDER INSTALLATION

A. General: Place, protect, and repair vapor barrier-retarder systems in accordance with ASTM E1643 and manufacturer's instructions.

B. Sheet Vapor Barrier: Apply directly over compacted subgrade and under subbase. Lay with 6" wide side laps and end laps and seal watertight with manufacturers adhesive or tapes. Lay film just before subbase is placed and protect against punctures. Repair punctures with adhesive-applied extra sheet before proceeding.

3.04 REINFORCEMENT INSTALLATION

A. Comply with the Concrete Reinforcing Steel Institute (CRSI) "Recommended Practice for Placing Reinforcing Bars", and as indicated on drawings and herein specified.

B. Clean reinforcement of loose rust, mill scale, dirt, and other materials or coatings, which reduce or destroy bond with concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by chairs, spacers, and hangers as required. Set wire ties so ends are pointed into concrete.

D. In all cases, provide minimum concrete protection over bar reinforcement of at least 3" unless otherwise indicated on drawings.

E. Do not place bars more than 2" beyond the last leg of continuous support. Do not use supports to hold runways for conveying equipment.

F. Install mesh welded wire fabric reinforcement in as long lengths as practicable, lapping pieces at least one mesh plus 2" but in no case less than 8". Lace splices with wire. Offset end laps to prevent continuous laps in either direction. All welded wire fabric reinforcement must be securely supported at three feet maximum in each direction.

3.05 JOINTS, INSERTS AND EMBEDDED ITEM INSTALLATION

A. Joints: Provide slab joints, sawed joints and formed construction joints. Locate and install joints, which are not shown on drawings, so as not to impair the strength and appearance of the structure. Submit joint layout to Architect if requested.

B. Inserts: Set and build into the work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Properly locate all embedded items in cooperation with other trades, and secure in position before concrete is placed. Use setting drawings, diagrams, instructions, and directions provided by suppliers of the items to be attached thereto.

C. Embedded Items: Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
   2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashings is shown at lintels, shelf angles, and other conditions.

3.06 CONCRETE PLACEMENT

A. Comply with ACI 301, and as herein specified.

B. Pre-Placement Inspection: Before placing concrete, clean and inspect formwork, reinforcing steel, and items to be embedded or cast-in. Notify other crafts in ample time to permit the installation of their work, and cooperate with them in setting such work, as required. Make sure soil treatment for termite control has been applied, where required, before vapor barrier, subbase, and concrete are installed. Coordinate the installation of joint materials and vapor barriers with placement of forms and reinforcing steel.

C. Notify the Testing Company 24 hours before placing any concrete. Coordinate governmental inspections, if required, with agency having jurisdiction. Allow sufficient time for inspection of reinforcing and for corrective action prior to scheduled concrete placement.

D. Conveying: Convey concrete from the mixer to the place of final deposit by methods that will prevent the separation or loss of materials. Provide equipment for chuting, pumping, and pneumatically conveying concrete of proper size and design as to insure a practically continuous flow of concrete at the point of delivery and without segregation of the materials. Keep open troughs and chutes clean and free from coatings of hardened concrete. Do not allow concrete to drop freely more than 10 feet. Do not use vibrators to transport concrete inside of forms. All equipment and methods used for conveying are subject to the approval of the Architect.

E. Depositing: Deposit concrete continuously or in layers of such thickness that no concrete will be placed on hardened concrete so as to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete near or in its final location to avoid segregation due to rehandling or flowing, and displacement of the reinforcement.

F. Cold Weather Placing: Comply with the requirements of ACI 306.1.

G. Hot Weather Placing: Comply with the requirements of ACI 305.1.

H. Consolidation: Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners. When using vibrators, insert and withdraw vibrators vertically at uniformly spaced locations not farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate the placed layer of concrete and at least 6” into the proceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit the duration to the time necessary to consolidate the concrete and complete embedment or reinforcement and other embedded items without causing segregation of the mix.

3.07 FINISH OF FORMED SURFACES

A. Rough Form Finish: For formed concrete surfaces not exposed to view in the finished work or by other construction, unless otherwise indicated. This is the concrete surface having texture imparted by form facing material used, with tie holes and defective areas repaired and patched, fins and other projections exceeding ¼” in height rubbed down or chipped off.

B. Smooth Form Finish: For formed concrete surfaces exposed to view, or that are to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, damp-proofing, painting or other similar system. This is as-cast concrete surface obtained with selected form facing material, arranged orderly and symmetrically with a minimum of seams. Repair and patch defective areas with fins or other projections completely removed and smooth.

C. Smooth Rubbed Finish: Provide a smooth rubbed finish for exposed concrete surfaces and surfaces which have received smooth form finish treatment not later than one day after form removal. Moisten concrete surfaces and rub smooth with carborudum brick or other abrasive until uniform color and texture is produced. Do not apply cement grout other than that created by rubbing process.

3.08 SLAB FINISHES

A. Place, consolidate, strike off and level concrete slab to proper elevation. After the concrete has stiffened sufficiently to permit the operation, and water sheen has disappeared, float surface at least twice to uniform sandy texture.

B. Trowel Finish: After floating, trowel surface at least twice to smooth dense finish.

C. Slabs to Receive Floor Covering: Finish as in paragraph “Trowel Finish” above, except trowel to remove trowel marks and to smooth, even finish; omit second troweling.

D. Non-Slip Broom Finish: (At exterior walks, steps, and elsewhere as indicated).

3.08 REMOVAL OF FORMS

A. Do not remove forms until the concrete has attained 67% or 28 day strength or minimum of 4 days. Use a method of form removal that will not cause overstressing of the concrete.

3.09 CONCRETE CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Start initial curing as soon as free water has disappeared from concrete surface. Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Immediately after concrete finishing operations cure concrete according to ACI 308.1, by one or a combination of the following methods: Weather permitting; keep continuously moist for not less than 7 days. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 7 days in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.

D. Curing Methods: Perform curing of concrete by moist curing, by moisture-retaining cover curing, by curing compound, by curing and sealing compound, and by combinations thereof, as herein specified. **Curing method and project conditions shall be compatible with subsequent additional surface treatments and finishing products and procedures. Review drawings for finish types and locations to coordinate requirements with other trades.**
   1. Provide moisture curing by keeping concrete surface continuously wet by covering with water, by water-fog spray, or by covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 12” lap over adjacent absorptive covers. Do not allow Absorbent Cover materials to dry out during specified curing period.
   2. Provide moisture-cover curing by covering concrete surface with specified moisture-retaining cover, placed in widest practicable width with sides and ends lapped at least 12” and sealed with waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape. The cover shall be placed flat on the concrete surface, avoiding wrinkles, to minimize mottling immediately after wetting the slab to rejection. It shall be placed and weighted so that it remains in contact with the concrete during the specified duration of curing. Windrows of sand or earth, or pieces of lumber shall be placed along all edges and joints in the film to retain moisture and prevent wind from getting under the film and displacing it.
   3. Surfaces of exterior exposed concrete surfaces of slabs, curbs, sidewalks, and interior concrete surfaces NOT subject to additional surface treatments and finishing.: Provide curing and sealing compound meeting ASTM C1315 as follows:
      a. Apply specified curing and sealing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours). Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer’s directions. Recoat areas subjected to heavy rainfall within 3

hours after initial application. Maintain continuity of coating and repair damage during curing period.

b. Do not use membrane curing and sealing compounds on surfaces which are to receive liquid densifier treatments, be covered with coating material applied directly to concrete, waterproofing, painting, and other coatings and finish materials, unless otherwise acceptable to Architect.

4. Surfaces of freshly placed interior concrete slabs to receive tile, resilient flooring, or other subsequent additional surface treatments and finishing which ALLOW proper dissipation of curing material: Provide dissipating resin curing compound meeting ASTM C309 as follows:
   a. Apply specified dissipating resin curing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours). Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.
   b. Dissipating all curing compound residue shall be fully removed prior to application of any subsequent floor coverings or treatments.
5. Surfaces of freshly placed interior concrete slabs to receive tile, resilient flooring, or other subsequent additional surface treatments and finishing which DO NOT ALLOW proper dissipation of curing material: Provide moisture curing method specified.
6. Curing Formed Surfaces:
   a. Cure formed concrete surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.
7. Curing Unformed Surfaces:
   a. Cure unformed surfaces, such as slabs and other flat surfaces by application of appropriate curing compound. Moisture curing, or moisture retaining cover.

3.10 ADDITIONAL SURFACE TREATMENTS AND FINISHING

A. General: Refer to drawings for interior finish types and locations.

B. Penetrating Liquid Densifier Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.
   1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
   2. Apply compound on exposed floors indicated. Application shall be made by factory certified applicator, and in strict accordance with the directions of the manufacturer. Spray, squeegee or roll on liquid densifier to clean, dry concrete surface at a rate no greater than 225 sq. ft. per gallon. The liquid should be scrubbed into the surface with a mechanical scrubber. Keep the surface wet with the densifier during the application process. When the product becomes slippery under foot, but not more than 40 minutes after initial application, the surface shall then be thoroughly flushed with water, broomed, and squeegeed or vacuumed to remove all excess liquid.

3.11 PROTECTION

A. No wheeling, working, or walking on finished surfaces will be allowed for 16 hours after concrete is placed.

B. Provide plywood or other acceptable protective cover at all traffic areas throughout the job.

C. Protect all exposed concrete floors, steps, and walks from paint and other materials or equipment that may mar or damage these surfaces.

3.12 MISCELLANEOUS ITEMS

A. Filling Holes: Fill in holes and openings left in concrete for the passage of work by other trades after their work is in place. Mix, place, and cure concrete to blend with in-place construction. Provide all other miscellaneous concrete filling required to complete work.

B. Non-Shrink Grout Application: Grout out equipment bases and other locations indicated with non-shrink grout. Provide non-metallic type where grout is exposed.

C. Drainage Items: Unless otherwise indicated, provide 4000 psi concrete for culverts and other items required for drainage installation.

3.13 CONCRETE SURFACE REPAIRS

A. General: Repair and patch defective areas with cement mortar of the same type and class as the original concrete, immediately after removal of forms. Cut out honeycomb, rock pockets, voids over ½" diameter, and holes left by tie rods and bolts, down to solid concrete but in no case to a depth of less than 1". Make edges of cuts perpendicular to the concrete surface, before placing cement mortar in the same manner as adjacent concrete. Proprietary patching compounds may be used when acceptable to the Architect.

B. Smooth, Exposed-To-View Surfaces: Blend cements so that, when dry, patching mortar will match color of surrounding concrete. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

C. Concealed Formed Surfaces: Repair defects that adversely affect the durability of the concrete. If defects cannot be repaired, remove and replace the concrete.

D. Other repair methods may be used, subject to Architect's acceptance.

3.14 CLEAN-UP

A. Do not allow debris to accumulate. Clean up all concrete and cement materials, equipment and debris upon completion of any portion of the concrete work, and upon completion of the entire cast-in-place concrete work.

END OF SECTION

SECTION 03 41 00

STRUCTURAL PRECAST CONCRETE
(WITH COMMERCIAL ARCHITECTURAL (CA) FINISH)

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes the performance criteria, materials, design, production, and erection of structural precast and precast, prestressed concrete with a commercial architectural (CA) finish for the entire project. The work performed under this Section includes all labor, material, equipment, related services, and supervision required for the manufacture and erection of the structural precast and precast, prestressed concrete work shown on the Contract Drawings.

B. This Section includes the following with a commercial architectural (CA) finish:
   1. Beams, columns, double tees.
   2. Walls, spandrels.
   3. Insulated, precast concrete units.
   4. Insulated, architectural precast units.

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide structural precast concrete members and connections capable of withstanding design loads indicated within limits and under conditions indicated on Drawings.

1.3 SUBMITTALS

A. Comply with Section 01 33 00.

B. Professional Engineering: Submit comprehensive engineering design (signed and sealed) by a qualified professional engineer licensed in jurisdiction where Project is located and who is experienced in providing structural precast concrete engineering services of the kind indicated.

C. Fabricator Qualification Data: Submit documentation demonstrating qualifications, capabilities, and experience, as defined in Quality Assurance.

D. Erector Qualifications Data: Submit documentation demonstrating qualifications, capabilities, and experience, as defined in Quality Assurance. Include list of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

E. Product Data: Submit for each type of product indicated. Retain quality control records and certificates of compliance for 5 years after completion of structure.

F. Samples: Submit design reference samples for initial verification of design intent, approximately 12 by 12 by 2 inches, representative of finishes, colors, and textures of exposed surfaces of structural precast concrete members.

1. When back face of precast concrete member is to be exposed, include Samples illustrating workmanship, color, and texture of the concrete.

G. Design Mixtures: Submit for each precast concrete mixture. Include compressive strength.

H. Shop (Erection) Drawings:

1. Detail fabrication and installation of structural precast concrete units including connections at member ends and to each adjoining member.
2. Indicate locations, plan views, elevations, dimensions, shapes, and cross sections of each unit, openings, support conditions and types of reinforcement, including special reinforcement.
3. Indicate aesthetic intent including joints, rustications or reveals, and extent and location of each surface finish.
4. Indicate welded connections by AWS standard symbols. Show size, length, and type of each weld.
5. Detail loose and cast-in hardware, lifting and erection inserts, connections, and joints.
6. Indicate locations, tolerances and details of anchorage devices to be embedded in or attached to structure or other construction.
7. Include and locate openings larger than 10 in. Where additional structural support is required for openings include header design.
8. Coordinate and indicate openings and inserts required by other trades.
9. Indicate location of each structural precast concrete member by same identification mark placed on unit.
10. Indicate relationship of structural precast concrete members to adjacent materials.
11. Indicate locations and details of joint treatment.
12. Indicate areas receiving toppings and magnitude of topping thickness.
13. Indicate estimated cambers for floor slabs receiving cast-in-place topping.
14. Indicate multiple wythe connection devices.
15. Indicate shim sizes and grouting sequence.
16. Design Modifications: If design modifications are proposed to meet performance requirements and field conditions, notify the Architect and submit design calculations and Shop Drawings. Do not affect the appearance, durability or strength of members when modifying details or materials. Maintain the general design concept when altering size of members and alignment.

I. Provide handling procedures, erection sequences, and for special conditions provide temporary bracing and shoring plan.

1.4 TESTING AND SPECIAL INSPECTIONS – FABRICATION

A. Comply with Section 01 45 33.

B. Quality-Control Testing: Test and inspect precast concrete according to PCI MNL 116 requirements. If using self-consolidating concrete also test and inspect according to PCI TR-6

"Interim Guidelines for the Use of Self-Consolidating Concrete" and ASTM C1611, ASTM C1712, ASTM 1610, and ASTM C1621.

A. In addition to PCI Certification, Owner will employ an accredited independent testing agency to evaluate structural precast concrete fabricator's quality-control and testing methods.
   1. Allow Owner's testing agency access to material storage areas, concrete production equipment, concrete placement, and curing facilities. Cooperate with Owner's testing agency and provide samples of materials and concrete mixtures as may be requested for additional testing and evaluation.

B. Strength of precast concrete members will be considered deficient if units fail to comply with ACI 318 concrete strength requirements.

C. Testing: If there is evidence that strength of precast concrete members may be deficient or may not comply with ACI 318 requirements, fabricator shall employ an independent testing agency to obtain, prepare, and test cores drilled from hardened concrete to determine compressive strength according to ASTM C 42 and ACI 318.
   1. Test results shall be reported in writing on the same day that tests are performed, with copies to Architect, Contractor, and precast concrete fabricator. Test reports shall include the following:
      a. Project identification name and number.
      b. Date when tests were performed.
      c. Name of precast concrete fabricator.
      d. Name of concrete testing agency.
      e. Identification letter, name, and type of precast concrete member(s) represented by core tests; design compressive strength; type of failure; actual compressive strength at breaks, corrected for length-diameter ratio; and direction of applied load to core in relation to horizontal plane of concrete as placed.

D. Patching: If core test results are satisfactory and precast concrete members comply with requirements, clean and dampen core holes and solidly fill with precast concrete mixture that has no coarse aggregate, and finish to match adjacent precast concrete surfaces.

E. Acceptability. Structural precast concrete members that do not comply with acceptability requirements in PCI MNL 116, including concrete strength, and manufacturing tolerances, are unacceptable. Chipped, spalled or cracked members may be repaired. Replace unacceptable units with precast concrete members that comply with requirements.

F. Material Test Reports for aggregates: From an accredited testing agency, indicating and interpreting test results for compliance with requirements indicated.

G. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements.
   1. Cementitious materials.
   2. Reinforcing materials and prestressing tendons.
   3. Admixtures.
   4. Bearing pads.
   5. Structural-steel shapes and hollow structural sections.
   6. Insulation.

7. Other components specified in Contract Documents with applicable standards.

1.5 TESTING AND SPECIAL INSPECTIONS – ERECTION

A. Comply with Section 01 45 33.

B. Testing and Special Inspections : Owner shall employ a qualified independent testing laboratory to perform testing and special inspections according to ASTM C1077 and ASTM E329, including the following:
   1. Erection of loadbearing precast concrete members.
   2. Field welds will be subject to visual inspections and dye penetrant or magnetic particle testing in accordance with ASTM E165 or ASTM E1444. Testing agency shall be qualified in accordance with ASTM E543.
   3. Testing agency will report test results promptly and in writing to Contractor and Architect.

C. Welding Certificates: Copies of certificates for welding procedure specifications (WPS) and personnel certification.

1.6 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products which have been in satisfactory use in similar service for five years. Use experience fabricators and installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

B. Standards: Comply with the provision of the following specifications and standards, except as otherwise noted or specified, or as accepted or directed by the Architect and Engineer of Record:
   1. Comply with Section 03 00 00.
   2. ACI 216.1/TMS 0216.1, Standard Method for Determining Fire Resistance of Concrete and Masonry Construction Assemblies.
   3. ASTM C1077, Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation.
   4. ASTM E329, Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspections.
   5. AWS D1.1, Structural Welding Code – Steel.
   6. AWS D1.4, Structural Welding Code – Reinforcing Steel.
   7. PCI MNL 116, Precast / Prestressed Concrete Institute (PCI) Manual for Quality Control for Plants and Production of Structural Concrete Products.
   8. PCI MNL 117, Precast / Prestressed Concrete Institute (PCI) Manual for Quality Control for Architectural Precast Products.
   9. PCI MNL 120, Precast / Prestressed Concrete Institute (PCI) Design Handbook – Precast and Prestressed Concrete," recommendations applicable to types of structural precast concrete members specified.
   10. PCI MNL 124, Precast / Prestressed Concrete Institute (PCI) Manual for Design for Fire Resistance of Precast Prestressed Concrete.
   11. PCI MNL 135, Precast / Prestressed Concrete Institute (PCI) Tolerance Manual for Precast and Prestressed Concrete Construction for camber and dimensional tolerances applicable to types of structural precast members specified.

C. Fabricator Qualifications: A firm that complies with the following requirements and is experienced in producing structural precast concrete units similar to those indicated for this Project and with a record of successful in-service performance.

1. Assumes responsibility for engineering structural precast concrete units to comply with performance requirements. This responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

2. Participates in PCI's Plant Certification program and is designated a PCI-certified plant for Group C, Category **C3A – Prestressed Straight-Strand Structural Members or C4A - Prestressed Deflected-Strand Structural Members.**

3. Has sufficient production capacity to produce required members without delaying the Work.

4. Certification shall be maintained throughout the production of the precast concrete units. Production shall immediately stop if at any time the fabricator's certification is revoked, regardless of the status of completion of contracted work. Production will not be allowed to re-start until the necessary corrections are made and certification has been re-established. In the event certification(s) can not be re-established in a timely manner, causing project delays, the fabricator, at no additional cost, will contract out the remainder of the units to be manufactured at a PCI certified plant.

H. Erector Qualifications: A precast concrete erector Qualified by the Precast/Prestressed Concrete Institute (PCI) prior to beginning work at the jobsite. Submit a current Certificate of Compliance furnished by PCI designating qualification in **Category S1 (Simple Structural Systems) for horizontal decking members and single-lift wall panels.**

I. Sample Units: After sample approval and before fabricating CA precast concrete members, with **architectural finish,** produce sample units to establish the approved range of selections made under sample Submittals. Produce a minimum of **2 (Two)** sample units approximately **16 ft.^{2} (4'x4')** in area. Incorporate full scale details of architectural features, finishes, textures and transitions in sample units.

1. Locate units where indicated in Contract Documents or, if not indicated, as directed by Architect.
2. Damage part of an exposed-face surface for each finish, color, and texture, and demonstrate adequacy of repair techniques proposed for repairs of surface blemishes.
3. After acceptance of repair technique, maintain one sample unit at the fabricator's plant and one at the Project site in an undisturbed condition as a standard for judging the completed Work.
4. Demolish and remove sample units when directed.

J. Mockups: After sample panel approval but before production of structural precast concrete units, with **architectural finish,** construct full-sized mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution. Mockups to be representative of the finished work in all respects including **typical window opening, typical vertical and horizontal joints, sealants** and precast concrete complete with anchors, connections, and joint fillers as accepted on the final Shop Drawings. Build mockups to comply with the following requirements, using materials indicated for the completed work:

1. Build mockups in the location and of the size indicated in Contract Documents or, if location is not indicated, as directed by Architect.
2. Notify Architect in advance of dates and times when mockups will be constructed.
3. Obtain Architect's approval of mockups before starting fabrication of precast concrete members.
4. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
5. Demolish and remove mockups when directed.
6. Approved mockups may become part of the completed Work if undamaged at the time of Substantial Completion.
7. Approval of mockups does not constitute approval of deviations from the Contract Documents unless such deviations are specifically approved by Architect in writing.

K. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 - Coordination.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver all structural precast concrete members in such quantities and at such times to assure compliance with the agreed upon project schedule and setting sequence to ensure continuity of installation.

B. Handle and transport members in a manner to avoid excessive stresses that could cause cracking or other damage.

C. Store units with adequate dunnage and bracing, and protect units to prevent contact with soil, staining, and to control cracking, distortion, warping or other physical damage.

D. Unless otherwise specified or shown on Shop Drawings, store members with dunnage across full width of each bearing point.

E. Place stored members so identification marks are clearly visible, and units can be inspected.

F. Place dunnage of even thickness between each member.

G. Lift and support members only at designated points indicated on the Shop Drawings.

1.8 SEQUENCING

A. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction without delaying the Work. Provide locations, setting diagrams, templates, instructions, and directions, as required, for installation.

PART 2 – PRODUCTS

2.1 FABRICATORS

A. Fabricators (Subject to compliance with Quality Assurance requirements): Provide products from single Fabricator in compliance with Performance Requirements and Quality Assurance Standards specified for project conditions.

2.2 MATERIALS - GENERAL

A. General: Unless otherwise noted, material quality, quantity, types, and design shall be as selected by Design Engineer and Fabricator subject to compliance with Performance Requirements specified and project conditions.

2.3 FORM MATERIALS

A. Forms: Rigid, dimensionally stable, nonabsorptive material, warp and buckle free, that will provide precast concrete surfaces within fabrication tolerances indicated; nonreactive with concrete and suitable for producing required surface finishes.

1. Form-Release Agent: Commercially produced form-release agent that will not bond with, stain or affect hardening of precast concrete surfaces and will not impair subsequent surface or joint treatments of precast concrete.

B. Surface Retarder: Chemical set retarder capable of temporarily delaying setting of newly placed concrete to depth of reveal specified.

2.4 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A615, Grade 60 (Grade 420), deformed.

B. Low-Alloy-Steel Reinforcing Bars: ASTM A706, deformed.

C. Steel Bar Mats: ASTM A 184, fabricated from ASTM A 615, Grade 60 (Grade 420) or ASTM A 706, deformed bars, assembled with clips.

D. Plain-Steel Welded Wire Reinforcement: ASTM A185, or ASTM A1064, fabricated from galvanized and chromate wash treated steel wire into flat sheets.

E. Deformed-Steel Welded Wire Reinforcement: ASTM A497, or ASTM A1064, flat sheet.

F. Supports: Use bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 116.

2.5 PRESTRESSING TENDONS

A. Prestressing Strand: ASTM A416, Grade 250 (Grade 1720) or Grade 270 (Grade 1860), uncoated, 7-wire, low-relaxation strand or ASTM A886, Grade 270 (Grade 1860), indented, 7-wire, low-relaxation strand (including supplement).

B. Unbonded Post-Tensioning Strand: ASTM A416, Grade 270 (Grade 1860), 7-wire, low-relaxation strand with corrosion inhibitor conforming to ACI 423.7, with polypropylene tendon sheathing. Include anchorage devices.

C. Prestressing Strand: ASTM A910, Grade 270 (Grade 1860), uncoated, weldless, 2-and 3-wire, low relaxation strand.

D. Post-Tensioning Bars: ASTM A722, uncoated high strength steel bar.

2.6 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type I or III.
   1. For surfaces exposed to view in finished structure, use **gray or white (Refer Finishes Section)**, same type, brand, and mill source throughout the precast concrete production.

B. Supplementary Cementitious Materials
   1. Fly Ash: ASTM C618, Class C or F with maximum loss on ignition of 3%.
   2. Metakaolin: ASTM C618, Class N.
   3. Silica Fume: ASTM C1240 with optional chemical and physical requirements.
   4. Ground Granulated Blast-Furnace Slag: ASTM C989, Grade 100 or 120.

C. Normal Weight Aggregates: **(Refer Finishes Section)**. Except as modified by PCI MNL 116, ASTM C33, with coarse, non-reactive aggregates complying with **Class 5S.** Stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for Project.

D. Coloring Admixture: **(Refer Finishes Section).** ASTM C979, synthetic or natural mineral-oxide pigments or liquid coloring admixtures, temperature stable and nonfading.

E. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 116.

G. Air Entraining Admixture: ASTM C260, certified by manufacturer to be compatible with other required admixtures.

H. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and to not contain calcium chloride, or more than 0.15 percent chloride ions or other salts by weight of admixture.
   1. Water-Reducing Admixture: ASTM C494, Type A.
   2. Retarding Admixture: ASTM C494, Type B.
   3. Water-Reducing and Retarding Admixture: ASTM C494, Type D.
   4. Water-Reducing and Accelerating Admixture ASTM C494, Type E.
   5. High Range, Water-Reducing Admixture: ASTM C494, Type F.
   6. High-Range, Water-Reducing and Retarding Admixture: ASTM C494, Type G.
   7. Plasticizing Admixture for Flowable Concrete: ASTM C1017.
   8. Corrosion Inhibiting Admixture: ASTM C1582.

2.7 STEEL CONNECTION MATERIALS

A. Carbon-Steel Shapes and Plates: ASTM A36.

B. Carbon-Steel Headed Studs: ASTM A108, Grades 1010 through 1020, cold finished, AWS D1.1/D1.1M, Type A or B, with arc shields and with the minimum mechanical properties of PCI MNL 116, Table 3.2.3.

C. Carbon-Steel Plate: ASTM A283, Grade C.

D. Malleable Iron Castings: ASTM A47, Grade 32510 or 35028.

E. Carbon-Steel Castings: ASTM A27, Grade 60-30 (Grade 415-205).

F. High-Strength, Low-Alloy Structural Steel: ASTM A572.

G. Carbon-Steel Structural Tubing: ASTM A500, Grade B or C.

H. Wrought Carbon-Steel Bars: ASTM A675, Grade 65 (Grade 450).

I. Deformed-Steel Wire or Bar Anchors: ASTM A496 or ASTM A706.

J. Carbon-Steel Bolts and Studs: ASTM A307, Grade A or C (ASTM F568M, Property Class 4.6) carbon-steel, hex-head bolts and studs; carbon-steel nuts (ASTM A563, Grade A); and flat, unhardened steel washers (ASTM F844).

K. High-Strength Bolts and Nuts: ASTM A193, Grade B5 or B7, ASTM A325, or ASTM A490, Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts, (ASTM A563) and hardened carbon-steel washers (ASTM F436).

L. Shop-Primed Finish: Prepare surfaces of nongalvanized steel items, except those surfaces to be embedded in concrete, according to requirements in SSPC-SP 3 and shop-apply **lead- and chromate-free, rust –inhibitive primer, complying with performance requirements in MPI 79** according to SSPC-PA 1.

M. Galvanizing Paint: Zinc paint with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035B or SSPC-Paint 20. Comply with manufacturer's requirements for surface preparation.

2.8 BEARING PADS AND OTHER ACCESSORIES

A. Provide one of the following bearing pads for structural precast concrete members **as recommended by precast fabricator for application:**

1. Elastomeric Pads: AASHTO M 251, plain, vulcanized, 100 percent polychloroprene (neoprene) elastomer, molded to size or cut from a molded sheet, 50 to 70 Shore A durometer according to ASTM D2240, minimum tensile strength 2250 psi (15.5 MPa) per ASTM D412.

2. Random-Oriented, Fiber-Reinforced Elastomeric Pads: Preformed, randomly oriented synthetic fibers set in elastomer. Surface hardness of 70 to 90 Shore A durometer according to ASTM D2240. Capable of supporting a compressive stress of 3000 psi (20.7 Mpa) with no cracking, splitting or delaminating in the internal portions of the pad.
3. Cotton-Duck-Fabric-Reinforced Elastomeric Pads: Preformed, horizontally layered cotton-duck fabric bonded to an elastomer. Surface hardness of 80 to 100 Shore A durometer according to ASTM D2240. Conforming to Division II, Section 18.10.2 of AASHTO LRFD Bridge Design Specifications or Military Specification, MIL-C-882E.
4. Frictionless Pads: Polytetrafluoroethylene (PTFE), glass-fiber reinforced, bonded to stainless or mild-steel plates, or random-oriented, fiber-reinforced elastomeric pads, of type required for in-service stress.

B. Erection Accessories: Provide clips, hangers, high density plastic or steel shims, and other accessories required to install structural precast concrete members.

C. Welding Electrodes: Comply with AWS standards for steel type and/or alloy being welded.

2.9 GROUT MATERIALS

A. Sand-Cement Grout: Portland cement, ASTM C150, Type I, and clean, natural sand, ASTM C144, or ASTM C404. Mix at ratio of 1 part cement to 2 ½ to 3 parts sand, by volume, with minimum water required for placement and hydration. Water-soluble chloride ion content of grout less than 0.06 percent chloride ion by weight of cement when tested in accordance with ASTM C1218.

B. Nonshrink Grout: Premixed, prepackaged ferrous and non-ferrous aggregate shrink-resistant grout containing selected silica sands, portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C1107, Grade A for drypack and Grades B and C for flowable grout and of consistency suitable for application with a 30-minute working time. Water-soluable chloride ion content of grout less than 0.06 percent chloride ion by weight of cement when tested in accordance with ATM C1218.

C. Epoxy-resin grout: Two-component mineral-filled epoxy-resin: ASTM C88 of type, grade, and class to suit requirements.

2.10 INSULATED PANEL ACCESSORIES

A. Polyisocyanurate Board Insulation:
1. Comply with Section 07 21 00.
2. Rigid, cellular polyisocyanurate thermal insulation complying with ASTM C591, Grade 1, Type IV, square edged, unfaced, “R” Value of 6.0 minimum per nominal inch thickness.
3. Refer to drawings for minimum “R” value and/or thickness requirements and locations.

F. Wythe Connectors: As recommended by precast fabricator for application from either glass-fiber in vinyl-ester polymer, polypropylene pin, bent galvanized reinforcing bars, galvanized welded wire trusses, galvanized bent wire connectors, epoxy coated carbon fiber grid, or fiberglass truss manufactured to connect wythes of precast concrete panels.
1. Provide holes in insulation for connector placement at least 4 in. and no more than 12 in. from edges of member or openings.

2.11 CONCRETE MIXTURES

A. Prepare design mixtures for each type of precast concrete required.
   1. Limit use of fly ash to 35 percent replacement of portland cement by weight; granulated blast-furnace slag to 50 percent of portland cement by weight; and metakaolin and silica fume to 10 percent of portland cement by weight.

B. Design mixtures may be prepared by a qualified independent testing agency or by qualified precast plant personnel at structural precast concrete fabricator's option.

C. Limit water-soluble chloride ions to maximum percentage by weight of cement permitted by ACI 318 or PCI MNL 116 when tested in accordance with ASTM C1218.

D. Normalweight Concrete Mixtures: Proportion mixtures by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normalweight concrete with the following properties:
   1. Compressive Strength (28 Days): 5000 psi minimum.
   2. Release Strength: As required by design.
   3. Maximum Water-Cementitious Materials Ratio: 0.45.

E. Lightweight Concrete Mixtures: Proportion mixtures by either laboratory trial batch or field test data methods according to ACI 211.2, with materials to be used on Project, to provide lightweight concrete with the following properties:
   1. Compressive Strength (28 Days): 5000 psi minimum.
   2. Release Strength: as required by design.
   3. Density (Unit Weight): Coordinate requirements with aggregate required for project conditions and tested accordance with ASTM C567.

F. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 116.

G. When included in design mixtures, add other admixtures to concrete mixtures according to manufacturer's written instructions.

H. Concrete Mixture Adjustments: Concrete mixture design adjustments may be proposed if characteristics of materials, Project conditions, weather, test results, or other circumstances warrant.

2.12 FORM FABRICATION

A. Form: Accurately construct forms, mortar tight, of sufficient strength to withstand pressures due to concrete placement and vibration operations and temperature changes, and for prestressing and detensioning operations. Coat contact surfaces of forms with release agent before reinforcement is placed. Avoid contamination of reinforcement and prestressing tendons by release agent.

B. Maintain forms to provide completed structural precast concrete members of shapes, lines, and dimensions indicated in Contract Documents, within fabrication tolerances specified.

1. Edge and Corner Treatment: Uniformly **chamfered** or as built-in on standard forms.

2.13 FABRICATION

A. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement. Do not relocate bearing plates in members unless approved by Architect.

1. Weld headed studs and deformed bar anchors used for anchorage according to AWS D1.1/D1.1M and AWS C5.4, "Recommended Practices for Stud Welding."

B. Furnish loose hardware items including steel plates, clip angles, seat angles, anchors, dowels, hangers, and other hardware shapes for securing precast concrete members to supporting and adjacent construction.

C. Cast-in reglets, slots, and other accessories in structural precast concrete members as indicated on Contract Drawings.

D. Cast-in openings larger than 10 inches in any dimension. Do not drill or cut openings or prestressing strand without Engineer's approval.

E. Reinforcement: Comply with recommendations in PCI MNL 116 for fabricating, placing, and supporting reinforcement.

1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete. When damage to epoxy coated reinforcing exceeds limits specified in ASTM A775, repair with patching material compatible with coating material and epoxy coat bar ends after cutting.
2. Accurately position, support, and secure reinforcement against displacement during concrete-placement and consolidation operations. Locate and support reinforcement by plastic tipped or corrosion resistant metal or plastic chairs, runners, bolsters, spacers, hangers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 116.
3. Place reinforcing steel and prestressing tendons to maintain at least ¾ in. minimum concrete cover. Provide cover requirements in accordance with ACI 318 when units are exposed to corrosive environment or severe exposure conditions. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.
4. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces in accordance with ACI 318 and wire tie laps, where required by design. Offset laps of adjoining widths to prevent continuous laps in either direction.

F. Reinforce structural precast concrete members to resist handling, transportation, and erection stresses, and specified in-place loads, whichever governs.

G. Prestress tendons for structural precast concrete members by either pretensioning or post-tensioning methods. Comply with PCI MNL 116.
   1. Delay detensioning or post-tensioning of precast prestressed concrete members until concrete has reached its indicated minimum design release compressive strength as established by test cylinders cured under the same conditions as concrete member.
   2. Detension pretensioned tendons either by gradually releasing tensioning jacks or by heat-cutting tendons, using a sequence and pattern to prevent shock or unbalanced loading.
   3. If concrete has been heat cured, detension while concrete is still warm and moist to avoid dimensional changes that may cause cracking or undesirable stresses.
   4. Protect strand ends and anchorage not exposed to view with bitumastic, zinc-rich or epoxy paint.

H. Comply with requirements in PCI MNL 116 and in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.

I. Place concrete in a continuous operation to prevent cold joints or planes of weakness from forming in precast concrete members.
   1. Place backup concrete to ensure bond with face-mixture concrete.

J. Thoroughly consolidate placed concrete by vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing or entrapped air voids on surfaces. Use equipment and procedures complying with PCI MNL 116.
   1. Place self-consolidating concrete without vibration in accordance with PCI TR-6 “Interim Guidelines for the Use of Self-Consolidating Concrete.” If face and backup concrete is used, ensure adequate bond between concrete mixtures.

K. Comply with PCI MNL 116 procedures for hot and cold-weather concrete placement.

L. Identify pickup points of precast concrete members and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each precast concrete member on a surface that will not show in finished structure.

M. Cure concrete, according to requirements in PCI MNL 116, by moisture retention without heat or by accelerated heat curing using live steam or radiant heat and moisture. Cure members until compressive strength is high enough to ensure that stripping does not have an effect on the performance or appearance of final product.

2.14 INSULATED PANEL CASTING

A. Cast, screed and consolidate bottom concrete wythe supported by form.

B. Place insulation boards, abutting edges and ends of adjacent boards. Stagger end joints between rows to minimize cold joints. Stagger joints of insulation layers one-half board apart. Insert wythe connectors through insulation, and consolidate concrete around connectors according to connector manufacturer’s written instructions.

C. Cast and screed top wythe and apply required finish.

D. Maintain temperature below 150 deg. F (65 deg. C) in bottom cast concrete wythe.

2.15 FABRICATION TOLERANCES

A. Fabricate structural precast concrete members of shapes, lines and dimensions indicated, so each finished member complies with PCI MNL 135 product tolerances as well as position tolerances for cast-in items.

2.16 FINISHES

A. Schedule of Exposed Finishes (Refer to drawing finish schedules):
   1. Commercial Architectural (CA) Finish Type: **PCI Product Number 230.**
      a. Locations: **Exterior exposed to view surfaces.**
      b. Color: **Gray.**
         i. Course Aggregate: **1975# gray 5/8 inch limestone.**
         ii. Fine Aggregate: **950# gray crushed limestone.**
      c. Concrete Color: **650# Ash Grove Gray.**
      d. Exposure: **Light.**
      e. Finish: **(N/A).**
      f. Texture: **Sandblasted (Abrasive-Blast).**
   2. Commercial Architectural (CA) Finish Type:
      a. Locations: **Interior wall exposed to view surfaces.**
      b. Color: **Gray.**
         i. Course Aggregate: **1975# gray 5/8 inch limestone.**
         ii. Fine Aggregate: **950# gray crushed limestone.**
      c. Concrete Color: **650# Ash Grove Gray.**
      d. Exposure: **(N/A).**
      e. Finish: **Smooth Steel-trowel.**
      f. Texture: **(Field Painted).**
   3. Commercial (Structural) Finish Type: **Standard Grade.**
      a. Locations: **Interior ceiling exposed to view surfaces.**
      b. Color: **Gray.**
         i. Course Aggregate: **1975# gray 5/8 inch limestone.**
         ii. Fine Aggregate: **950# gray crushed limestone.**
      c. Concrete Color: **650# Ash Grove Gray.**
      d. Exposure: **(N/A).**
      e. Finish: **As-Cast.**
      f. Texture: **(Field Painted).**

B. Commercial (Structural) Finishes Types:
   1. Commercial Grade: Remove fins and protrusions larger than 1/8 inch and fill holes with a diameter larger than ½ inch. Rub or grind ragged edges. Faces shall be true, well-defined surfaces. Air holes, water marks, and color variations are acceptable. Allowable form joint offsets are limited to 3/16 in..
   2. Standard Grade: Normal plant-run finish produced in forms that impart a smooth finish to concrete. Surface holes smaller than 1/2 inch caused by air bubbles, normal color variations, form joint marks, and minor chips and spalls are acceptable. Fill air holes

greater than 1/4 inch in width that occur in high concentration (more than one per 2 in.^{2}). Major or unsightly imperfections, honeycombs, or structural defects are not permitted. Allowable joint offset limited to 1/8 inch.

3. Grade B Finish: Fill air pockets and holes larger than 1/4 inch in diameter with sand-cement paste matching color of adjacent surfaces. Fill air holes greater than 1/8 inch in width that occur in high concentration (more than one per 2 in.^{2}). Grind smooth form offsets or fins larger than 1/8 inch. Repair surface blemishes due to dents in forms. Discoloration is permitted at form joints.
4. Grade A Finish: Repair all surface blemishes and fill all air holes with the exception of air holes 1/16 inch in width or smaller and form marks where the surface deviation is less than 1/16 inch. Float-apply a neat cement-paste coating to exposed surfaces. Rub dried paste coat with burlap to remove loose particles. Discoloration is permitted at form joints. Grind smooth all form joints.

C. Commercial Architectural (CA) Finishes Types:

1. Exposed faces shall be free of joint marks, grain, or other obvious defects. Corners, including false joints shall be uniform and straight. Finish exposed-face surfaces of structural precast concrete members to match approved **design reference sample** and as follows:
   a. PCI's "Architectural Precast Concrete – Color and Texture Selection Guide," of plate numbers indicated.
   b. As-Cast Surface Finish: Provide surfaces to match accepted sample or mockup units for acceptable surface air voids, sand streaks, and honeycombs.
   c. Abrasive-Blast Finish: Use abrasive grit, equipment, application techniques, and cleaning procedures to expose aggregate and surrounding matrix surfaces to match accepted sample or mockup units.

D. Screed or float finish unformed surfaces. Strike off and consolidate concrete with vibrating screeds to a uniform finish, float finish, if required. Hand screed at projections. Normal color variations, minor indentations, minor chips, and spalls are permitted. No major imperfections, honeycombing, or defects are permitted.

E. Smooth steel-trowel finish unformed surfaces. Consolidate concrete, bring to proper level with straightedge, float and trowel to a smooth, uniform finish.

PART 3 – EXECUTION

3.1 PREPARATION

A. Furnish loose connection hardware and anchorage devices for precast concrete members to be embedded in or attached to the building structural frame or foundation before starting that Work. Provide locations, setting diagrams, templates and instructions for the proper installation of each anchorage device.

3.2 EXAMINATION

A. Examine supporting structural frame or foundation and conditions for compliance with requirements for installation tolerances, bearing surface tolerances, and other conditions affecting precast concrete performance.

B. Proceed with precast concrete installation only after unsatisfactory conditions have been corrected.

C. Contractor shall notify precast concrete erector that supporting cast-in-place concrete foundation and building structural framing has attained minimum allowable design compressive strength or supporting steel or other structure is structurally ready to receive loads from precast concrete members prior to proceeding with installation.

3.3 ERECTION

A. Install loose clips, hangers, bearing pads, and other accessories required for connecting structural precast concrete members to supporting members and backup materials.

B. Erect structural precast concrete level, plumb and square within the specified allowable erection tolerances. Provide temporary structural framing, shoring and bracing as required to maintain position, stability, and alignment of members until permanent connections are completed.

1. Install temporary steel or plastic spacing shims or bearing pads as precast concrete members are being erected. Surface weld steel shims to each other to prevent shims from separating.
2. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
3. Remove projecting lifting devices and use plastic patchcaps or sand-cement grout to fill voids within recessed lifting devices flush with surface of adjacent precast concrete surfaces when recess is exposed.
4. Unless otherwise indicated provide uniform joint widths of ¾ in..

C. Connect structural precast concrete members in position by bolting, welding, grouting, or as otherwise indicated on approved Shop (Erection) Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and/or grouting are completed.

1. Disruption of roof flashing continuity by connections is not permitted; concealment within roof insulation is acceptable.

D. Welding: Comply with applicable AWS D1.1, AWS D1.4 and AWS D1.6 requirements for welding, welding electrodes, appearance of welds, quality of welds, and methods used in correcting welding work.

1. Protect structural precast concrete members and bearing pads from damage during field welding or cutting operations and provide noncombustible shields as required.
2. Welds not specified shall be continuous fillet welds, using not less than the minimum fillet as specified by AWS D1.1, D1.4 or D1.6.
3. Clean-weld-affected metal surfaces with chipping hammer followed by brushing or power tool cleaning and then reprime damaged painted surfaces in accordance with manufacturer’s recommendations.
4. Visually inspect all welds critical to precast concrete connections. Visually check all welds for completion and remove, reweld or repair all defective welds, if services of AWS-certified welding inspector are not furnished by Owner.

E. At bolted connections, use upset threads, thread locking compound or other approved means to prevent loosening of nuts after final adjustment.
   1. Where slotted connections are used, verify bolt position and tightness at installation. For sliding connections, properly secure bolt but allow bolt to move within connection slot.
   2. For slip critical connections, one of the following methods shall be used to assure proper bolt pretension:
      a. Turn-of-Nut – in accordance with AISC.
      b. Calibrated Wrench – in accordance with AISC.
      c. Twist-off Tension Control Bolt – meeting ASTM F 1852.
      d. Direct-Tension Control Bolt – meeting ASTM F 1852.
   3. For slip critical connections, the method to be used and the inspection procedure to be used shall be approved by the Architect and coordinated with the inspection agency.

F. Grouting or Dry-Packing Connections and Joints: Indicate joints to be grouted and any critical grouting sequences on Shop (Erection) Drawings. Grout open spaces at keyways, connections and joints where required or indicated. Provide reinforcing steel where indicated. Retain flowable grout in place until it gains sufficient strength to support itself. Fill joints completely without seepage to other surfaces. Alternatively, pack spaces with stiff dry pack grout material, tamping until voids are completely filled. Place grout and finish smooth, level, and plumb with adjacent concrete surfaces. Promptly remove grout material from exposed surfaces before it affects finishes or hardens. Keep grouted joints damp for at least 24 hours after initial set.
   1. Trowel top of grout joints on roofs smooth to prevent any unevenness that might interfere with placing of, or cause damage, to insulation and roofing. Finish transitions due to different surface levels not steeper than 1 to 12.

G. Field cutting of precast, prestressed concrete members is not permitted without approval of the Engineer.

H. Fasteners: Do not use drilled or power-actuated fasteners for attaching accessory items to precast, prestressed concrete members unless approved by Precast Engineer and Engineer of Record.

3.4 ERECTION TOLERANCES

A. Erect structural precast concrete members level, plumb, square, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 135. Level out variations between adjacent members by jacking, loading, or any other feasible method as recommended by the fabricator and acceptable to the Architect.

3.5 REPAIRS

A. Repairs will be permitted provided structural adequacy, serviceability and durability of members and appearance are not impaired.

B. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 20 feet.

C. Prepare and repair damaged galvanized coatings with galvanizing repair paint according to ASTM A780.

C. Wire brush, clean, and paint damaged prime-painted components with same type of shop primer.

D. Remove and replace damaged structural precast concrete members when repairs do not comply with specified requirements.

3.6 CLEANING

A. Clean mortar, plaster, fireproofing, weld slag, and any other deleterious material from concrete surfaces and adjacent materials immediately.

B. Clean exposed surfaces of precast concrete members after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.
   1. Perform cleaning procedures, if necessary, according to precast concrete fabricator's recommendations. Protect adjacent work from staining or damage due to cleaning operations.
   2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

END OF SECTION 03 41 00

SECTION 04 20 00

UNIT MASONRY

PART 1 – GENERAL

1.01 SUMMARY

A. Provide concrete masonry construction work where indicated, complete.

1.02 SUBMITTALS

A. Comply with Section 01 33 00.

B. Product Certification: Submit certification from recognized testing agency for manufacturer's product compliance with specifications.

C. Product Data: Submit manufacturer's technical data and installation instruction for anchors and reinforcement.

D. Installer Qualifications: Submit documentation demonstrating qualifications, capabilities, and experience.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

B. Field Construction Mock-up: Not required for this project.

C. Standards: Comply with the provisions of the following specifications and standards, except as otherwise noted or specified.
   1. National Concrete Masonry Association Standards and Specifications.
   2. TMS 402/ACI 530/ASCE 5 Building Code Requirements and Specification for Masonry Structures.
   3. TMS 602/ACI 530.1/ASCE 6 Specification for Masonry Structures.
   4. ASTM A82 Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
   5. ASTM A615 Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement.
   6. ASTM C90 Standard Specification for Loadbearing Concrete Masonry Units.
   7. ASTM C144 Standard Specification for Aggregate for Masonry Mortar.
   8. ASTM C150 Standard Specification for Portland Cement
   9. ASTM C207 Standard Specification for Hydrated Lime for Masonry Purposes.
   10. ASTM C270 Standard Specification for Mortar for Unit Masonry.
   11. ASTM C404 Standard Specification for Aggregates for Masonry Grout.
   12. ASTM C1384 Standard Specification for Admixtures for Masonry Mortars.
   13. ASTM C1714 Standard Specification for Preblended Dry Mortar Mix for Unit Masonry.

D. Installer Qualifications:
   1. An experienced masonry installer who employs project personnel certified by Masonry Contractors Association of America (MCAA) or other nationally recognized masonry trade organization.
   2. Assign experienced masons from previous applications including supervisory mason. These personnel shall be on site at all times while work is being performed.

1.04 TESTING AND INSPECTIONS

A. Testing and Inspections:
   1. Comply with Section 01 45 33 – Special Inspections and Procedures.
   2. Refer to Statement of Special Inspections for schedule of required testing and inspections.
   3. Owner shall provide services of qualified independent testing agency to preform required testing and inspections.
   4. Masonry construction shall be inspected and verified in accordance with TMS 402 and TMS 602 quality assurance programs as required by applicable building code.

PART 2 – PRODUCTS

2.01 MASONRY – GENERAL

A. Manufacturer: National Concrete Masonry Association (NCMA) certified member. Obtain each type of unit from one manufacturer, cured by one process, and of uniform texture and color.

B. Finish and texture to be as indicated on drawings or to be selected from manufacturer's standard samples for approved equals.

C. Provide special shapes where required for corners, lintels, jambs, sash, control joints, headers, bonding, cap, and other special conditions. Provide full 8" face units at CMU corners. Refer to drawings for typical unit types, sizes, shapes and coursing. Comply with referenced standards and other specified requirements for each type of masonry unit required.

2.02 CONCRETE MASONRY UNITS

A. Load-Bearing and Non-Load-Bearing Concrete Masonry Units:
   1. Grade: Solid or hollow load bearing block, Aggregate ASTM C33 normal weight, Cement ASTM C150, Quality ASTM C90, 2,000 psi minimum compressive strength.
   2. At fire rated assemblies provide block design and classification required for compliance with assembly rating and type indicated on drawings. Submit certificate from Underwriters Laboratories or other recognized testing agency, as evidence that material supplied meets or exceeds rating and classification standards required.

2.03 MORTAR AND GROUT

A. Grout Mix: ASTM C476. Compressive strength to be minimum 2,000 psi.

B. Mortar Mix:
   1. ASTM C270, Type S, for masonry below grade, masonry in contact with earth, and all masonry in Seismic Design Categories D, E, and F (refer to structural drawings for the appropriate Seismic Design Category).
   2. ASTM C270, Type N, for above-grade masonry (except in Seismic Design Categories D, E, and F).
   3. Measure and batch materials either by volume or weight, such that required proportions can be accurately controlled and maintained. Measurement of sand exclusively by shovel will not be permitted. Mix mortars with the maximum amount of water consistent with workability to provide maximum tensile bond strength within the capacity of mortar. Mix ingredients for a minimum of 5 minutes in a mechanical mixer. Do not use mortar or grout that has began to set, or if more than 2-1/2 hours has elapsed since initial mixing. Re-temper mortar during 2-1/2 hour period as required to restore workability.
   4. Do not add air-entraining agents or other admixtures to mortar or grout materials without Architect's prior written approval.

C. Portland Cement: ASTM C150, Type I, except Type III may be used for cold weather construction. Provide natural color or white as required to produce mortar color.

D. Hydrated Lime: ASTM C207, Type S.

E. Aggregate for Mortar: Sand, conforming to ASTM C144 or ASTM C404, Size No. 2.

F. Aggregate for Grout: ASTM C404, Size No. 8 or Size No. 89.

G. Water: Clean and potable. When using block, use Admix that matches the product used in the CMU.

2.04 REINFORCING

A. Vertical Reinforcing Bars: ASTM A615, Grade 60, deformed billet bars of sizes and spacing as indicated on drawings, free from loose rust, scale and other coatings that may reduce bond.

B. Horizontal Joint Reinforcing: Provide welded wire units prefabricated with deformed continuous side rods and plain cross rods into straight lengths of not less than 10 feet, with prefabricated corner and tee units, and complying with requirements below:
   1. Manufacturer: AA Wire Products, Hohmann & Barnard, Inc., National Wire Products, or approved equal.
   2. Material: ASTM A82 carbon steel with ASTM A153 - Class B2 hot dipped galvanized coating.
   3. Side and Cross Rod Wire Size: 9 gage (0.1875-inch diameter) galvanized steel for each 2 square feet of wall area. Vertical spacing shall not exceed 16-inches.
   4. Width: Fabricate joint reinforcement in units with widths of approximately 2" less than nominal width of walls and partitions as required to provide mortar coverage of not less than 5/8-inch on joint faces exposed to exterior and ½-inch elsewhere.
   5. Single-Wythe Masonry: Provide type as follows with single pair of side rods:

a. Ladder or truss type design with perpendicular or diagonal cross rods spaced not more than 16-inches on center.

2.05 MASONRY ACCESSORIES

A. Sealant Backer Rod: Compressible rod stock polyethylene foam, polyethylene jacketed polyurethane foam, butyl rubber foam, neoprene foam or other flexible, permanent, durable non-absorptive material as recommended by compatibility with sealant by sealant manufacturer. Provide size and shape of rod which will control the joint depth for sealant placement, break bond of sealant at bottom of joint, form optimum shape of sealant bead on back side, and provide highly compressible backer to minimize the possibility of sealant extrusion when joint is compressed.

B. Joint Sealant: Refer Section 07 92 00 for requirements.

C. Preformed Control Joints: Polyvinyl chloride material. Provide with corner and tee accessories, cement fused joints. Hohmann & Barnard, Inc. “VS Series”, Greenstreak Model “673”, or approved equal.

D. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials, recommended by masonry unit manufacturer.

E. Anchor Bolts (where shown on drawings): ASTM A307, Grade A, galvanized.

PART 3 – EXECUTION

3.01 GENERAL

A. Install materials and systems in accordance with manufacturer’s instructions and approved submittals. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.

B. Comply with standards as follows:
   1. Comply with PCA Recommended Practices for Laying Concrete Block and NCMA TEK Bulletins.
   2. Comply with cold weather and warm weather protection procedures as specified in TMS / SCI / ASCE Building Code Requirements for Masonry Structures.

3.02 PREPARATION

A. CMU: Do not wet concrete masonry units.

B. Cleaning Reinforcing: Before placing, remove loose rust, ice and other coatings from reinforcing.

3.03 INSTALLATION

A. Cut masonry units using motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to fit adjoining work neatly. Use full size units without cutting wherever possible.

B. Keep cavities clean of mortar droppings and other materials during wall construction. Strike joints flush facing cavity.

C. Coursing: Install masonry per tolerances specified. Lay in running bond with vertical joint in each course centered on units in course above and below, except where other coursing is indicated. Do not tooth corners.

D. Joints: Maintain uniform joint width of 3/8-inch. Provide full bed, head and collar joints except at weeps. Do not slash head joints. Use as dry a mortar mix as practicable and compress joints as much as possible to produce a dense tight joint.
   1. Concealed Joints: Strike flush.
   2. Exposed CMU Joints: Tooled.

E. Fill vertical and horizontal cells of CMU solidly with grout where indicated. Fill space between hollow metal frames and masonry solidly with grout. Grout frames full.

F. Install lintels and accessories in masonry construction as indicated on drawings.

G. Install reinforcing as specified and indicated on drawings.

H. Provide expansion and control joints in accordance with NCMA recommendations and as indicated on drawings. Install sealants per manufacturer's instructions.

3.04 TOLERANCES

A. NCMA Standards shall govern masonry work except where specified differently.
   1. Variation from Plumb: For vertical lines and surfaces of columns, walls and arises do not exceed ¼-inch in 10 feet, or 3/8-inch in a story height not to exceed 20 feet, nor ½-inch in 40 feet or more. For external corners, expansion joints, control joints and other conspicuous lines, do not exceed ¼-inch in any story of 20 feet maximum, nor ½-inch in 40 feet or more.
   2. Variation from Level: For lines of exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines, do not exceed ¼-inch in any bay or 20 feet maximum, nor ¾-inch in 40 feet or more.
   3. Variation of Linear Building Line: For position shown in plan and related portion of columns, walls and partitions, do not exceed ½-inch in any bay or 20 feet maximum, nor ¾-inch in 40 feet or more.
   4. Variation in Cross-Sectional Dimensions: For columns and thickness of walls, from dimensions shown, do not exceed – ¼-inch nor + ½-inch.

3.05 REPAIR, POINTING AND CLEANING

A. Remove and replace damaged units.

B. Pointing: During the tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar. Point-up joints at corners, openings, and adjacent work to provide a neat, uniform appearance, properly prepared for application of caulking or sealant compounds.

C. Clean concrete masonry by dry brushing, NCMA TEK No. 28.

END OF SECTION

SECTION 05 40 00

COLD-FORMED METAL FRAMING

PART 1 – GENERAL

1.01 SUMMARY

A. Provide cold-formed metal framing:
   1. Exterior and interior steel stud and joist framing.

1.02 SUBMITTALS

A. Comply with Section 01 33 00.

B. Submit shop drawings. Indicate manufacturer's recommendations for supplemental bracing, accessories, and details as may be required for proper installation.

C. Submit product data and deflection criteria.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for at least three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

B. Standards: Comply with the provisions of the following specifications and standards, except otherwise noted or specified, or as accepted or directed by the Architect.
   1. AISI, Specification for Design of Cold-Formed Steel Structural Members.
   2. AWS D1.3, Structural Welding Code.
   3. ASTM A1003 Standard Specification for Sheet Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members.
   4. ASTM C645, Specifications for Non-Load (Axial) Bearing Steel Studs, Runners (Tracks), and Rigid Furring Channels for Screw Application of Gypsum Board.
   5. ASTM C754, Specifications for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Board.
   6. ASTM C1007 Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories.

1.04 LOADING AND DEFLECTION CRITERIA

A. In addition to the loads indicated on the drawings, components to withstand design criteria as follows:
   1. Interior partition framing: 5 psf minimum lateral load.
   2. All other framing locations, unless otherwise indicated: L/240 total deflection.

B. Design system to provide movement of components without damage.

1.05 TOLERANCES

A. Fabrication Tolerances: 1/8-inch in 10’.

B. Erection Tolerances: 1/16-inch.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Manufacturers: Marino, Dietrich, Dale/Incor, Superior, USG, Gold Bond, Unimast, or approved equal.

B. Sheet Steel: ASTM A1003, G90 galvanized coating.

C. Cold-Formed Metal Framing Materials: Refer to drawings for specific member requirements:
   1. Wall Framing: C-shaped steel studs with 1.625-inch flange and flange return lip.
   2. Runner Channel: U-shaped with 1.25-inch minimum flange.
   3. Joist Framing: C-shaped load-bearing steel joists with 1.625-inch flange and flange return lip.
   4. Furring Channel: W-shaped 1 ½” x 18 ga (150F125-33) steel furring channels.
   5. Resilient Channel: Single-leg, ½" deep x 1 ¼” wide screw flange
   6. Deflection Channel: Deep leg deflection track with 4.0-inch minimum flange length.
   7. Units 14 gage (68 mils.) (.0677-inch min.) and heavier: Yield point 50,000 psi.
   8. Units 16 gage (54 mils.) (.0538-inch min.) and heavier: Yield point 50,000 psi.
   9. Units 18 gage (43 mils.) (.0428-inch min.): Yield point 33,000 psi.
   10. Units 20 gage (33 mils.) (.0329-inch min.): Yield point 33,000 psi.
   11. Units 24 gage (18 mils.) (.0179-inch min.): Yield point 33,000 psi.

D. Framing Accessories: With each type of metal framing required, provide manufacturers standard accessories as recommended by manufacturer for applications indicated, as needed to provide a complete metal framing system, including:
   1. Supplementary framing.
   2. Lateral bracing, bridging, and solid blocking.
      a. Strap: 1-1/2” x 20 gage.
      b. Channels: 1-1/2” x 20 gage.
   3. Web stiffeners.
   4. Gusset plates.
   5. Deflection track and vertical side clips.
   6. Stud kickers and girts.
   7. Joist hangers and end closures.
   8. Reinforcement plates.
   9. Anchors, clips, and fasteners.

PART 3 – EXECUTION

3.01 GENERAL

A. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction. Coordinate with work of other sections.

B. Comply with requirements of ASTM C1007 for installation of steel studs and accessories and Metal Lath/Steel Framing Association Lightweight Steel Framing Systems Manual.

C. Make provisions for erection stresses. Provide temporary alignment and bracing. Framing components may be prefabricated into panels prior to erection. Perform lifting of prefabricated panels in a manner to prevent damage or distortion in any members in the assembly. Wire tying of framing components is NOT permitted.

3.02 INSTALLATION

A. Runner Tracks: Install continuous tracks sized to match studs. Align tracks accurately to the layout at base and top of studs. Secure tracks as recommended by the stud manufacturer for the type of construction involved, except do not exceed 24-inches on center spacing for nail or power-driven fasteners to cast-in-place concrete. Do not exceed 48" o.c. for post-installed fasteners to pre-stress concrete. Power-driven fasteners shall not be used in pre-cast concrete. Provide fasteners at corners and ends of tracks.

B. Wall Studs: Install at 24-inches on center, unless otherwise indicated.
   1. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements.
   2. Secure studs to top and bottom runner tracks by either welding or screw fastening at both inside and outside flanges. Erect horizontal and vertical load bearing studs one piece full length. Splicing of studs is NOT permitted. Punch-outs shall be 10-inches minimum from ends of studs.
   3. Allow for deflection, directly below horizontal building framing for non-load bearing framing as indicated on drawings.
   4. Install horizontal stiffeners in stud system, spaced vertically at not more than 4 feet on center. Fasten at each stud intersection.
   5. Construct corners using minimum 3 studs. Double stud wall openings, door and window jambs with opening larger than 2 feet square, except where indicated in manufacturers instructions. Install runner tracks and jamb studs with stud shoes or by welding and space jack studs same as full height studs of the wall. Secure stud system all around to wall opening frame in the manner indicated.
   6. Install supplementary framing, blocking, and bracing in the metal framing system wherever walls or partitions are indicated to support fixtures, equipment, services, casework, heavy trim and furnishing, and similar work requiring attachment to the wall or partition. Where type of supplementary support is not otherwise indicated, comply with the stud manufacturer's recommendations and industry standards in each case, considering the weight of loading resulting from the items supported.
   7. Where stud system abuts structural columns or walls, anchor ends of stiffeners to supporting structure.
   8. Install diagonal racking bracing at each corner where walls are free standing and not attached to structure.
   9. Frame both sides of expansion and control joints, with separate studs; DO NOT bridge the joint with components of the stud system.

C. Joist: Install at 24-inches on center, unless otherwise indicated.
   1. Place joist as shown on drawings; not more than 2-inches from abutting walls. Connect joist to supports using fasteners or welding
   2. Set joist parallel and level, with lateral bracing and bridging.
   3. Locate joist end bearing directly over load bearing studs or provide load distributing member to top of stud track. Punch-outs shall be 10-inches minimum from ends of joist.
   4. Provide web stiffeners at reaction point and/or as shown on drawings.
   5. Provide double joist at floor openings exceeding 2 feet and at interruption of one or more spanning members.
   6. End blocking shall be provided where joist ends are not otherwise restrained from rotation.

D. Restore damaged components. Protect work from damage.

END OF SECTION

SECTION 05 50 00

METAL FABRICATIONS

PART 1 - GENERAL

1.01 SUMMARY

A. Provide the following where indicated on drawings:
   1. Rough hardware.
   2. Pipe bollards.
   3. Loose bearing, leveling plates and templets.
   4. Loose steel lintels.
   5. Anchor bolts, expansion anchors and miscellaneous fasteners.
   6. Steel supports for work of other trades.
   7. Stainless steel protective wall cladding and corner guards.
   8. Stainless steel thru wall scupper fabricated assemblies.

1.02 SUBMITTALS

A. Comply with Section 01 33 00.

B. Shop Drawings: Submit shop drawings for miscellaneous metal fabrications. Include plans, elevations, and details of sections and connections. Show anchorage and accessory items. Indicate welded connections using standard AWS A2.0 welding symbols.

C. Upon request, submit product data.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

B. Standards: Comply with the provisions of the following specifications and standards, except as otherwise noted or specified, or as accepted or directed by the Architect.
   1. AISC A36, “Specification of Structural Steel”.
   2. ASTM A53, “Specification of Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless”.
   3. ASTM A500, “Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes”.
   4. ASTM A501, “Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing”.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Ferrous Materials:
   1. Steel Plates, Shapes and Bars: ASTM A36.
   2. Steel Pipe, Black Finish: ASTM A53.
   3. Steel Tubing: ASTM A500 or A501.
   4. Rolled Steel Floor Plates: ASTM A786.
   5. Reinforcing Bars: ASTM A615, Grade 60.
   6. Concrete Inserts: Threaded or wedge type.
   7. Welding Rods and Bare Electrodes: AWS specifications.

B. Stainless Steel Materials:
   1. Plate or Sheets: ASTM A666, Type 302 or 304.
   2. Fasteners: Type 302 or 304.
      a. Bolts and Nuts:
         1). Hexagon head type.
         2). Socket head type.
      b. Plain Washers: Round.
   3. Finish: Satin, No. 4 (Unless otherwise indicated).

C. Fasteners:
   1. Bolts and Nuts:
      a. Hexagon head type, ASTM A 307, Grade A.
      b. Socket head type, ASTM A307, Grade A
   2. Lag Bolts: Square head, FS FF-B-561.
   3. Machine Screws: Cadmium plated steel, FS FF-S-92.
   4. Wood Screws: Flat head carbon steel, FS FF-S-111.
   5. Plain Washers: Round carbon steel, FS FF-W-92.
   6. Drilled-In Expansion Anchors: FS FF-S-325.
   7. Toggle Bolts: Tumble-wing type, FS FF-B-588.
   8. Lock Washers: Spring type carbon steel, FS FF-W-84.
   9. Zinc-Coating: Fasteners in exterior assemblies or exterior walls.

D. Auxiliary Materials:
   1. Rubber Washers: Polyvinyl. Exposed conditions, colors to be selected by Architect from manufacturer's standard samples.
   2. Interior Anchoring Cement: Hydraulic expansion cement.
   3. Exterior/Interior Anchoring Cement: Erosion-resistant hydraulic expansion cement.
   4. Finish: Primed and painted, refer to Section 09 90 00 for additional requirements.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION

A. Take field measurements prior to preparation of shop drawings and fabrication. Do not delay project. Allow for cutting and fitting if field measurement not practical.

B. Form work true to line with sharp angles and edges. Weld continuously, grind flush and make smooth on exposed surfaces, unless otherwise indicated. Remove sharp edges subject to human contact.

C. Field weld components as indicated. Perform field welding in accordance with AWS D1.1.

D. Install work plumb and level.

E. Touch-up damaged coatings with shop primer and galvanize repair paint.

F. Paint items scheduled in accordance with Section 09 90 00.

3.02 MISCELLANEOUS METAL FABRICATIONS

A. Steel Supports:
   1. General: Refer drawings for requirements and conditions.
   2. Provide channels, braces, angles, etc., as indicated and assemble as detailed. Secure all connections to provide rigid supports of all items required including supports not specifically specified in other sections. Coordinate work with other trades.

B. Stainless Steel Fabricated Assemblies:
   1. General: Refer drawings for requirements and conditions.
   2. Provide assemblies as indicated and assemble as detailed. Secure all connections to provide rigid supports of all items required including supports not specifically specified in other sections. Coordinate work with other trades.
   3. Finish exposed to view surfaces.

END OF SECTION

SECTION 06 10 00

ROUGH CARPENTRY

PART 1 - GENERAL

1.01 SUMMARY

A. Provide rough carpentry where indicated on plans:
   1. Wood grounds, nailers, and blocking.
   2. Wood sheathing.

1.02 SUBMITTALS

A. Comply with Section 01 33 00.

B. Submit for approval product data.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

B. Lumber Standards and Grade Stamps: U.S. Product Standard PS 20, American Softwood Lumber Standard and inspection agency grade stamps. Factory mark each piece of lumber or plywood with type, grade, mill and grading agency identification or submit mill certificate that material has been inspected and graded in accordance with requirements if it cannot be marked on material surface.

C. Construction Panel Standards: PS 1, U.S. Product Standard for Construction and Industrial Plywood; APA PRP-108.

D. Preservative Treatment: AWPA UC3B for lumber and AWPA UC3B for plywood; waterborne pressure treatment. Label each piece of pressure treated lumber and plywood with the quality control mark.

E. Fire-Retardant Treatment: AWPA UCFB for lumber and AWPA UCFB for plywood; noncorrosive type. Identify material with appropriate classification marking of Underwriters Laboratories, Inc., U.S. Testing, Timber Products Inspection or other testing and inspecting agency acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General:
   1. Preservative Treatment: Provide for wood in contact with soil concrete, masonry, roofing, flashing, dampproofing and waterproofing or where installed less than 18 inches above

grade.
2. Fire-Retardant Treatment: Provide at building interior and exterior where required by code.
3. Moisture Content: 19 percent for lumber items not specified to receive wood preservative treatment and stamped “S-DRY”, “K-D”, or “MC19" .

B. Dimension Lumber:
1. Species: Spurce-Pine-Fir graded under National Grading Rules, PS 20-70, or approved Equal.
2. Framing: No. 2 grade or better.

C. Construction Panels:
1. Plywood Decking: APA sheathing, Exposure 1, exterior grade. AWPA UC3B treated where in direct contact with masonry or concrete. Waferboard, composite board and oriented stand board (but not structural particle-board) are accepted as equals providing specified span ratings are met for installed condition. In all cases, thickness shown is minimum regardless of span rating. Material used for same purpose shall be of same thickness.

D. Fasteners and Adhesives:
1. Fasteners: Comply with Section 05 50 00. Nails, metal connectors, bolts, nuts, screws, washers, staples, and other fasteners (except as specified or noted otherwise); hot-dip galvanized steel.
2. Power Nails: Not permitted without prior approval of Architect.
3. Adhesives: Meet requirements of American Plywood Association Specification AFG-01, (latest revision). Use Phenol Resorcinol type for use on pressure treated wood products.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Wood framing: Comply with recommendations of NFPA Manual for House Framing, NFPA Recommended Nailing Schedule, and NFPA National Design Specifications for Wood Construction.

B. Plywood: Comply with recommendations of APA Design and Construction Guide - Residential and Commercial.

C. Provide nailers, blocking and grounds where required. Set work plumb, level and accurately cut.

D. Install materials and systems in accordance with manufacturer's instructions. Install materials and systems in proper relation with adjacent construction. Coordinate with other work.

E. Comply with manufacturer's requirements for cutting, handling, fastening and working treated materials.

F. Securely attach carpentry work to substrate by anchoring and fastening as indicated and as required by recognized standards. Countersink nail heads on exposed carpentry work and fill holes. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members.

Install fasteners without splitting of wood; predrill as required.

G. Restore damaged components. Protect work from damage.

END OF SECTION 06 10 00

SOLID SURFACING FABRICATIONS

SECTION 06 61 16

PART 1 - GENERAL

1.01 SUMMARY

A. Provide solid surfacing fabrications including but not limited to following:
   1. Lavatory tops with integral bowls.
   2. Millwork counter tops with sinks and cove backsplashes.

1.02 SUBMITTALS

A. Comply with Section 01 33 00.

B. Product Data: Indicate Product description including solid surface sheets, sinks, bowls and illustrating full range of standard colors, fabrication information and compliance with specified performance requirements. Submit Product data with resistance to list of chemicals.

C. Shop Drawings: Submit Shop Drawings. Indicate plans, sections, dimensions, component sizes, edge details, thermosetting requirements, fabrication details, attachment provisions, sizes of furring, blocking, including concealed blocking and coordination requirements with adjacent work. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, waste receptacles and other items installed in solid surface.

D. Coordination Drawings: Submit coordination drawings indicating plumbing and miscellaneous steel work indicating locations of wall rated or non-rated, blocking requirements, locations and recessed wall items and similar items.

E. Samples: Submit minimum 6" x 6" samples. Cut sample and seam together for representation of inconspicuous seam. Indicate full range of color and pattern variation. Approved samples will be retained as standards for work.

F. Operational and Maintenance Data:
   1. Submit manufacturer's care and maintenance data, including repair and cleaning instructions. Include in Project closeout documents.
   2. Provide a commercial care and maintenance kit and video. Review maintenance procedures and warranty details with Owner upon completion.

G. Warranty: Submit manufacturer’s material warranty specified.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer’s instructions.

B. Standards: Comply with the provisions of the following specifications and standards, except as otherwise noted or specified, or as accepted or directed by the Architect.
   1. ASTM C920, Standard Specification for Elastomeric Joint Sealants.

2. ASTM D638, Standard Test Method for Tensile Properties of Plastics.
3. ASTM D785, Standard Test Method for Rockwell Hardness of Plastics and Electrical Insulating Materials.
4. ASTM D790, Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
5. ASTM D5420, Standard Test Method for Impact Resistance of Flat, Rigid Plastic Specimen by Means of a Striker Impacted by a Falling Weight (Gardner Impact).
6. ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials.
7. ASTM E228, Standard Test Method for Linear Thermal Expansion of Solid Materials with a Push-Rod Dilatometer.
8. ASTM G21, Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
9. ASTM G22, Standard Practice for Determining Resistance of Plastics to Bacteria.
10. ASTM G155, Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials.
11. UL 723, Standard for Test for Surface Burning Characteristics of Building Materials.
12. UL 2824, GREENGUARD Certification Program, Method for Measuring Microbial Resistance from Various Sources Using Static Environmental Chambers.

C. Installer Qualifications: Provide work executed by competent installers with minimum 5 years experience in the application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.

D. Mock-Ups: Not required.

E. Manufacturer Warranty: Provide manufacturer's standard warranty for material only for period of 10 years against defects and/or deficiencies. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Architect and at no expense to Owner.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Avonite, DuPont "Corian", Samsung Chemical USA, Wilsonart Contract, or approved equal.

2.02 MATERIALS

A. Description: Solid Surface: Non-porous, homogeneous material maintaining the same composition throughout the part with a composition of acrylic polymer, aluminum trihydrate filler and pigment.

B. Performance/Design Criteria:

Property	Requirement (min or max)	Test Procedure
1. Solid Surface Based Products:		
a. Tensile Strength	6000 psi min	ASTM D638
b. Tensile Modulus	1.5×10^6 psi min	ASTM D638

c.	Tensile Elongation	0.4% min.		ASTM D638
d.	Flexural Strength	10000 psi min		ASTM D790
e.	Flexural Modulus	1.2×10^{6} psi min		ASTM D790
f.	Hardness	>85-Rockwell "M" scale min.		ASTM D785
g.	Thermal Expansion	2.2×10^{-5} in./in./°F		ASTM E228
h.	Fungi and Bacteria	Does not support microbial growth		ASTM G21 & G22
i.	Microbial Resistance	Highly resistant to mold growth		UL 2824
j.	Ball Impact	No fracture - 1/2 lb. Ball: 6 mm slab - 36" drop 12 mm slab - 144" drop		NEMA LD 3, Method 3.8
k.	Weatherability	ΔE*94<5 in 1,000 hrs		ASTM G155
l.	Flammability			ASTM E84, UL 723
		All Colors		
		6 mm	**12 mm**	
m.	Flame Spread	<25	<25	
n.	Smoke Developed	<25	<25	
o.	Class	A	A	NFPA 101

C. Solid Surface Material: 3/4" thick, unless otherwise indicated on drawings.

D. Non-porous, homogeneous material maintaining the same composition throughout the part with a composition of acrylic polymer, aluminum trihydrate filler and pigment; not coated, laminated or of composite construction; meeting following criteria:

E. Flammability: Class 1 and A when tested to UL 723.

F. Adhesive for Bonding to Other Products: One component silicone to ASTM C920.

G. Sealant: A standard mildew-resistant, FDA/UL recognized silicone color matched sealant or clear silicone sealants.

H. Sink/Bowl Mounting Hardware: Manufacturer's approved bowl clips, brass inserts and fasteners for attachment of undermount sinks/bowls.

2.03 COMPONENTS

A. Finishes: Color as selected by Architect from manufacturer’s full color range. Ensure surfaces have uniform finish type as follows:
   1. Finish Type: Matte, with a 60° gloss rating of 5 - 20.

B. Counter Perimeter Frame: Ensure 3/4" thick, moisture resistant cores for counter tops in wet areas having sinks or lavatories are 3/4" thick exterior grade plywood with waterproof adhesive, Fir or Poplar plywood, veneer core only. Ensure fire retardant Product contains fire-retardant chemicals injected with raw materials during manufacturing and achieves a maximum flame-spread rating of 25 with a maximum smoke development of 200 when tested to ASTM E84.

C. Lavatory Tops with Integral Bowls: Molded countertop of solid polymer material, complete with integrally molded bowls of solid polymer material; edge details as indicated on Drawings. Provide with coved backsplash and endsplashes as shown on Drawings.

1. Intergral Bowls (Sinks): Equal to Dupont “Corian” No. “8254” (Basis of design). Refer drawings for additional requirements.

D. Fabrication:
1. Fabricate components in shop to greatest extent practical to sizes and shapes indicated, in accordance with approved Shop Drawings and solid polymer manufacturer requirements. Form joints between components using manufacturer’s standard joint adhesive without conspicuous joints. Provide factory cutouts for plumbing fittings and bath accessories as indicated on Drawings.
2. Where indicated, thermoform corners and edges or other objects to shapes and sizes indicated on Drawings, prior to seaming and joining. Cut components larger than finished dimensions and sand edges to remove nicks and scratches. Heat entire component uniformly prior to forming.
3. Ensure no blistering, whitening and cracking of components during forming.
4. Fabricate backsplashes from solid surfacing material with optional radius cove where counter and backsplashes meet as indicated on Drawings. Backsplashes for most colors may be fabricated by traditional means discussed in K-25294 *Backsplashe*s. Colors with metallic/mica particle or veined colors creating directional aesthetics (K-26833 *Directional Aesthetics*) may require the techniques in Technical Bulletin K-28235 *Thermoformed Backsplash*.
5. Fabricate joints between components using manufacturer's standard joint adhesive. Ensure joints are inconspicuous in appearance and without voids. Attach 50 mm (2") wide reinforcing strip of solid polymer material under each joint. Reinforcing strip of solid polymer material is not required when using joint adhesive.
6. Provide holes and cutouts for plumbing and bath accessories as indicated on Drawings.
7. Rout and finish component edges to a smooth, uniform finish. Rout cutouts, then sand edges smooth. Repair or reject defective or inaccurate work.
8. Fabrication Tolerances:
   a. Variation in Component Size: +/-1/8".
   b. Location of Openings: +/-1/8" from indicated location.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions:
1. Examine substrates and conditions, with fabricator present for compliance with requirements for installation tolerances and other conditions affecting performance of work. Proceed with installation only after unsatisfactory conditions have been corrected.
2. Verify actual site dimensions and location of adjacent materials prior to commencing work.
3. Examine cabinets upon which counter tops are to be installed. Verify cabinets are level to within 1/8" in 10' - 0".
4. Notify Architect in writing of any conditions which would be detrimental to installation.

B. Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

3.02 INSTALLATION

A. Install components plumb, level, rigid, scribed to adjacent finishes in accordance with reviewed Shop Drawings and Product installation details.

B. Fabricate field joints using manufacturer's recommended adhesive, with joints being inconspicuous in finished work. Exposed joints/seams are not permitted. Keep components and hands clean when making joints. Reinforce field joints as specified herein. Cut and finish component edges with clean, sharp returns.

C. Route radii and contours to template. Anchor securely to base component or other supports. Align adjacent components and form seams to comply with manufacturer’s written recommendations using adhesive in color to match work. Carefully dress joints smooth, remove surface scratches and clean entire surface.

D. Install countertops with no more than 1/8" sag, bow or other variation from a straight line.

E. Adhere undermount/submount/bevel mount sinks/bowls to countertops using manufacturer's recommended adhesive and mounting hardware.

F. Adhere top mount sinks/bowls to countertops using manufacturer recommended adhesives and color-coordinated silicone sealant. [Secure seam mount bowls and sinks to counter tops using color matched joint adhesive.]

G. Seal between wall and components with joint sealant as specified herein and in Section 07 92 00, as applicable.

H. Provide backsplashes and endsplashes as indicated on Drawings. Adhere to countertops using a standard color-coordinated silicone sealant. Adhere applied sidesplashes to countertops using a standard color-matched silicone sealant. Provide coved backsplashes and sidesplashes at walls and adjacent millwork. Fabricate radius cove at intersection of counters with backsplashes to dimensions shown on reviewed Shop Drawings. Adhere to countertops using manufacturer’s standard color-coordinated joint adhesive.

I. Keep components and hands clean during installation. Remove adhesives, sealants and other stains. Ensure components are clean on date of Substantial Completion of the Work.

J. Coordinate connections of plumbing fixtures with Division 22 - Plumbing.

3.03 REPAIR

A. Repair minor imperfections and cracked seams and replace areas of severely damaged surfaces in accordance with manufacturer’s “Technical Bulletins”.

B. Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Architect at no cost to Owner.

3.04 CLEANING

A. Remove excess adhesive and sealant from visible surfaces.

B. Clean surfaces in accordance with manufacturer’s “Care and Maintenance Instructions”.

3.05 PROTECTION

A. Provide protective coverings to prevent physical damage or staining following installation for duration of Project.

B. Protect surfaces from damage until date of Substantial Completion of the Work.

END OF SECTION

SECTION 07 19 00

WATER REPELLENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Provide water repellents for vertical exposed surfaces where indicated:
   1. Exterior structural precast concrete.

1.02 SUBMITTALS

A. Comply with Section 01 33 00.

B. Product Data: Submit manufacturer’s product data and installation instructions.

C. Warranty: Submit manufacturer’s specified warranty.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for five years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

B. Provide five year warranty for water repellent coating, guaranteeing the installation waterproofing and watertight, except for structural cracks or opening caused by settling, expansion or contraction.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Manufacturers (Vertical Surfaces): “MasterProtect H 200”, ProSoCo SureKleen “Weather Seal Siloxane WB”, Sonneborn “Penetrating Sealer 40", L & M “Hydropel WB" or approved equal.

B. Water Repellents:
   1. Appearance: Clear, non-gloss, non-yellowing.
   2. Vapor Transmission: Breathing type, non vapor barrier.
   3. Penetrating Sealers (Not Visible): Water-based.
   4. Application Rate: (2) Coats suitable for substrate and project conditions.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install materials and systems in accordance with manufacturer's instructions. Install materials with uniform appearance. Coordinate with work of other sections.

B. Clean substrate of substances which might interfere with penetration/adhesion of water repellents. Test for moisture content in accordance with repellent manufacturer's instructions to ensure that surface is sufficiently dry.

C. Coordinate with sealants where feasible, delay application of water repellents until installation of sealants has been completed in joints adjoining surfaces to be coated.

D. Do not proceed with the application (except with the written recommendation of the manufacturer) when ambient temperature is less than 50 degrees F; or when rain or temperatures below 40 degrees F are predicted for a period of 24 hours; or within 3 days after surfaces become wet from rainfall or other moisture sources.

E. First Coat: Apply heavy, saturation-type, flood coat form bottom up with sufficient material applied to produce a 6 inch to 8 inch rundown below contact point of spray pattern with surface. Apply in overlapping pattern and coverage controlled to approximate recommendation by manufacturer. Allow first coat application to penetrate surface (approximately 3 to 5 minutes).

F. Second Coat: Apply in same saturating manner as first coat.

END OF SECTION

SECTION 07 21 00

BUILDING INSULATION

PART 1 – GENERAL

1.01 SUMMARY

A. Provide building insulation and vapor retarders where indicated.
   1. Exterior walls cavity and continuous, board type.
   2. Below low slope roofing systems, board type.
   3. Interior walls, blanket type.
   4. Gape fillers, foam-in-place type.

1.02 SUBMITTALS

A. Comply with Section 01 33 00.

B. Submit product data.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

B. Standards: Comply with the provisions of the following specifications and standards, except as otherwise noted or specified, or as accepted or directed by the Architect.
   1. ASHRA Standard 90.1, Energy Conservation Code.
   2. ASTM C518, Standard Test Method for Steady State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
   3. ASTM C578, Specification for Preformed, Cellular Polystyrene Thermal Insulation.
   4. ASTM C665, Specification for Mineral-Fiber Thermal Insulation For Light Frame Construction and Manufactured Housing.
   5. ASTM C1104, Standard Test Method for Determining the Water Vapor Sorption of Unfaced Mineral Fiber Insulation.
   6. ASTM C1029, Standard Specification for Spray-Applied Rigid Cellular Polyurethane Thermal Insulation.
   7. ASTM C1289, Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
   8. ASTM C1763, Standard Test Method for Water Absorption by Immersion of Thermal Insulation Materials.
   9. ASTM D1621, Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
   10. ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials.
   11. NAIMA, North American Insulation Manufacturers Association - Standards of Products.

PART 2 – PRODUCTS

2.01 MATERIALS

A. General: Refer to drawings for minimum “R” value and/or thickness requirements and locations.

B. Flame Spread and Smoke Development Ratings:
   1. Tested in accordance with ASTM E84 standards.
   2. Exposed and Concealed Insulation: Flame spread rating of 0 to 25, smoke development rating of 0 to 450.

C. Environmental Requirements and Certifications:
   1. VOC Emission Testing Compliance: Greenguard or Greenguard Gold test method, Pass.
   2. Formaldehyde Content: Free of formaldehyde containing materials.

D. Accessories:
   1. Adhesives, mechanical anchors, hangers and clips for application per manufacturer’s recommendations.
   2. Crack sealers, tapes, primers, and accessories for application per manufacturer’s recommendations.

2.02 BOARD INSULATION

A. Manufacturers: Dow, GAF, Johns Manville, StarRfoam Manufacturing, or approved equal for application.

B. Locations and Types:
   1. Exterior Walls – Cavity and Continuous Insulation Assemblies:
      a. Type: Extruded polyisocyanurate closed cell rigid ASTM C578, Type I, Class 2, “R” of 6.5 minimum per nominal inch ASTM C518, compressive strength 25 psi minimum ASTM D1621, water absorption less than 0.1 percent maximum by volume ASTM C1763, square edges.
      b. Vapor Retarder: Integral foil face vapor retarder, where indicated.

2.03 BLANKET AND BATT INSULATION

A. Manufacturers: Certainteed, Johns Manville, Owens-Corning, or approved equal for application.

B. Locations and Types:
   1. Interior Walls: Glass fiber ASTM C665, Type I, Class A, unfaced, water vapor sorption 5 percent of less by weight ASTM C1140, fungi resistance pass rating ASTM C1338.
   2. Width: Provide in same width as stud framing spacing, unless otherwise indicated.

2.04 LOW SLOPE ROOFING SYSTEMS BOARD INSULATION

A. General:

1. Refer to specification section of low slope roofing system specified for additional requirements for materials and installation.
2. Manufacturers subject to compliance with general requirements of low slope roofing system specified.

B. Manufacturers: Carlisle, Firestone, GAF, Johns Manville, or approved equal for application.

C. Locations and Types:
1. Primary Continuous and Tapered Boards:
   a. Reinforced polyisocyanurate closed cell rigid with coated facers ASTM C1289, Type II, Class 1, Grade 2, LTTR “R” of 5.7 minimum per nominal inch ASTM C518, compressive strength 20 psi minimum ASTM D1621, water absorption 0.5 percent by volume maximum ASTM C1763, square edges. Note: R-Value requirement as shown on drawings is exclusive of taper insulation.
   b. Profiles: Tapered for drainage, where indicated.
2. Cover Boards:
   a. Reinforced high density closed cell polyisocyanurate rigid with coated facers ASTM C1289, Type II, Class 4, Grade 2, LTTR “R” of 2.5 minimum per nominal 1/2" ASTM C518, compressive strength 120 psi minimum ASTM D1621, square edge profile in 1/2” thickness minimum, water absorption less than 3 percent ASTM C1763, mold resistance pass rating ASTM D3273.
3. Vapor Retarder: Material type acceptable with manufacturer of low slope roofing system specified compatible with substrate conditions.

2.05 FOAM-IN-PLACE INSULATION

A. Manufacturers: Dow “Great Stuff”, Loctite “Titefoam”, Sika “Sika Boom”, or approved equal.

B. Locations and Types:
Gap fillers, Window and Door Perimeters: Minimal expanding, single component polyurethane foam sealant ASTM C1029, closed cell content 80 percent minimum ASTM D2856, “U” value 0.25 minimum ASTM C518, compressive strength 9.3 psi minimum ASTM D1621, dimensional stability 14.31 percent maximum by volume ASTM D2126, moisture resistant

PART 3 – EXECUTION

3.01 GENERAL INSTALLATION

A. Install materials and systems in accordance with manufacturer’s instructions applicable to products and project conditions. Install materials and systems in proper relation with adjacent construction. Coordinate with work of other sections.

B. Extend insulation in thickness indicated to envelope entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation.

C. Thermal Assembly Penetrations: Coordinate locations of water piping in exterior walls to ensure placement on warm side of insulation and insulation encapsulates piping.

D. Apply single layer of insulation to produce thickness indicated, unless multiple layers are otherwise indicated or required to make up total thickness.

E. Seal joints between closed-cell (non-breathing) insulation 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.

F. Protect installed insulation. Repair construction damaged by contractor activities prior to concealment and installation of subsequent materials.

3.02 BOARD INSTALLATION

A. Above Grade Applications:
   1. Cut and friction fit insulation over or between framing members as indicated.
   2. Alternatively install insulation with suitable fasteners, adhesives, or over impaling pins.

3.03 BATT AND BLANKET INSTALLATION

A. General: Install glass-fiber blankets in cavities formed by framing members according to the following requirements:
   1. Use blanket widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
   2. Place blankets in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.

B. Cold-Form Metal Framing Construction: For wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping stapling flanges to flanges of metal studs.

3.04 FOAM-IN-PLACE INSTALLATION

A. General:
   1. Clean, prepare, and prime substrates per manufacturer’s recommendations.
   2. Install foam-in-place insulation in quantities and rates recommend by manufacturer for project conditions to provide thermal performance specified.
   3. Remove excess material, clean, and prepare insulation surfaces as required for installation of other work.

B. Gap Fillers, Window and Door Perimeter Applications:
   1. Install foam-in-place insulation in quantities and rates recommend by manufacturer to neatly fill cracks, joints, and voids from thermal intrusion.
   2. Avoid filling joints intended for weeping water from assemblies.
   3. Avoid expansive insulation applications that prohibits proper function of adjacent assemblies.

END OF SECTION

SECTION 07 42 93

SOFFIT PANELS

PART 1 - GENERAL

1.01 SUMMARY

A. Provide prefabricated sheet metal vented soffit panel and trim system, complete.

1.02 SUBMITTALS

A. Comply with Section 01 33 00.

B. Product Data: Submit manufacturer’s product technical data and installation instructions.

C. Samples: Submit manufacturer’s color charts showing full range of colors available for selection by Architect. Submit 6"x6" minimum physical sample of panel profile upon Architect’s approval of color selected.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

B. Standards: Comply with the provisions of the following specifications and standards, except as otherwise noted or specified, or as accepted or directed by the Architect.
   1. SMACNA, (Sheet Metal and Air Conditioning Contractors National Association, Inc.) Architectural Sheet Metal Manual (Fifth Addition).
   2. AA, (Aluminum Association), Aluminum Construction Manual - Aluminum Sheet Metal Work in Building Construction.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Sheet Metal:
   1. Manufacturers: Vincent, Petersen Aluminum, Copper Sales, or approved equal.
   2. Sheet Aluminum: ASTM B 209, alloy 3003, mill finish, temper #14, 20 gauge (.032 inch).

B. Auxiliary Materials:
   1. Fasteners: Comply with Section 05 50 00. Same metal as flashing/sheet metal or other noncorrosive metal as Solder recommended by sheet metal manufacturer. Match finish of exposed heads with materials being fastened.
   2. Reglets and metal accessories: Sheet metal clips, cleats, straps, anchoring devices and similar accessory units as required for installation of work, matching or compatible with material being installed, noncorrosive, size and gage required for performance.

2.02 SOFFIT PANELS

A. Panels to be aluminum, 0.032 inch thick minimum, flush panel fully vented design, enterlocking panel edge joints, ribs 6 inches on center, 1 /2 inches minimum profile depth by 12 inches wide minimum, unless otherwise indicated. Panels shall be interlocked full length of panel. Open air percentage of 12 percent minimum.

2.03 FABRICATION:

A. Fabricate edges, trim, and other exposed metal soffit sheet metal work.

B. Fabricate for weather-resistant performance; with expansion provisions for running work, sufficient to permanently prevent leakage, damage or deterioration of the work. Form work to fit substrates.

C. Form exposed sheet metal work without excessive oil-canning, buckling and tool marks, true to line and levels as indicated, with exposed edges folded back to form hems.

D. Seams: Fabricate nonmoving seams in sheet metal with flat-lock seams. Form seams and revit joints for additional strength where required.

E. Expansion Provisions: Where lapped or bayonet-type expansion provisions cannot be used, or would not be sufficiently weatherproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant (concealed within joints).

PART 3 - EXECUTION

3.01 INSTALLATION

A. Follow recommendations of SMACNA and AA Manuals for specific application.

B. Install materials and systems in accordance with manufacturer's instructions. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.

C. Anchor units of work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints and seams which will be permanently watertight and weatherproof.

D. Secure edges soffit panels to other work with trim angles.

E. Retainers: Where indicated, provide saw cuts for metal counterflashing system using metal flashing receiver as detailed and indicated.

F. Restore damaged components and finishes. Clean and protect work from damage.

END OF SECTION

SECTION 07 54 23

SINGLE-PLY MEMBRANE ROOFING (TPO)

PART 1 - GENERAL

1.01 SUMMARY

A. Provide the following where indicated:

1. Thermoplastic polyolefin (TPO) single-ply membrane roofing, roof insulation, and sheet metal flashing in conjunction with roofing system.

B. Roof related sheet metal work including pre-fabricated mechanical roof penetrations, pre-fabricated roof vents, pipe boots, etc. may be supplied by other related Sections but shall be installed under this Section. Coordinate with other related sections as required.

1.02 SUBMITTALS

A. Comply with Section 01 33 00.

B. Installer's Certification: Submit roofing manufacturer's certification indicating name of installer, qualifications and date issued for Installer's designated on site supervisory personnel.

C. Product Data: Submit specifications, installation instructions, and general recommendations from single-ply membrane roofing system manufacturer.

D. Shop Drawings: Submit Manufacturer's approved complete shop drawings showing roof configuration, slopes, membrane sheet and insulation layout, details at perimeter, installation details of flashing, penetration details, curbs, accessories, locations of fasteners, locations of adhesive bead spacing and bead width, and special conditions. Include detail showing proposed Night Seal and Cut-Off flashing to be used at end of each day's work.

E. Samples: Submit 12" square color samples of finished roofing sheets, including "T-shaped" side/end lap seam. Submit 12" square samples of required insulation.

F. Manufacturer's Certification: Submit a "system" letter from the manufacturer agreeing "That all roofing components exclusive of the deck, contained in the system proposed are approved and compatible with the warranty requirements of the roof system as specified, and that the warranty specified will be issued at completion of project if system is installed as designed

G. Final Inspection: Upon completion submit roofing system manufacturer's final inspection report indicating all defective or non-conforming work has been corrected.

H. Manufacturer's Warranty: Submit sample of roof warranty for review and approval. Submit final warranty.

I. Installer's Warranty: Submit on Owner's designated form.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Deliver, handle, and store materials in accordance with manufacturer's instructions.

B. Manufacturer Qualifications: A qualified manufacturer that is FM approved for membrane roofing system specified. Obtain primary flexible single-ply membrane sheet from a single manufacturer. Provide secondary materials as approved by manufacturer of primary materials.

C. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by the membrane roofing system manufacturer for a minimum period of five (5) years to install manufacturer’s product and that is eligible to receive manufacturer’s special warranty.

D. FM Approvals Listing: Provide membrane roofing, base flashings, and component materials that comply with requirements in FM Approvals 4450 and FM approvals 4470 as part of a membrane roofing system, and that are listed in FM Approvals “RoofNav” for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approval markings.

1. Fire/Windstorm Classification: Class 1A-90

E. Standards: Comply with the provisions of the following specifications and standards, except as otherwise noted or specified, or as accepted or directed by the Architect.

1. ANSI/SPRI/FM 4435/ES-1 Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems.

2. ASTM D1549, Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer.

3. ASTM D6878, Standard Specification for Thermoplastic Polyolefin Based Sheet Roofing.

4. FM 4470 – Approval Standard for Single-Ply, Polymer-Modified Bitumen Sheet, Built-Up Roof (BUR) and Liquid Applied Roof Assemblies for Use in Class 1 and Noncombustible Roof Deck Construction.

5. NRCA, (National Roofing Contractors Association), Roofing & Waterproofing Manual (Current Edition).

6. SMACNA, (Sheet Metal and Air Conditioning Contractors National Association, Inc.), Architectural Sheet Metal Manual (Current Edition).

1.04 PRE-INSTALLATION CONFERENCE

A. A pre-installation conference shall be conducted no earlier than two weeks before the start of roofing work. Participants shall include Owner, Contractor, Installer’s designated on site certified supervisory personnel, and Architect. The conference shall not be scheduled until all submittals have been received and approved by the Architect.

B. The required submittals defined herein, shall include as a minimum the following:

1. Work Schedule.

2. Product Data.

3. Shop Drawings.

4. Samples.

5. Manufacturer’s Certification.

6. Installer’s Certification of designated on site supervisory personnel.

7. Manufacturer’s sample roof warranty.

C. Contractor shall notify Owner and Architect when Manufacturer’s final Warranty inspection is to occur. Furnish a copy of the warranty inspection report to Construction Administrator.

D. The Contractor must provide copies of all disposal receipts for any hazardous materials removed from roof.

E. The Contractor shall not remove any more roofing during the day than can be completely replaced with new roofing materials including night seal-off and flashing of perimeter and accessories.

1.05 MANUFACTURER’S WARRANTY

A. Manufacturer’s Warranty: The State of Missouri is prohibited from entering into binding arbitration. No warranty shall be accepted with any arbitration clause. Warranties shall be governed by and construed in accordance with the laws of the State of Missouri. Manufacturer's standard or amended 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, cover boards, roofing accessories, and other components of membrane roofing system.

2. Warranty Period: 20 years from date of Substantial Completion.

1.06 INSTALLER’S WARRANTY

A. Installer Warranty: Submit roofing Installer's warranty, on Owner’s designated warranty form (Refer Roofing Installer’s Warranty Form section), signed by Installer, covering the Work of this Section, including all components of membrane roofing system such as membrane roofing, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, and walkway products, for the following warranty period:

1. Warranty Period: Two years from date of Substantial Completion.

1.07 ROOFING INSTALLER’S WARRANTY FORM (<u>EXAMPLE ONLY – TO BE COMPLETED BY OWNER AND CONTRACTOR</u>)

A. WHEREAS <**Insert name**> of <**Insert address**>, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:

1. Owner: **State of Missouri, Office of Administration, Division of Facilities Management, Design and Construction.**

2. Address: **730 Truman Building, 301 West High Street, Jefferson City, Missouri 65102.**
3. Building Name/Type: **Fort Leonard Wood Readiness Center.**
4. Address: **8133 Iowa Avenue, Building No. 986 – Fort Leonard, Missouri**.
5. Area of Work: **Low Slope Roof Areas above Drill Hall and Lockers**.
6. Acceptance Date: <**Insert date**>.
7. Warranty Period: <**Insert time**>.
8. Expiration Date: <**Insert date**>.

B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
   a. Lightning;
   b. Peak gust wind speed exceeding 90 mph;
   c. Fire;
   d. Failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
   e. Faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
   f. Vapor condensation on bottom of roofing; and
   g. Activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.

2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.

3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.

4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.

5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin,

or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.

6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.

7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this <**Insert day**> day of <**Insert month**>, <**Insert year**>.

1. Authorized Signature: <**Insert signature**>.
2. Name: <**Insert name**>.
3. Title: <**Insert title**>.

PART 2 - PRODUCTS

2 .01 GENERAL

A. Listing: UL Class A, external fire exposure, UL 90, Class 90 wind uplift, FM Construction Bulletin 1-90, Class 1 Construction.

B. Compatibility: Provide products which are recommended by manufacturers to be fully compatible with indicated substrates or provide separation materials as required to eliminate contact between incompatible materials.

2 .02 MATERIALS

A. MEMBRANE ROOFING TPO

1. Manufacturers: Carlisle SynTec Systems, Firestone Building Products, GAF, or Johns Manville.

2. NRCA Assembly Matrix: TP-C-A-S
   a. Membrane Type: Thermoplastic
   b. Deck Characteristics Type:
      1). Concrete.
   c. Attachment Type:
      1). Insulation board: Fully adhered.
      2). Cover Board: Fully adhered.
      3). Membrane: Fully adhered.
   d. Surfacing Type: Smooth, non ballasted.

3. Membrane: TPO - Thermoplastic polyolefin complying with ANSI/RMA, 60 mils, ASTM D6878, Type I, polyester reinforced, with factory applied pressure sensitive adhesive,

ASTM C1549 solar reflectance 0.74 minimum, color white.

4. Seaming Materials: Heat welded as recommended by membrane manufacturer.

5. Curb and Parapet Flashing: Same material as membrane.

6. Formable Flashing: Non-reinforced, flexible, heat weldable sheet, composed of thermoplastic polyolefin polymer and ethylene propylene rubber.

B. INSULATION MATERIALS

1. General:
   a. Comply with Section 07 21 00, unless otherwise indicated herein.
   b. Provide vapor retarder materials acceptable with singly-ply roofing manufacture compatible with substrate conditions.
   c. Provide insulating and cover board materials acceptable with single-ply roofing manufacturer, in sizes to fit applications indicated, selected from insulation manufacturer's standard thicknesses, widths, lengths, and compatible with roofing membrane, method of attachment and project conditions.
   d. Provide products with Class A flame spread rating of less than 25 and smoke development rating less than 450.

2. Manufacturers: Subject to compliance with general requirements.

3. Insulation and cover boards:
   a. Primary Continuous and Tapered Boards: Polyisocyanurate, rigid, ASTM C1289, Type II, Class 1, Grade 2, LTTR "R" of 5.7 minimum per nominal inch ASTM C518, compressive strength 20 psi minimum ASTM D1621, water absorption 0.5 percent by volume maximum ASTM C1763, square edges. Note: R-Value requirement as shown on drawings is exclusive of taper insulation.
   b. Cover Boards: High density closed cell polyisocyanurate rigid board with coated facers, ASTM C1289, Type II, Class 4, Grade 2, LTTR "R" of 2.5 minimum per nominal 1/2" ASTM C518, compressive strength 120 psi minimum ASTM D1621, square edge profile in 1/2" thickness minimum, water absorption less than 3 percent ASTM C1763, mold resistance pass rating ASTM D3273.

C. AIR BARRIER MATERIALS

1. Air Barrier Materials: Joint and gap sealing products used to restrict air pressure from entering into roofing system from inside building thermal envelope. Materials shall have an air permeability not greater than 0.004 cfm/sq. ft. under a pressure differential of 0.3 inch water gauge per ASTM E2178, Class A flame spread rating of less than 25 and smoke development rating less than 450, and compatible with substrates and roofing system.
   a. Roofing Flashing Membrane: Pressure sensitive fully adhered flashing as recommended by manufacturer for roofing system.
   b. Sealants: Comply with Section 07 92 00. Two-component, semi-rigid, 100 percent solids, epoxy resin with Shore A durometer hardness of 80 in accordance with ASTM D2244.
   c. Non-Shrink Grout: Comply with Section 03 30 00.
   d. Foam-In-Place Insulation (Concealed conditions only): Comply with Section 07 21 00.

D. AUXILIARY MATERIALS

1. Fasteners:
   a. Comply with Section 05 50 00.
   b. Treated wood substrates: Hot dipped galvanized fasteners, ASTM A653, Class G 185 coating.
   c. 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 membrane roofing system manufacturer.

2. Adhesive: Type recommended by membrane manufacturer for project conditions.

3. Primers and Surface Conditioners: Compatible with substrate conditions, adhesives, and roofing system.

4. Sealants: As recommended by membrane manufacturer.

5. Sheet Metal Fabrications, Extruded Edging, and Accessories: Comply with Section 07 60 00. Prefabricated metal edge securement shall comply with ANSI/SPRI/FM 4435/ES-1. All other assemblies to comply with SMACNA and NRCA recommendations.

6. Prefabricated Control or Expansion Joint Flashing: As required and approved to satisfy roof warranty.

7. Pre-Molded Inside/Outside Corners: Types as recommended by roof membrane manufacturer for specific project conditions.

8. Pipe Flashings: Compatible with roof membrane system for sizes and types as indicated on drawings.

9. Metal Termination Bars: Manufacturer’s standard stainless steel or aluminum bars, approximately 1 inch wide by 0.05 inch thick, pre-punched. Comply with Section 05 50 00.

PART 3 - EXECUTION

3.01 ENVIRONMENTAL REQUIREMENTS

A. Do not install membrane during inclement weather or when air temperature may fall below 40 degrees F.

3.02 EXAMINATION

A. Inspect substrate and report unsatisfactory conditions in writing. Verify that surfaces and site conditions are ready to receive work; deck clean and smooth, free of snow or ice; properly sloped to drains.

B. Comply with roof system manufacturer's instructions and recommendations; clean, prime and prepare substrate.

C. Verify roof openings, curbs, and protrusions through roof are solidly set; strips and reglets are in place.

D. Special Note: Tornado shelter penetration assemblies and installation shall comply with ICC500 and require special inspections during installation. Refer to Section 01 45 33.

E. Provide cementitious leveling compound or patching mortar at concrete substrate depressions and surface irregularities as required to insure proper installation of roofing system.

F. Proceed with roofing work only after substrate construction and penetrating work have been completed. Beginning work means acceptance of substrate.

3.03 EDGE SECUREMENT, FLASHING AND ACCESSORIES

A. Install wood nailer securement in accordance with FM 1-49 and approved submittals. Unless otherwise indicated on drawings or approved, minimum attachment as follows:
   1. Concrete Substrates (Minimum 2,500 psi):
      a. 1/2" diameter anchors with 1” diameter minimum bearing washer spaced 48”.
      b. 3/8” diameter anchors with 1” diameter minimum bearing washer spaced 32” o.c..
      c. At corners, fasteners doubled.
      d. Minimum 8” penetration.

B. Install prefabricated extruded metal edge securements and sheet metal assemblies in accordance with Test Methods RE-1, RE-2, and RE-3 of ANSI/SPRI ES-1. Install all other sheet metal assemblies per SMACNA and NRCA recommendations.

C. Apply flexible flashing to seal membrane to vertical elements.

D. Seal flashing and flanges of items penetrating membrane.

3.04 AIR BARRIER APPLICATION

A. Apply air barrier materials to seal joints, cracks, holes, and penetrations in concrete deck surface in accordance with manufacturer’s instructions.

B. Extend air barrier fill materials under blocking to deck edge. Seal penetration perimeters and edges.

3.05 INSULATION APPLICATION

A. Roller apply adhesive primer to deck and substrates at coverage rates and curing schedule per roofing manufacturer’s recommendations.

B. Adhesive Installation: Use qualified personnel to install adhesive of type, bead width, bead spacing, and curing schedule approved by manufacturer. Adhesive beads shall not be less than 1/2" wide, spaced greater than 6” O.C., less than eight (8) beads per 4’x4’ board, or provide less coverage than required in FM, “Loss Prevention Data Sheet 1-90” for project materials and conditions.

C. Fully adhere first layer of primary continuous insulation to deck and substrates. Fully adhere second layer of primary insulation with joints staggered from first layer. Install boards with tightly butted joints and neatly fitted around penetrations. Lay boards with edges in moderate contact without forcing.

D. Fully adhere tapered insulation boards with tightly butted joints and neatly fitted around penetrations. Lay boards with edges in moderate contact without forcing. Form cant strips, crickets, saddles, and tapered areas with additional material as indicated and as required for proper drainage of membrane.

E. Do not install more insulation each day than can be covered with membrane before end of day and before start of inclement weather.

3.06 COVER BOARD APPLICATION

A. Fully adhere cover board over insulation and tapered insulation boards. Lay cover board layer with joints staggered from top insulation layer. Install cover board with tightly butted joints and neatly fitted around penetrations. Lay boards with edges in moderate contact without forcing.

B. Miter, cope or form cover board butt joints and edges for full and continuous contact of roof membrane through roof plane transitions. Where smooth and continuous roof plane transitions cannot be accomplished by means of modifications to cover board, provide sheet metal backing extending 6” min. into each change in roof plane set in mastic with butt joints lapped 6” minimum.

3.07 MEMBRANE APPLICATION

A. Fully adhere membrane in accordance with manufacturer’s instructions and final shop drawings. Cut sheets to maximum size possible in order to minimize seams and to accommodate contours of roof deck and proper drainage across shingled laps of sheets.

B. Unroll and position membrane over substrate to desired alignment and overlaps. Allow membrane to relax before positioning and adhering. Follow manufacturer’s instruction for field membrane and roof edge membrane application.

C. Apply adhesive at locations and coverage rates in accordance with manufacturer’s instructions.

D. Bond sheet to substrate. Work out air bubbles, wrinkles, and fishmouths. Firmly press sheet into place without stretching.

E. Install adjoining membrane sheets in same manner, overlapping edges a minimum of 2 inches to provide for a minimum 1 ½” hot air weld. Shingle joints on sloped substrate in direction of drainage. Minimize seams and shingle overlaps to shed water.

F. Hot air weld the membrane sheets a minimum of 1 ½” with a 3,000 kw dedicated generator automatic hot air welding machine as approved by roof membrane manufacturer. Electrical cord for hand welders #14 size wire limited to 50 feet and #12 size wire limited to 100 feet.

G. Continue membrane up vertical surfaces minimum 8 inches unless otherwise noted. Reinforce membrane with multiple thickness of membrane material over joints.

H. Seal items penetrating membrane with counterflashing membrane material. Install membrane flashing. Seal watertight to membrane.

3.08 FIELD QUALITY CONTROL

A. Final Roof Inspection: Arrange for roofing system manufacturer’s technical personnel to

inspection roof installation upon completion and submit report that all defective and non-conforming work has been corrected. Schedule inspections with Owner and Architect.

B. Repair or remove and replace components of membrane roofing system where inspections indicate that they do not comply with specified requirements. Defective or non-confirming conditions defined as follows, unless more stringent criteria required by roofing system manufacturer:

1. Blister, Bubble, Capillaries or Voids: A spongy raised portion of roofing membrane resulting from improper surface preparation, pressure of entrapped air, entrapped water vapor, inadequate adhesive, adhesive bonding failure, improper attachment method, or resulting from climatic installation conditions. Such conditions shall not exceed Four (4) inches in individual diameter, multiple occurrences be spaced less than Forty Eight (48) inches on center, or multiple occurrences exceeding Sixteen (16) square inches within One Hundred Forty Four (144) square feet of surface area.

2. Fishmouth: Opening or void in lapped edge or seam.

3. Punctures or Holes: Condition compromising system watertight effectiveness.

4. Seam or Joint Separation: Unbonded edge condition where probing tool penetrates lapped area under firm pressure.

5. Slope, Drainage, or Ponding (Standing Water): Criteria for judging proper slope for drainage is no ponding water on roof surface Forty-Eight (48) hours after precipitation event during conditions conducive to drying.

6. Wrinkles or Distortions: Surface condition that impede the proper flow of water drainage.

7. Insulation and/or Cover Board Joints: Butt joints exceeding 1/4" wide or uneven surfaces exceeding 1/4" vertical measured in transition plane. Condition shall not create damming of water.

C. Additional inspections, at Contractor’s expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.09 PROTECTING AND CLEANING

A. Upon completion of work, remove debris and clean exposed surfaces.

B. Protect membrane roofing system from damage and wear during remainder of construction period.

C. 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.

END OF SECTION

SECTION 07 60 00

FLASHING AND SHEET METAL

PART 1 - GENERAL

1.01 SUMMARY

A. Provide flashing and sheet metal where indicated:

1. Sheet metal flashing, coping, fascia, exposed trim, edges, counterflashing, cleats, caps, sills, drips, etc.

2. Prefabricated metal extrusions.

3. Gutters and downspouts.

4. Thru wall scuppers and conductor heads.

5. Elastic flashing.

6. Sheet metal accessories.

1.02 SUBMITTALS

A. Comply with Section 01 33 00.

B. Shop Drawings: Prior to fabrication submit shop drawings for each typical sheet metal item indicating assembly, profile, material, gages, jointing, and fastening.

C. Test Reports: Submit edge securement assembly test reports indicating compliance with ANSI/SPRI/FM 4435/ES-1 Test Methods RE-1, RE-2, and RE-3.

D. Product Data: Submit roof edge securement system product data.

E. Samples: 6"x6" minimum square color sample of each product exposed to view. Provide sample of typical roof edge securement assembly.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

B. Standards: Comply with the provisions of the following specifications and standards, except as otherwise noted or specified, or as accepted or directed by the Architect.

1. SMACNA, (Sheet Metal and Air Conditioning Contractors National Association, Inc.) Architectural Sheet Metal Manual (Fifth Addition).

2. AA, (Aluminum Association), Aluminum Construction Manual - Aluminum Sheet Metal Work in Building Construction.

3. ANSI/SPRI/FM 4435/ES-1 Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Sheet Metal:

1. Prefinished Steel Sheets: 24 gauge hot dipped galvanized steel (G90) commercial quality, primed and finished one side with Kynar base fluoropolymer coating 1.0 mil total dry film thickness, and with wash coat on reverse side. Colors as selected by Architect. Coat pre-painted side with liquid applied factory installed strippable film for protection of finished surface. Vincent “ColorClad”, Peterson “PacClad” or Copper Sales “Una-Clad”.

2. Sheet Aluminum: ASTM B 209, alloy 3003, mill finish, temper #14, 20 gauge (.032 inch).

3. Sheet Stainless Steel: Comply with Section 05 50 00.

4. Zinc-Coated Steel: ASTM A 526, G90 hot-dip galvanized, 20 gauge (.032 inch).

B. Roof Edge Securement System:

1. Performance Requirements:
   a. Roof edge securement assemblies shall comply with ANSI/SPRI/FM 4435/ES-1.
   b. Extruded bar shall lock membrane, prevent wind pullback.
   c. Splices to allow thermal expansion.
   d. Fascia shall freely thermal cycle to prevent maintenance.

2. Fascia Metal: .050” thick-formed aluminum with Kynar 500 finish and matching splice plates. Colors to be selected from manufacturer’s full color range.

3. Extruded Bar: 6063-T6 alloy aluminum with pre-punched slotted holes. Bar miters welded.

4. Anchor Bar Cleat: 20 gauge, G-90 steel with pre-punched holes.

5. Fasteners: #9 x 2” stainless steel fasteners. No exposed fasteners permitted.

C. Flexible Sheet Membrane Flashing: Non-reinforced flexible black elastic rubber sheet, 20 mils thick, formulated from virgin polyvinyl chloride with plasticizers and other modifiers to remain flexible and waterproof in concealed applications.

D. Auxiliary Materials:

1. Fasteners: Same metal as flashing/sheet metal or other noncorrosive metal as Solder recommended by sheet metal manufacturer. Match finish of exposed heads with materials

being fastened.

2. Solder: ASTM B 32, 50-50 tin/lead solder, with rosin flux.

3. Roofing Cement: ASTM D 2822, asphaltic.

4. Bituminous isolation coating. SSPC - Paint 12, solvent-type bituminous mastic, nominally free of sulfur, compound for 15-mil dry film thickness per coat.

5. Mastic and elastomeric sealant: Polyisobutylene; nonhardening, non-skinning, nondrying, nonmigrating sealant.

6. Epoxy seam sealer: 2-Part noncorrosive metal seam cementing compound, recommended by manufacturer for non-moving joints including riveted joints.

7. Polyethylene underlayment: 6 mil carbonated polyethylene film.

8. Reglets and metal accessories: Sheet metal clips, cleats, straps, anchoring devices and similar accessory units as required for installation of work, matching or compatible with material being installed, noncorrosive, size and gage required for performance.

9. Adhesives: Type recommended by flashing sheet metal manufacturer for water/weather resistant seaming and adhesive application of flashing sheet.

10. Paper Slip Sheets: 5-lb. rosin-sized building paper.

11. Fastening devices: One inch aluminum screws or 1 ½ inch ring shanked nails, unless otherwise indicated. Refer also to Section 05 50 00.

2.02 FABRICATION:

A. Fabricate flashing, counterflashing and other sheet metal work not exposed to view of aluminum. Fabricate flashing, gutters, downspouts, conductor heads, scuppers, copings, caps, edges, trim, and other exposed sheet metal work of pre-painted, or pre-primed and field painted, steel sheets. Use lead at drains, vents, where indicated, and where required to conform to contour of roofing components and accessories.

B. Fabricate for waterproof and weather-resistant performance; with expansion provisions for running work, sufficient to permanently prevent leakage, damage or deterioration of the work. Form work to fit substrates.

C. Form exposed sheet metal work without excessive oil-canning, buckling and tool marks, true to line and levels as indicated, with exposed edges folded back to form hems.

D. Fabricate pre-painted steel with strippable film in place. If soldering is necessary, mechanically remove coating. Touch up with color matched paint.

E. Seams: Fabricate nonmoving seams in sheet metal with flat-lock seams. Form aluminum seams with epoxy seam sealer; rivit joints for additional strength where required.

F. Expansion Provisions: Where lapped or bayonet-type expansion provisions cannot be used, or would not be sufficiently water/weatherproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

G. Sealant Joints: Where movable, non-expansion type joints are indicated or required for proper performance of work, form metal to provide for proper installation of elastomeric sealant.

H. Separate dissimilar metals from each other to prevent electrolytic action by painting each metal surface in area of contact with a heavy application of bitumastic coating, or by other permanent separation as recommended by manufacturers of dissimilar metals.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install roof edge securement systems in compliance with ANSI/SPRI/FM 4435/ES-1. Follow recommendations of SMACNA and AA Manuals for specific application.

B. Install materials and systems in accordance with manufacturer's instructions. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.

C. Anchor units of work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints and seams which will be permanently watertight and weatherproof.

D. Underlayment: Where aluminum is to be installed directly on cementituous or wood substrates, install a course of paper slip sheet and a course of polyethylene underlayment.

E. Bed flanges of work in a thick coat of bituminous roofing cement where required for waterproof performance.

F. Secure edges of flashing to other work with angles and bars, and seal with sealant as indicated.

G. Retainers: Where indicated, provide saw cuts for metal counterflashing system using metal flashing receiver as detailed and indicated.

H. Seal edges of metal flashings to substrates with roofing cement; install bed or bead of cement in manner which will maintain a watertight seal.

I. Remove strippable film form pre-painted steel work. Restore damaged components and finishes. Clean and protect work from damage.

END OF SECTION

SECTION 07 72 00

ROOF ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

A. Provide roof accessories, complete.

1. Gutter debris screens.

1.02 SUBMITTALS

A. Comply with Section 01 33 00.

B. Product Data: Submit manufacturer's product data for gutter debris screens.

C. Warranty: Submit manufacturer's warranty for gutter debris screens.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.01 GUTTER DEBRIS SCREENS

A. Manufacturers: Amerimax, Diamond Back Gutter Covers, Gutter Dome, Gutter Gekko, Quality Edge, Versaguard, or approved equal.

B. Warranty: Manufacturer's standard twenty (20) year materials warranty.

C. Materials:
1. General Design: Compatible with project conditions.
2. Performance Characteristics:
   a. Filtration: Minimum 60 gallons of water per minute.
   b. Screen (mesh): Type 304 Stainless steel, standard 40 mesh minimum, 440 micron opening minimum.
   c. Frame Materials: 24 gauge aluminum or hot dipped galvanized steel.
   d. Frame Design: Ridged hemmed edge with pre-drilled holes for field installation.
   e. Width: Compatible with guttering design.
   f. Length: Manufacturer's standard lengths, 4'-0" minimum.
3. Hardware: Screw fasteners, stainless steel.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Comply with accessory manufacturers' instructions and recommendations. Coordinate installation with roofing system to ensure product performance. Anchor securely to structure to withstand inward and outward loads.

END OF SECTION

SECTION 07 84 00

FIRESTOPPING

PART 1 – GENERAL

1.01 SUMMARY

A. Provide firestopping at the following locations where indicated:
   1. Penetrations through fire-resistance-rated floor and roof construction.
   2. Penetrations through fire-resistance-rated walls and partitions.
   3. Penetrations through smoke barriers and construction enclosing compartmentalized areas.
   4. Sealant joints in fire-resistance-rated construction.
   5. Identification labeling of through fire-resistant penetration and construction joint systems.

1.02 SUBMITTALS

A. Comply with Section 01 33 00.

B. Product Data: Submit manufacturer's specifications and installation instructions for product specified.

C. Shop Drawings: Submit materials and installation details for penetrations and joint systems in each type of construction to be firestopped. Shop drawings are not required for types of penetrations or joint systems illustrated in the Product Data.

D. Test Reports: Submit documentation from recognized testing agency firestopping material has been tested and meets specified performance requirements.

E. Installer Certification: Submit certification that the installer has the specified experience.

1.03 QUALITY ASSURANCE

A. Comply the governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Deliver, handle, and store materials in accordance with manufacturer's instructions.

B. Standards: Comply with the provisions of the following specifications and performance standards, except as otherwise noted or specified, or as accepted or directed by the Architect.
   1. ASTM C656, Standard Specification for Structural Insulating Board, Calcium Silicate.
   2. ASTM C665, Specification for Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
   3. ASTM C920, Standard Specification for Elastomeric Joint Sealants.

4. ASTM E119, Standard Test Methods for Fire Tests of Building Construction and Materials.
5. ASTM E814, Standard Test Methods for Fire Tests of Penetration Firestop Systems.
6. ASTM E1399, Standard Test Method for Cyclic Movement and Measuring the Minimum and Maximum Joint Widths of Architectural Joint Systems.
7. ASTM E1966, Test Method for Fire Resistive Joint Systems.
8. ASTM E2174, Standard Practice for On-Site Inspections of Installed Firestop Systems.
9. ASTM E2393, Standard Practice for On-Site Inspections of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers.
10. ASTM E3038, Standard Practice of Assessing and Qualifying Candidates as Inspectors of Firestop Systems and Fire-Resistive Joint Systems.
11. ANSI/UL 263, Fire Tests of Building Construction and Materials.
12. ANSI/UL 723, Surface Burning Characteristics of Building Materials.
13. ANSI/UL 1479, Fire Tests of Through-Penetration Fire-stops.
14. ANSI/UL 2079, Tests for Fire Resistance of Building Joint Systems.
15. Underwriters Laboratories (UL), UL Building Materials Directory; Through-Penetration Firestops Systems (XHEZ), Joint Systems (XHBN), Firestop Devices (XHJI), Forming Materials (XHKU), Wall Opening Protective Materials (CLIV), and Fill, Void or Cavity Materials (XHHW).

C. Installer Qualifications: Experienced in the installation of firestopping that is similar in material, design, and extent to the firestopping indicated for this Project.

1.04 SPECIAL INSPECTIONS

A. Comply with Section 01 45 33.

B. Inspections: Projects in Risk Category III and IV as defined by the building code, Owner shall engage a qualified independent inspection agency to inspect the following:
1. Through-penetration firestop systems in accordance with ASTM E2174, “Standard Practice for On Site Inspection of Installed Fire Stops”.
2. Joint systems in accordance with ASTM E2393, “Standard Practice for On Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers”.

C. Inspection Agency Qualifications: Certification per ASTM E3038.

D. Manufacturers are not qualified inspection agencies, and it is a conflict of interest for the manufacturer to perform inspections of installed firestopping systems according to inspection standards.

PART 2 – PRODUCTS

2.01 PERFORMANCE CRITERIA

A. General: Use only firestopping products that have been tested for specific fire-resistance-rated construction conditions conforming to construction assembly type, penetrating item type or joint opening width and movement capabilities, annular space requirements, and fire-rating involved for each separate instance.

1. Materials shall be asbestos free and tested per ASTM E119 or ANSI/UL 263 with characteristics defined per test ANSI/UL 723 and bear classification marking of UL or qualified independent testing agency.
2. Provide products that are compatible with each other, with the substrates forming openings, and with the items, if any, penetrating the firestopping, under the conditions represented by this project, based on testing and field performance demonstrated by manufacturer. Use only products specifically listed for use in listed systems.
3. Firestopping systems for construction gaps shall have capability appropriate to the potential movement of the gap, demonstrated by testing in accordance with ASTM E1300 for a minimum of 500 cycles at 10 cycles per minute. L-Rating of 1 cmf per linear foot maximum. Determine ratings in accordance with ANSI/UL 2079.
4. Provide materials with minimum flame (F-Rating) and temperature (T-Rating) of one hour, but not less than fire resistance rating of assembly being penetrated as tested per ASTM E814 or joint protected as tested per ASTM E1966.
5. Ratings: Refer to drawings for minimum rating values and location requirements.
6. Refer to mechanical / electrical drawings and specifications for additional requirements.

B. Manufacturers: Subject to performance compliance with through-penetration firestop systems (XHEZ) and/or wall opening protective materials (CLIV) and/or joint systems (XHBN) and/or perimeter fire containment systems (XHDG) and/or continuity head-of-wall joint systems (XHBO) listed in UL Fire Resistance Directory, materials from the following manufacturers are acceptable:
   1. 3M.
   2. DOW.
   3. Fibrex.
   4. Hilti.
   5. IIG Minwool, LLC.
   6. Johns Manville International.
   7. Owens Corning.
   8. RectorSeal / Metacaulk.
   9. Rockwool.
   10. Rockwool Malaysis SDN BHD.
   11. Rock Wool Manufacturing Company.
   12. Specified Technologies, Inc.
   13. Tremco.
   14. USG.

2.02 MATERIALS

A. Intumescent Sealants: Single component intumescent latex formulations containing no water soluble intumescent ingredients capable of expanding a minimum 8 times.

B. Endothermic Sealants: Single component latex formulations that upon cure do not re-emulsify during exposure to moisture.

C. Elastomeric Sealants: ASTM C920. Single component latex formulations that upon cure do not re-emulsify during exposure to moisture and accommodate minimum ±25 percent movement.

D. Firestop Devices: Factory-assembled steel collars lined with intumescent material capable of expanding a minimum 30 times sized to fit specific outside diameter of penetrating item.

E. Fire Rated Cable Pathways: Gangable device modules capable of being retrofitted around existing cables and comprised of steel raceway with intumescent foam pads allowing 0 to 100 percent cable fill and requiring no additional action in the form of plugs, twisting closure, putty, pillow, or sealant to achieve fire and leakage ratings.

F. Wall Opening Protective Materials: Intumescent, non-curing pads or inserts for protection of electrical switch and receptacle boxes to reduce horizontal separation to less than 24”.

G. Firestop Putty: Intumescent, 100% solids, non-hardening, water resistant, butyl rubber based putties containing no solvents or silicone compounds.

H. Wrap Strips: Single component intumescent elastomeric strips faced on both sides with a plastic film and capable of expanding a minimum 30 times.

I. Firestop Pillows: Re-enterable, non-curing, mineral fiber core encapsulated with an intumescent coating on all six sides contained in a flame retardant poly bag.

J. Firesafing Insulation Batt: ASTM C665, Type I. Mineral wool fiber insulation or hydrous calcium silicate-inorganic, unfaced. Thickness required to achieve assembly performance.

K. Firesafing Insulation Board: ASTM C656, Type II, Grade 5. Inorganic, non-combustible, hight-temperature insulation board composed primarily of lime, silica, and reinforcing fibers. Thickness required to achieve assembly performance.

L. Mortar: Portland cement based dry-mix product formulated for mixing with water at Project site to form a non-shrinking, water-resistant, homogenous mortar.

M. Silicone Sealants: Moisture curing, single component, silicone elastomeric sealant for horizontal surfaces (pourable or nonsag) or vertical surface (nonsag).

N. All-Weather Coatings: Moisture curing, single component silicone copolymer elastomeric spray coatings for horizontal surfaces where greater water resistance is required or inclement weather is anticipated.

O. Silicone Foam: Multicomponent, silicone-based liquid elastomers, that when mixed, expand and cure in place to produce a flexible, non-shrinking foam.

P. Composite Sheet: Intumescent material sandwiched between a galvanized steel sheet and steel wire mesh protected with aluminum foil capable of sustaining a minimum 2,500 lbs when subjected to load testing.

Q. Cast-In-Place Firestop Device: Single component molded firestop device installed on forms prior to concrete placement with totally encapsulated, tamper-proof integral firestop system and smoke sealing gasket.

R. Fire-Rated HVAC Retaining Angles: Steel angle system with integral intumescent firestop gasket for use on steel HVAC ducts.

S. Firestop Plugs: Re-enterable, foam rubber plug impregnated with intumescent material capable of expanding minimum 10 times with expansion beginning at 350°F for use in blank openings and cable sleeves.

T. Fire-Rated T Rating Collar Device: Louvered steel collar system with synthetic aluminized polymer coolant wrap installed on metallic pipes where T Ratings are required by applicable building code requirements.

U. Fire-Rated Cable Grommet: Molded two-piece grommet made from plenum grade polymer with a foam inner core for sealing cable penetrations up to 0.53 in. diameter.

V. Fire-Rated Closet Flange Gasket: Molded, single-component, intumescent gasket for use beneath a closet flange in floor applications.

W. Protective Wrap: Endothermic Wrap incorporating foil scrim evaluated for protection of cable pathways, liquid fuel lines, as well as in through-penetration and membrane-penetration firestopping. Testing to incorporate protection of Electrical Metallic Tubing (EMT), Rigid Metallic Conduit (RMC), Cable Trays, single and/or multi containment liquid fuel lines. Wrap to have a maximum weight of no greater than 1.4 lbs/ft^2 and allow for the use of steel tie wire when installed around piping, conduits, and/or cable trays.

PART 3 – EXECUTION

1.01 PREPARATION

A. Examination of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

B. Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, scale, laitance, rust, release agents, water repellents, and any other substances that may inhibit optimum adhesion.

C. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.

D. Do not proceed until unsatisfactory conditions have been corrected.

1.02 FIRESTOPPING INSTALLATION

A. General Requirements: Install through-penetration firestop systems and fire-resistive joint systems in accordance with “Performance Criteria” Article and in accordance with the conditions of testing and classification as specified in the published design.

B. Manufacturer’s Instructions: Comply with manufacturer’s instructions for installation of firestopping products.
   1. Seal all openings or voids made by penetrations to ensure an air and water resistant seal.

2. Consult with mechanical engineer, project manager, and damper manufacturer prior to installation of through-penetration firestop systems that might hamper the performance of fire dampers as it pertains to duct work.
3. Protect materials from damage on surfaces subjected to traffic.
4. Apply a suitable bond-breaker to prevent three-sided adhesion in applications where this condition might occur such as the intersection of a gypsum wallboard/steel stud wall to floor or roof assembly where the joint is backed by a steel ceiling runner or track.
5. Where joint application is exposed to the elements, fire-resistive joint sealant must be approved by manufacturer for use in exterior applications and shall comply with ASTM C920, “Specification for Elastomeric Joint Sealants”.

C. Install identification labels for through penetration and construction joints systems. Provide pressure sensitive self-adhesive vinyl labels, preprinted with the following information:
1. The words “Warning – Through Penetration Firestop System – Do Not Disturb. Notify Building Management of Any Damage.”
2. Listing agency’s system number or designation.
3. System manufacturer’s name, address, and phone number.
4. Installer’s name, address, and phone number.
5. General contractor’s name, address, and phone number.
6. Date of installation.

1.03 FIELD QUALITY CONTROL

A. Special Inspections: Coordinate installation of firestopping work with inspection agency. Notify testing agency at least 7 days prior to date when firestopping installation will be ready for inspection.

B. Keep areas of work accessible until inspection by authorities having jurisdiction.

C. Where deficiencies are found, repair or firestopping products so they comply with requirements.

1.04 ADJUSTING AND CLEANING

A. Remove equipment, materials and debris, leaving area in undamaged, clean condition.

B. Clean all surfaces adjacent to sealed openings to be free of excess firestopping materials and soiling as work progresses.

END OF SECTION

SECTION 07 92 00

JOINT SEALANTS

PART 1 - GENERAL

1.01 SUMMARY

A. Provide joint sealers at interior and exterior vertical and horizontal joints. Work includes joints around frames of doors, windows, louvers, or other openings in exterior walls, flooring joints, joints at penetrations of walls, decks, roofs, and floors by piping and other services and equipment, joints between items of equipment and other construction, joints at plumbing fixtures, joints at dissimilar material transitions, expansion and contraction joints of masonry and concrete, and other joints indicated to be sealed.

1.02 SUBMITTALS

A. Comply with Section 01 33 00.

B. Product Data: Submit manufacturer’s specifications, recommendations and installation instructions for each type of sealant and miscellaneous materials. Include letter of certifications, or certified test laboratory reports indicating that each material complies with the requirements and is intended for the application indicated.

C. Samples: Submit minimum 2" long sample of each color required for each type of sealant exposed to view. Samples will be viewed for color only.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

B. Standards: Comply with the provisions of the following specifications and performance standards, except as otherwise noted or specified, or as accepted or directed by the Architect.
   1. ASTM C834, Standard Specification for Latex Sealants.
   2. ASTM C920, Standard Specification for Elastomeric Joint Sealants.
   3. ASTM C1193, Standard Guide for Use of Joint Sealants.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Compatibility: Provide joint sealers, joint fillers and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by testing and field experience.

B. Colors: As selected by Architect from Manufacturer’s standard colors or match color of material applied, unless otherwise indicated.

2.02 ELASTOMERIC JOINT SEALANTS

A. Provide manufacturer's standard chemically curing, elastomeric sealant of base polymer indicated which complies with ASTM C920 requirements, including those for type, grade class, and uses.

B. One-Component Nonsag Urethane Sealant: Type M, Grade NS, Class 25, Master Builders "MasterSeal NP 1", Tremco "Dymonic", Bostik "Chem-Calk 900", Pecora "Dynatrol 1", Mameco "Vulkem 116", or approved equal.

C. Two-or-More Component Nonsag Urethane Sealant: Type M, Grade NS, Class 25. Tremco "Dymeric", Master Builders "MasterSeal NP 2", Bostik "Chem-Calk 500", Pecora "Dynatrol II", or approved equal.

D. Two-Component Pourable Urethane Sealant: Type M, Grade P, Class 25. Tremco "THC 900", Master Builders "MasterSeal SL-2", Bostik "Chem-Calk 550", Pecora "NR-200 Urexpan", or approved equal.

E. One-Component Pourable Urethane Sealant: Type S, Grade P, Class 25. Master Builders "MasterSeal SL-1", Bostik "Chem-Calk 550", Pecora "NR-201 Urexpan", Maneco "Vulken 45", or approved equal.

F. One-Component Mildew-Resistant Silicone Sealant: Type S, Grade NS, Class 25. GE "SCS 1702", Dow Corning "786", Tremco "Proglaze White", Pecora "863 #345", or approved equal.

2.03 ACRYLIC EMULSION SEALANT

A. One component, nonsag, acrylic, paintable, mildew-resistant, complying with ASTM C834. Tremco "Acrylic Latex Caulk", Master Builders "MasterSeal NP 520", Pecora "AC-20", Woodmont "Chem-Calk 600", or approved equal.

2.04 MISCELLANEOUS MATERIALS

A. Joint Cleaner: Type of joint cleaning compound recommended by sealant manufacturer for the joint surfaces to be cleaned.

B. Joint Primer/Sealer: Type recommended by the sealant manufacturer for the joint surfaces to be primed or sealed.

C. Bond Breaker Tape: Polyethylene tape or other plastic tape as recommended by sealant manufacturer, to be applied to sealant-contact surfaces where bond to the substrate or joint filler must be avoided for proper performance of sealant. Provide self-adhesive tape wherever applicable.

D. Sealant Backer Rod: Compressible rod stock polyethylene foam, polyethylene jacketed polyurethane foam, butyl rubber foam, neoprene foam or other flexible, permanent, durable non-absorptive material as recommended for compatibility with sealant by the sealant manufacturer. Provide size and shape of rod which will control the joint depth for sealant placement, break bond of sealant at bottom of joint, form optimum shape of sealant bead on back side, and provide a highly compressible backer to minimize the possibility of sealant extrusion when joint is compressed.

E. Joint Fillers for Concrete Paving: Refer to Section 03 30 00 for requirements.

PART 3 - EXECUTION

3.01 JOINT TYPES AND USAGE

A. Acrylic Emulsion Sealant: All interior joints except joints with metal, aluminum, and wet work.

B. Elastomeric Sealants: Use single or multi-component urethane at all exterior joints and all interior joints with aluminum or metal. Use mildew resistant silicone sealant at sinks, plumbing fixtures and other wet work. Use minimum 35 Shore A hardness single or multi-component pourable polyurethane sealant for horizontal joints subject to pedestrian and vehicular traffic.

3.02 JOINT SURFACE PREPARATION

A. Clean joint surfaces immediately before installation of sealant. Remove dirt, insecure coatings, moisture, and other substances which would interfere with bond of sealant.

B. Preform preparation in accordance with manufacturer’s recommendations for substrate conditions.

C. For elastomeric sealants, do not proceed with installation of sealant over joint surface which have been painted, lacquered, waterproofed or treated with water repellent or other treatment or coating. Remove coating or treatment from joint surfaces before installing sealant.

D. Etch cementitious joint surfaces to remove excess alkalinity. Etch with 5% solution of muriatic acid; neutralize with dilute ammonia solution, rinse thoroughly with water and allow to dry before sealant installation.

E. Rough joint surfaces on vitreous coated and similar non-porous materials, wherever sealant manufacturer’s data indicates lower bond strength than for porous surfaces. Rub with fine abrasive cloth or wool to produce a dull sheen.

3.03 INSTALLATION

A. Install materials and systems in accordance with manufacturer's instructions and ASTM C1193. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.

B. Examine substrate; report unsatisfactory conditions in writing. Beginning work means acceptance of substrates.

C. Clean and prime joints, and install bond breakers, backer rods and sealant as recommended by manufacturers.

D. Do not apply sealant at temperatures below 40 deg F.

E. Apply sealant with hand-calking gun with nozzle of proper size to fit joints. Use sufficient pressure to insure full contact to both sides of joint to full depth of joint. Employ only proven installation techniques, which will ensure that sealants will be deposited in uniform, continuous ribbons without gaps or air pockets, with complete “wetting” of the joint bond surfaces equally

on opposite sides. Except as otherwise indicated, fill sealant rabbet to a slightly concave surface, slightly below adjoining surfaces. Where horizontal joints are between a horizontal surface and a vertical surface, fill joint to form a slight cove, so that joint will not trap moisture and dirt.

F. Install sealants to depths as shown or, if not shown, as recommended by the sealant manufacturer but within the following general limitations, measured at the center (thin) seciton of the bead.
   1. For sidewalks, pavements and similar joints sealed with elastomeric sealants and subject to traffic and other abrasion and indentation exposure, fill joints to a depth equal to 75% of joint width, but neither more than 5/8 inch deep nor less than 3/8 inch deep.
   2. For normal moving joints sealed with elastomeric sealants, but not subject to traffic, fill joints to a depth equal to 50% of joint width, but neither more than ½ inch deep nor less than 1/4 inch deep.
   3. For joints sealed with non-elastomeric sealants, fill joints to a depth in the range of 75% to 125% of joint width.

G. Do not allow sealants or compounds to overflow or spill onto adjoining surfaces. Use masking tape or other precautionary devices to prevent staining of adjoining surfaces, by either primer/sealer or the sealant.

H. Tool joints immediately after application of sealant if required to achieve full bedding to substrate or to achieve smooth sealant surface.

I. Cure and protect sealants as directed by manufacturers. Replace or restore damaged sealants. Clean adjacent surfaces to remove spillage.

END OF SECTION

SECTION 08 11 19

STEEL DOORS AND FRAMES

PART 1 – GENERAL

1.01 SUMMARY

A. Provide steel doors and frames, complete.
   1. Exterior and interior steel doors.
   2. Hollow metal steel frames.

1.02 SUBMITTALS

A. Comply with Section 01 33 00.

B. Product Data: Submit manufacturer's technical data for construction and installation.

C. Shop Drawings: Submit shop drawings indicating elevations, sections, details, and anchorage (including types, sizes and locations) design by manufacturer for project conditions.

D. Manufacturer's Certification: Submit manufacturer's quality assurance certification specified.

E. Manufacturer's Warranty: Submit manufacturer's standard warranty.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

B. Standards: Comply with the provisions of the following specifications and standards, except as otherwise noted or specified, or as accepted or directed by the Architect.
   1. General Assemblies:
      a. ANSI/SDI 250.8, Recommended Specifications for Standard Steel Doors and Frames (SDI-100).
      b. SDI 117, Manufacturing Tolerances Standard Steel Doors and Frames.
      c. SDI 250.8,
      d. ASTM C518, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
      e. ASTM E90, Standard Test Method for Laboratory Measurements of Airborne Sound Transmission Loss of Building Partitions and Elements.

   2. Fire Rated Assemblies:

a. NFPA 80, Standard for Fire Doors and Other Opening Protectives.
b. NFPA 252, Standard Methods for Fire Testing of Door Assemblies

3. Tornado Resistance Assemblies:
   a. ASTM E330, Test Method for Structural Performance of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.
   b. ASTM E1886, Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials.

C. Manufacturer's Quality Assurance: Certification that steel doors and frames have been tested by independent testing agency in accordance with specified ASTM and NFPA standards for design conditions and labeled indicating compliance.

1.04 SPECIAL INSPECTIONS

A. Comply with Section 01 45 33.

B. Inspections: Owner shall engage a professional structural engineer or a qualified independent inspection agency to inspect the installation of anchorages of steel doors and frame for compliance with ICC 500 Tornado Shelter opening protectives.

C. Contractor shall coordinate the inspection services with the progress of the work. The contractor shall provide sufficient notice to allow proper scheduling of all personnel. The contractor shall provide safe access to work for performing inspections.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Ceco, Curries, Steelcraft, Republic, or approved equal subject to conformance with performance requirements specified.

B. Provide steel doors and frames from a single manufacturer.

2.02 GENERAL

A. Materials: All steels used to manufacturer doors, frames, anchors, and accessories shall meet at least one or more of the following requirements:
   1. Cold rolled steel conforming to ASTM designations A1008.
   2. Hot rolled, pickled and oiled steel complying with ASTM designations A1011.
   3. Hot dipped zinc coated steel shall be of the alloyed type and comply with ASTM A924.

B. Classification (Level, Performance, and Model): Conform to requirements of SDI 250.8 reference standards.

C. Fabrication and Tolerances: Comply with provisions of SDI 250.8 and SDI 117. Fabricate steel doors and frames rigid, neat in appearance and free from defects,

warp, or buckle. Provide clean cut, straight, and true molded members, well formed and aligned miters, dressed and ground smooth, and where applicable, concealed fasteners. Reinforce at corners as required to prevent sagging. Accurately form metal to required sizes and profiles including astragals. Fit, assemble, and weld units at factory.

D. Labeling: Comply with provisions of SDI 250.8. DO NOT paint labels.

E. Anchors, Fasteners, Accessories: Manufacturers standard, hot-dipped galvanized at exterior. Provide not less than 3 anchors per jamb.

2.02 STEEL FRAMES

A. Steel Frames:
   1. Exterior: Level 3, welded type, extra heavy duty, 16 gauge (0.0598 inch) sheet steel, G60 zinc coating, mill phosphatized.
   2. Exterior (Tornado Resistant Units): Level 4, maximum duty, welded type, 14 gauge minimum (0.0747 inch), G60 zinc coating, mill phosphatized.
   3. Interior: Level 3, welded type, extra heavy duty, 16 gauge (0.0598 inch) sheet steel.
   4. Profiles: Refer to drawings for types.
   5. Joints: Mitered or coped corners.
   6. Glazing Frames: Provide manufacturers standard steel channel or tubular stops, predrilled for screws and factory finished as specified for doors and frames. Glass and glazing is specified in Section 08 80 00.
   7. Accessories: Door silencers and plaster guards, minimum 3 on strike jamb.

2.02 STEEL DOORS

A. General Units:
   1. Exterior: Level 2, Model 1, heavy duty, minimum 18 gauge (0.0358 inch) sheet steel, G60, mill phosphatized. Thermally improved with maximum U-value of 0.24 BTU/hr./sq. ft/degree F (ASTM C518), “R” factor 14.97.
   2. Interior: Level 2, Model 1, heavy duty, minimum 18 gauge (0.0358 inch) Acoustically improved with minimum STC of 33 (ASTM E90).
   3. Sizes: Refer to drawings for types.
   4. Thickness: 1 3/4 inches.
   5. Cores Construction: Continuously reinforced with a full core of resin-impregnated kraft honeycomb with 1-inch nested, hexagonal-shaped cells. Bond core to inside of both face sheets or polystyrene insulated panel core.
   6. Channel Fillers: Flush steel channel fillers for top channel of exterior doors.
   7. Hardware Reinforcing: Comply with provisions of SDI A250.8.
   8. Vision Panels: Provide glazing stops/moldings for glazed panels. Glass and glazing specified in Section 08 80 00.
   9. Astragals: Provide T and U astragal for pairs of exterior and fire-rated doors and as indicated on door schedule.

B. Fire Rated Units:
   1. Performance Requirements: Comply with provisions of NFPA 80.
   2. Labeling: Comply with provisions of SDI A250.8 and NFPA 252. Labels shall be affixed to components. DO NOT paint labels.

C. Tornado Resistant Units:
   1. Performance Requirements: Comply with opening protective design provisions of 2014 ICC 500. Refer to drawings for additional structural design criteria.
   2. Pressure Testing, ASTM E330: Components and assembly design shall meet or exceed structural loads as determined by ACSE 7 for project conditions, for pressure testing performance requirements.
   3. Missile Impact Testing, ASTM E1886: Components and assembly design shall meet or exceed minimum impact (Basic Wind Speed 250 mph) resistance testing with large missile (15 lb.) at velocity of 100 mph.
   4. Labeling: Unit shall be tested, listed, and labeled by an independent testing agency (UL) in accordance with 2014 ICC 500 requirements. Labels shall be affixed to components. DO NOT paint labels.
   5. Doors: Level 4, Model 1, maximum duty, 14 gauge (0.0747 inch) minimum sheet steel, G60, mill phosphatized. Thermally improved with maximum U-value of 0.24 BTU/hr./sq. ft/degree F (ASTM C518), “R” factor 14.97.
   6. Door Undercuts: 3/4" maximum where threashold is provided.
   7. Anchorage: Type, size, and spacing as defined by manufacturer to comply with performance requirements of steel door and frame assembly.

2.03 HARDWARE

A. Preparation: Prepare hollow metal units to receive mortised and concealed finished hardware, including cutouts, reinforcing, drilling, and tapping in accordance with door hardware schedule and templates provided by the hardware supplier. Reinforce hollow metal units to receive surface-applied hardware. Drilling and tapping for surface-applied hardware will be done on the job site.

B. Location of Hardware: Comply with provisions of SDI A250.8. Locate finish hardware as indicated in door hardware supplier templates and/or in compliance with Door and Hardware Institute publication “Recommended Location for Builder’s Hardware”.

2.04 FINISH

A. Finish: Factory primed and field finished. Provide manufacturers standard rust inhibitive primer compatible with finish paint specified in Section 09 90 00. Provide asphalt emulsion sound deadening coating on concealed frame interiors. DO NOT prime or paint testing agency labels.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install doors and frames in compliance with SDI 250.8. Set frames accurately in position, plumb and aligned, and securely anchor to adjacent construction.

B. Install hardware, adjust as required to provide smooth and proper operation with secure latching or locking.

C. Erect fire doors and frames in compliance with NFPA 80 and requirements of authorities having jurisdiction.

D. Clearances: Comply with provisions of SDI 250.8. Provide clearances of not more than 1/8-inch at jambs and heads, and not more than ¾-inch from floor or 3/16-inch from thresholds. Exterior doors provide 3/8-inch undercut for accessibility threshold standards.

E. Touch-up damaged coatings and leave ready to receive finish painting.

END OF SECTION

SECTION 08 41 13

ALUMINUM ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.01 SUMMARY

A. Provide aluminum swing doors, aluminum storefront framing, and hardware complete.

1.02 SUBMITTALS

A. Comply with Section 01 33 00.

B. Product Data: Submit manufacturer’s technical data and certificate indicating compliance with test procedures and performance standards specified.

C. Shop Drawings: Submit shop drawings of fabricated assemblies with manufacturer’s recommendations for installation with sections and details, including typical unit elevations at 1/4" scale, in relation to project substrate conditions. Show anchors, hardware, operators, trim, and accessories. Include glazing details.

D. Samples: Submit material color and finish samples.

E. Warranty: Submit warranty specified.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

B. Standards: Comply with the provisions of the following specifications and standards, except as otherwise noted or specified, or as accepted or directed by the Architect.
   1. American Architectural Manufacturers Association (AAMA).
   2. ASTM E283, Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
   3. ASTM E330, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
   4. ASTM E331, Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.

C. Warranty: Manufacturer’s Five (5) year warranty of defects in materials and workmanship of total system performance including hollow aluminum storefronts, windows, hardware, glazing systems, anchorage and setting systems, sealing, flashing, etc., as it relates performance requirements specified.

1.04 PERFORMANCE REQUIREMENTS

A. Provision for Thermal Movements: System performance to provide for expansion and contraction within system components caused by temperature cycling resulting from a surface temperature ranging from 0 degrees F to 180 degrees F without causing buckling, stressing on glass, failure of joint seals, undue stress on structural elements, damaging loads on fasteners, reduction of performance, or other detrimental effects. Operating doors and windows shall function normally over this temperature range.

B. Test Procedures and Performance (Refer to drawings for project structural design criteria):

1. Air Infiltration:
   a. Test units in accordance with ASTM E283 at static air pressure difference of 6.24 psf.
   b. Air infiltration shall not exceed 0.06 cfm/ft maximum per square foot of fixed wall area.

2. Water Resistance:
   a. Test unit in accordance with ASTM E331.
   b. There shall be no water leakage at a static test pressure of 12.0 psf.

3. Uniform Load Deflection:
   a. Test in accordance with ASTM E330.
   b. Design and size members to withstand not less than 20 psf minimum positive and negative design wind pressure normal to the plane of the wall, unless greater loads are required by local code requirements.
   c. Deflection under design load shall not exceed L/175 of the clear span.

4. Structural Uniform Load:
   a. Test in accordance with ASTM E330 at not less than 1.5 times the design wind pressure specified, minimum 60 psf.
   b. At conclusion of the test, there shall be no glass breakage, permanent damage to fasteners, storefront parts, or any other damage would cause the storefront to be defective.

5. Condensation Resistance Factor:
   a. Test unit in accordance with AAMA 1503.1.
   b. Condensation Resistance Factor (CRF) shall not be less than 59.

6. Thermal Transmittance:
   a. Test unit in accordance with AAMA 1503.1.
   b. Conductive thermal transmittance (U-Value) shall not be less than 0.63 BTU/hr/degree F/SF.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Manufacturers: EFCO, Kawneer, Oldcastle Building Envelope.

B. Framing:

1. Materials: Aluminum, extruded, 6063 T5 or T6 alloy and tempered, meeting requirements of ASTM B221-13, alloy GS 10A-T5.

2. Construction: Manufacturer's standard assemblies of either screw spline or shear block connections meeting test procedures and performance requirements specified. Where required by project conditions, provide additional vertical steel reinforcement.

3. Fasteners: Aluminum or non-magnetic stainless steel. Concealed fastenings shall be cadmium or zinc-plated steel.

C. Aluminum Entrances and Storefront (Refer to drawings):

1. Exterior Framing:
   a. Quality Standard: Equal to Kawneer series "451T" or EFCO series "403 (T)".
   b. Size: 2" x 4 1/2" in wall thickness and design required for project conditions.
   c. Construction: Thermal broken per manufacturer's standards.
   d. Glazing Stops: Units shall be 1 inch insulated double glazed consisting of 1/4 inch exterior pane, ½ inch air space, 1/4 inch interior pane install from exterior side.

D. Aluminum Swing Doors (Refer to drawings):

1. Framing:
   a. Quality Standard: Kawneer series "500" or EFCO series "D500".
   b. Size: As scheduled.
   c. Stiles, Top Rails and Cross Rails: 5" x 1 3/4" x 0.125" thick, plus or minus 0.005, glazing stop section 0.050" wall thickness.
   d. Bottom Rail: 10" minimum x 1 3/4" x 0.125" thick, plus or minus 0.005, glazing stop section 0.050" wall thickness.
   e. Glazing Stops:
      1). Exterior Units: Double glazed, 1" insulated unit, from exterior side.
      2). Interior Units: Single glazed, ¼" unit.

2. Door Hardware: (Refer to drawing door hardware schedule). Comply with Section 08 71 00.

E. Finish (Refer to Drawings):

1. Anodic (Inorganic): Finish all exposed areas of aluminum frames, doors, and components with electrolytically deposited color in accordance with Aluminum Association Designation AA-M10-C22-A41 or A31. Color shall be clear anodized Class 1 or II, AAMA 611-98.

F. Glazing (Refer to drawing glazing schedule):

1. Glass: Comply with Section 08 80 00.

2. Glazing Stops: Dry glazed, snap-in type EPDM or neoprene bulb-type, replaceable, with gaskets on both interior and exterior sides of glazing units. Units shall be glazed from exterior side.

G. Auxiliary Materials:

1. General: Provide all other materials, not specifically described but required for a complete, weather tight, and proper installation of doors and framing systems, subject to acceptance

by the Architect.

a. Deflection channels: As recommended by system Manufacturer.
b. Continuous sill flashing sheet metal: 0.040 inch thick aluminum sheet, finish to match mullion sections where exposed.
c. Column cladding sheet metal: 0.040 inch thick aluminum sheet, finish to match mullion sections where exposed.
d. Thermal Barrier: Barrier material shall be poured-in-place two part polyurethane. A nonstructural thermal barrier is unacceptable.

2. Sealant: Comply with Section 07 92 00. Colors to match aluminum framing, unless otherwise indicated.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Take field measurements before fabrication where possible; do not delay job progress.

B. Install materials and systems in accordance with manufacturer's instructions. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.

C. Anchor securely in place to structure; install plumb, level and in true alignment. Isolate dissimilar materials to prevent corrosion.

D. Coordinate with glass and glazing work; install hardware and adjust for smooth, proper operation.

E. Seal frames with an approved sealant, in compliance with manufacturer’s recommendations and Section 07 92 00, making a neat fully weatherproof assembly.

F. Clean and protect completed system; repair damage.

END OF SECTION

SECTION 08 55 13

TORNADDO RESISTANT WINDOWS

PART 1 - GENERAL

1.01 SUMMARY

A. Provide aluminum tornado resistant window systems, complete.

1.02 SUBMITTALS

A. Comply with Section 01 33 00.

B. Product Data: Submit manufacturer’s technical data and certificate indicating compliance with test procedures and performance standards specified.

C. Test Report: Submit for test reports from recognized independent testing agency for tornado resistant window, including glazing assemblies, provided conforming to performance requirements specified.

D. Shop Drawings: Submit shop drawings of fabricated assemblies with manufacturer’s recommendations for installation with sections and details, including typical unit elevations at 1/4" scale, in relation to project substrate conditions. Show anchors, hardware, operators, trim, and accessories. Include glazing details.

E. Samples: Submit material color and finish samples.

F. Manufacturer’s Certification: Submit manufacturer’s quality assurance certification specified.

G. Warranty: Submit warranty specified.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

B. Standards: Comply with the provisions of the following specifications and standards, except as otherwise noted or specified, or as accepted or directed by the Architect.
   1. American Architectural Manufacturers Association (AAMA).
   2. ASTM E283, Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
   3. ASTM E330, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
   4. ASTM E331, Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.

5. ASTM E1886, Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials.
6. ASCE 7, Minimum Design Loads for Buildings and Other Structures.
7. Underwriters Laboratories, Inc. (UL).

C. Warranty: Manufacturer's Five (5) year warranty of defects in materials and workmanship of total system performance including hollow aluminum storefronts, windows, hardware, glazing systems, anchorage and setting systems, sealing, flashing, etc., as it relates performance requirements specified.

D. Manufacturer's Quality Assurance: Certification that tornado resistant window systems, including glazing, has been tested by independent testing agency in accordance with specified ASTM standards for design conditions and labeled indicating compliance.

1.01 SPECIAL INSPECTIONS

A. Comply with Section 01 45 33.

B. Inspections: Owner shall engage a professional structural engineer or a qualified independent inspection agency to inspect the installation of anchorages of tornado resistant window systems for compliance with ICC 500 Tornado Shelter opening protectives.

C. Contractor shall coordinate the inspection services with the progress of the work. The contractor shall provide sufficient notice to allow proper scheduling of all personnel. The contractor shall provide safe access to work for performing inspections.

1.04 PERFORMANCE REQUIREMENTS

A. Provision for Thermal Movements: System performance to provide for expansion and contraction within system components caused by temperature cycling resulting from a surface temperature ranging from 0 degrees F to 180 degrees F without causing buckling, stressing on glass, failure of joint seals, undue stress on structural elements, damaging loads on fasteners, reduction of performance, or other detrimental effects. Operating windows shall function normally over this temperature range.

B. General Performance Requirements:

1. Air Infiltration:
   a. Test units in accordance with ASTM E283 at static air pressure difference of 6.24 psf.
   b. Air infiltration shall not exceed 0.06 cfm/ft maximum per square foot of fixed wall area.

2. Water Resistance:
   a. Test unit in accordance with ASTM E331.
   b. There shall be no water leakage at a static test pressure of 12.0 psf.

3. Uniform Load Deflection:
   a. Test in accordance with ASTM E330.
   b. Design and size members to withstand positive and negative design wind pressure normal to the plane of the wall, unless greater loads are required by local code

requirements.

c. Deflection under design load shall not exceed L/175 of the clear span.

4. Structural Uniform Load:
   a. Test in accordance with ASTM E330 at not less than 1.5 times the design wind pressure specified.
   b. At conclusion of the test, there shall be no glass breakage, permanent damage to fasteners, storefront parts, or any other damage would cause the storefront to be defective.

5. Condensation Resistance Factor:
   a. Test unit in accordance with AAMA 1503.1.
   b. Condensation Resistance Factor (CRF) shall not be less than 59.

6. Thermal Transmittance:
   a. Test unit in accordance with AAMA 1503.1 and label energy performance per NFRC standards.
   b. Conductive thermal transmittance (U-Value) shall not more than 0.37 BTU/hr/degree F/SF.

C. Tornado Resistant Performance Requirements:

1. Performance Requirements: Comply with opening protective design provisions of 2014 ICC 500. Refer to drawings for additional structural design criteria.

2. Pressure Testing, ASTM E330: Components and assembly design shall meet or exceed structural loads as determined by ACSE 7 for project conditions, for pressure testing performance requirements.

3. Missile Impact Testing, ASTM E1886: Components and assembly design shall meet or exceed minimum impact (Basic Wind Speed 250 mph) resistance testing with large missile (15 lb.) at velocity of 100 mph.

4. Labeling: Unit shall be tested, listed, and labeled by an independent testing agency (UL) in accordance with 2014 ICC 500 requirements. Labels shall be affixed to components. Do not remove labels.

5. Anchorage: Type, size, and spacing as defined by manufacturer to comply with performance requirements of assembly.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Manufacturers: UL tested products manufactured by Insulgard, Survivalite, Winco Window Company, are acceptable subject to compliance with performance requirements specified.

B. Framing:

1. General: Approved materials subject to compliance with performance requirements specified and compatible with substrate conditions.

2. Materials: Aluminum, extruded, 6005-T5 or 6105-T5 alloy and tempered, meeting requirements of ASTM B221.

3. Construction: Manufacturer's standard thermally broken aluminum framing assemblies of either screw spline or shear block connections meeting test procedures and performance requirements specified. Where required by project conditions, provide additional vertical reinforcement.

4. Glazing Stops: Units shall be insulated with multi-layer tornado resistant glazing system.

5. Fasteners: Aluminum or non-magnetic stainless steel. Concealed fastenings shall be cadmium or zinc-plated steel. Anchorage type, size and spacing shall be designed by manufacturer to comply with performance requirements specified.

C. Finish (Refer to Drawings):

1. Anodic (Inorganic): Finish all exposed areas of aluminum frames, doors, and components with electrolytically deposited color in accordance with Aluminum Association Designation AA-M10-C22-A41 or A31. Color shall be clear anodized Class 1 or II, AAMA 611-98.

D. Glazing (Refer to drawing glazing schedule):

1. Glass: Comply with Section 08 80 00.

2. Glazing Stops: Dry glazed, snap-in type EPDM or neoprene bulb-type, replaceable, with gaskets on both interior and exterior sides of glazing units. Units shall be glazed from exterior side.

E. Auxiliary Materials:

1. General: Provide all other materials, not specifically described but required for a complete, weather tight, and proper installation of doors and framing systems, subject to acceptance by the Architect.
   a. Deflection channels: As recommended by system Manufacturer.
   b. Continuous sill flashing sheet metal: 0.040 inch thick aluminum sheet, finish to match mullion sections where exposed.
   c. Column cladding sheet metal: 0.040 inch thick aluminum sheet, finish to match mullion sections where exposed.
   d. Thermal Barrier: Barrier material shall be poured-in-place two part polyurethane. A nonstructural thermal barrier is unacceptable.

2. Sealant: Comply with Section 07 92 00. Colors to match aluminum framing, unless otherwise indicated.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Take field measurements before fabrication where possible; do not delay job progress.

B. Install materials and systems in accordance with manufacturer's instructions. Install materials

and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.

C. Anchor securely in place to structure; install plumb, level and in true alignment. Isolate dissimilar materials to prevent corrosion.

D. Coordinate with glass and glazing work; install hardware and adjust for smooth, proper operation.

E. Seal frames with an approved sealant, in compliance with manufacturer's recommendations and Section 07 92 00, making a neat fully weatherproof assembly.

F. Clean and protect completed system; repair damage.

END OF SECTION

SECTION 08 71 00

DOOR HARDWARE

PART 1 - GENERAL

1.01 SUMMARY

A. Provide door hardware, complete.

1.02 SUBMITTALS

A. Comply with Section 01 33 00.

B. Product Data: Submit manufacturer's technical data cross referenced with shop drawings showing type, style, function, size, finish, manufacturer, model number, and product cut sheet.

C. Shop Drawings: Submit schedule of hardware cross-referenced with shop drawings showing manufacturer, model number, quantity of each different hardware item. Include fastenings and other pertinent information; mounting locations for hardware, and door and frame sizes and materials.

D. Core Schedule: Submit list of materials required for Owner to submit order for Contractor furnished and installed locking hardware cores and keys. Indicate model numbers and quantities compatible with hardware to be provided.

E. Manufacturer's Certification: Submit manufacturer's quality assurance certification specified.

F. Operating and Maintenance Instructions: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance. Provide special wrenches and tools applicable to each different or special component.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

B. Standards: Comply with the provisions of the following specifications and standards, except as otherwise noted or specified, or as accepted or directed by the Architect.
   1. ANSI A117.1, Accessibility and Usable Buildings and Facilities.
   2. ANSI/SDI 250.8, Recommended Specifications for Standard Steel Doors and Frames (SDI-100).
   3. ANSI/BHMA A156 Series, Standards for hardware materials and applications.
   4. ASTM E330, Test Method for Structural Performance of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.
   5. ASTM E1886, Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials

6. NFPA 80, Standard for Fire Doors and Other Opening Protectives.

C. Handicapped Accessibility: ADA and ANSI A117.1, Accessibility and Usable Buildings and Facilities.

D. Manufacturer's Quality Assurance: Certification that door hardware components and assembly sets have been tested by independent testing agency in accordance with specified ASTM and NFPA standards for design conditions and labeled indicating compliance.

E. Qualification of Supplier: The door hardware supplier shall have in his employ an AHC member of the American Society of Architectural Hardware Consultants.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Manufacturers: Approvals subject to compliance with performance requirements specified. Obtain hardware types from single manufacturer.

B. Performance Requirements:
1. Quality: All door hardware to be Grade 1 (Heavy Duty Commercial).
2. Locking: Locking hardware shall be provided with interchangeable cores compatible with Owner's Best 7-Pin series facility keying system.
3. Accessibility: All door hardware to comply with ANSI A117.1.
4. Fire Rating: All door hardware in fire rated assemblies to comply with NFPA 80 and UL labeled.
5. Tornado Resistant Units: Door hardware provided in tornado resistant opening protectives shall comply with the following:
   a. Comply with opening protective provisions of 2014 ICC 500.
   b. Pressure Testing, ASTM E330: Components and assembly design shall meet or exceed structural loads as determined by ACSE 7 for project conditions, for pressure testing performance requirements.
   c. Missile Impact Testing, ASTM E1886: Components and assembly design shall meet or exceed minimum impact (Basic Wind Speed 250 mph) resistance testing with large missile (15 lb.) at velocity of 100 mph.
   d. Labeling: Unit shall be tested, listed, and labeled by an independent testing agency (UL) in accordance with 2014 ICC 500 requirements. Labels shall be affixed to components.

C. Schedule: Refer to drawing door hardware schedule. Furnish in amounts and finish indicated or as required for complete and operable facility.

D. Hardware Types: Products of the following manufacturer's will be considered acceptable provided products are of equivalent weight, function, materials, design, and comply with performance requirements specified.
1. Continuous Geared Hinges
   a. Manufacturers: Ives, Markar, McKinney, Pemko.
   b. Finish: BHMA 689
2. Ball Bearing Hinges:
   a. Manufacturers: Hager, Ives, McKinney.

b. Finish: BHMA 626

3. Exterior Cylinder Removable (Interchangeable) Cores:
   a. Manufacturer: Best 7-Pin series (No Substitutes) to match Owner's facility keying system, Contractor furnished and installed.
   b. Finish: BHMA 626.
4. Rim Cylinders for Interchangeable Cores:
   a. Manufacturers (Compatible with cores): Best, Corbin Russwin , Schlage, Yale.
   b. Finish: BHMA 626.
5. (ANSI Function No. 08) Exit Panics with Two Point Locking Surface Vertical Rods, Cover Guards, Dust Proof Bottom Strikes, Exterior Escutcheon Trim with Rim Cylinders (Removable Cores), Exterior Lever Handles, Thru-Bolt Mounted:
   a. Alternates: (Refer drawings)
   b. Manufacturers: Corbin Russwin, Sargent, Von Duprin, Yale.
   c. Finish: BHMA 626.
6. (ANSI Function No. 02) Fire Exit Panics with Two Point Locking Surface Vertical Rods, Cover Guards, Dust Proof Bottom Strikes, Exterior Escutcheon Trim, Exterior Lever Handles, Thru-Bolt Mounted:
   a. Alternates: Alternate No. 3
   b. Manufacturers: Corbin Russwin, Sargent, Von Duprin, Yale.
   c. Finish: BHMA 626.
7. (ANSI Function No. 08) Exit Panic with Three Point Locking, Surface Vertical Rods, Cover Guards, Dust Proof Bottom Strike, Exterior Escutcheon Trim with Rim Cylinder (Removable Core), Exterior Lever Handle, Thru-Bolt Mounted:
   a. Manufacturers: Corbin Russwin, Sargent, Von Duprin, Yale.
   b. Finish: BHMA 626.
8. (ANSI Function No. F21) Entrance Mortis Lock with Three Point Locking, Dust Proof Bottom Strike, Exterior Escutcheon Trim with Mortis (Removable Core), Lever Handles:
   a. Manufacturers: Corbin Russwin, Sargent, Schlage, Yale.
   b. Finish: BHMA 626.
9. (ANSI Function No. F86) Storeroom Lock (Removable Core) with Lever Handles:
   a. Manufacturers: Corbin Russwin, Sargent, Schlage, Yale.
   b. Finish: BHMA 626.
10. (ANSI Function No. F75) Passage Latch with Lever Handles:
    a. Manufacturers: Corbin Russwin, Sargent, Schlage, Yale.
    b. Finish: BHMA 626.
11. (ANSI Function No. F76) Privacy Lock with Lever Handles:
    a. Manufacturers: Corbin Russwin, Sargent, Schlage, Yale.
    b. Finish: BHMA 626.
12. (ANSI Function No. 01) Exit Only Panic with Single Point Locking, Thru-Bolt Mounted:
    a. Alternates: Alternate No. 3
    b. Manufacturers: Corbin Russwin, Sargent, Von Duprin, Yale.
    c. Finish: BHMA 626.
13. Closer with Cover, Parallel Arm, Spring Cush, Thru-Bolt Mounted:
    a. Manufacturers: Corbin Russwin, LCN, Norton, Sargent.
    b. Finish: BHMA 689.
14. Kickplates:
    a. Manufacturers: Ives, Rockwood.
    b. Finish: BHMA 630.
15. Perimeter Seal Gaskets (Weather Proof):
    a. Manufacturers: Pemko, Zero International.

b. Finish: Black vinyl.

16. Perimeter Smoke Seal Gaskets:
    a. Manufacturers: Pemko, Zero International.
    b. Finish: Black vinyl.
17. Split Astragals (Weather Proof):
    a. Manufacturers: Pemko, Zero International.
    b. Finish: Black vinyl.
18. Smoke Seal Split Astragals:
    a. Manufacturers: Pemko, Zero International.
    b. Finish: BHMA 689 trim with black vinyl gaskets.
19. Door Bottom Sweeps (Weather Proof):
    a. Manufacturers: Pemko, Zero International.
    b. Finish: BHMA 689 with black vinyl gaskets.
20. Smoke Seal Door Bottom Sweeps:
    a. Manufacturers: Pemko, Zero International.
    b. Finish: BHMA 689 with black vinyl gaskets.
21. Thresholds (ADA / ANSI Compliant):
    a. Manufacturers: Pemko, Zero International.
    b. Finish: BHMA 689.
22. Rain Drip:
    c. Manufacturers: Pemko, Zero International.
    d. Finish: BHMA 630.

2.01 KEYING

A. Keying: Refer to hardware schedule key legend. Doors with removable core lock cylinders shall be keyed. Include construction keying and control keying with removable core cylinders. Coordinate final keying with Owner's facility keying system.

B. Supply 2 change keys for each lock.

C. Key Tags:
    1. Manufacturer: Barska, Kidde, Lund, or approved equal.
    2. Key Tags: Numbers corresponding to door schedule, color to be selected.

2.02 FASTENINGS

A. Furnish all necessary screws, bolts, and other fasteners of suitable size and type to properly anchor the hardware.

B. Furnish fastenings, where necessary, with expansion shields, toggle bolts, sex bolts, and other anchors, according to the material to which hardware is to be applied and the recommendations of the hardware manufacturer.

C. Furnish fastenings compatible with both hardware and substrate material and, if exposed, matching hardware finish.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Follow guidelines of DHI "Recommended Locations for Builder's Hardware and hardware manufacturers' instructions.

B. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.

C. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

D. Set thresholds in full bed of butyl-rubber or polyisobutylene mastic sealant.

E. Adjust operation, clean and protect.

END OF SECTION

SECTION 08 80 00

GLAZING

PART 1 - GENERAL

1.01 SUMMARY

A. Provide glass and glazing, complete.
   1. Glass and glazing for door and window opening systems will be supplied and installed under their respective sections.

1.02 SUBMITTALS

A. Comply with Section 01 33 00.

B. Product Data: Submit manufacturer’s product technical data, installation instructions, and maintenance data.

C. Test Report: Submit for test reports from recognized independent testing agency for glazing and assemblies provided conforming to performance requirements specified.

D. Samples: Prior to ordering, submit minimum 6"x6" sample of each type and thickness of glass specified for Architect’s approval.

E. Manufacturer’s Certification: Submit manufacturer’s quality assurance certification specified.

F. Manufacturer’s Warranty: Submit manufacturer’s warranty specified.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

B. Standards: Comply with the provisions of the following specifications and standards, except as otherwise noted or specified.
   1. ANSI Z97.1, American National Standard for Glazing Materials Used in Buildings – Safety Performance Specifications and Methods of Test.
   2. ASCE 7, Minimum Design Loads for Buildings and Other Structures.
   3. ASTM C162-05, Standard Terminology of Glass and Glass Products.
   4. ASTM C1036, Standard Specification for Flat Glass.
   5. ASTM C1048, Standard Specification for Heat-Treated Flat Glass – Kind HS, Kind FT Coated and Uncoated Glass.
   6. ASTM C1172, Standard Specification for Laminated Architectural Flat Glass.
   7. ASTM C1249, Standard Guide for Secondary Seal for Sealed Insulating Glass Units for Structural Sealant Glazing Applications.
   8. ASTM C1376, Standard Specification for Pyrolitic and Vacuum Deposition Coatings on Flat Glass.
   9. ASTM E330, Test Method for Structural Performance of Exterior Windows, Curtain Walls

and Doors by Uniform Static Air Pressure Difference.

10. ASTM E1886, Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials.
11. ASTM E2188, Standard Test Method for Insulating Glass Unit Performance.
12. ASTM E2189, Standard Test Method for Testing Resistance to Fogging in Insulating Glass Units.
13. ASTM E2190, Standard Specification for Insulating Glass Unit Performance and Evaluation.
14. Underwriters Laboratories, Inc. (UL).

C. Perform work in accordance with FGMA Glazing Manual, Laminators Safety Glass Association - Standards Manual for Glazing Installation Methods.

D. Manufacturer's Quality Assurance: Certification that glazing has been tested by independent testing agency in accordance with specified ASTM and NFPA standards for design conditions and labeled indicating compliance.

1.04 PERFORMANCE REQUIREMENTS

A. General: Provide glass and glazing capable of withstanding normal thermal movement, wind, and impact loads (where applicable) for project conditions. Watertight and airtight installation of each glazing unit is required. Each installation must withstand normal temperature changes, structural design loading without failure of any kind including loss or breakage of glass, failure of sealants or gaskets to remain watertight and airtight, deterioration of glazing materials, and other defects in work.

B. Design Wind Loads: Refer to drawings for project applicable codes and structural design criteria. Structural design of glazing assemblies shall be in accordance with ASCE 7.

C. Provide safety glass (tempered, laminated) complying with requirements of ANSI Z97.1 and 16 CFR 1201. Label each piece of glass indicating compliance with requirements. Do not remove label prior to installation.

D. Tornado Resistant Units:

1. Performance Requirements: Comply with opening protective design provisions of 2014 ICC 500. Refer to drawings for additional structural design criteria.
2. Pressure Testing, ASTM E330: Components and assembly design shall meet or exceed structural loads as determined by ACSE 7 for project conditions, for pressure testing performance requirements.
3. Missile Impact Testing, ASTM E1886: Components and assembly design shall meet or exceed minimum impact (Basic Wind Speed 250 mph) resistance testing with large missile (15 lb.) at velocity of 100 mph.
4. Labeling: Unit shall be tested, listed, and labeled by an independent testing agency (UL) in accordance with 2014 ICC 500 requirements. Labels shall be affixed to components. Do not remove labels.
5. Anchorage: Type, size, and spacing as defined by manufacturer to comply with performance requirements of assembly.

1.05 WARRANTY

A. Provide twenty (20) year warranty for compliance with performance requirements specified, including coverage for sealed glass units from seal failure, interpane dusting or misting, or defects exceeding those allowed by ASTM 1172.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

B. Glass Manufacturers: Vitro Industries, AFG Industries, Libby Owens Ford, or approved equal subject to compliance with performance requirements specified.

C. Glazing Fabrication Manufacturers: Saf-Glas, Tor-Gard, or approved equal subject to compliance with performance requirements specified.

2.02 GLASS

A. General: Comply with ASTM C1036, ASTM C1048, ASTM E2188, ASTM E2189, and ASTM E2190, of the types, classes, and forms specified.
   1. Annealed Float Glass: ASTM C1036, Type I (transparent flat glass), Quality-Q3; of class indicated.
   2. Heat-Treated Float Glass: ASTM C1048, Type I (transparent flat glass), Quality-Q3; of class, kind, and condition indicated.
      a. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated.
      b. Provide Kind HS (heat-strengthened) float glass in place of annealed float 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.
      c. For uncoated glass, comply with requirements for Condition A.
      d. For coated vision glass, comply with requirements for Condition C (other uncoated glass).
      e. Provide Kind FT (fully tempered) float glass in place of annealed or Kind HS (heat-strengthened) float glass where safety glass is indicated or required.
   3. Tinted Glass: ASTM C1036, float glass of class, kind, and conditions indicated, with integral mineral admixture incorporated in glass material during manufacturing initial melting process resulting in a degree of color that reduces both visual and radiant transmittance performance requirements.
   4. Sputter-Coated Float Glass (Low E): ASTM C1376, float glass with metallic-oxide or nitride coating deposited by vacuum deposition process after manufacture and heat treatment (if any), and complying with other requirements specified.
   5. Mirror Glass: Type 1, Class 1 (transparent), Quality Q2 (mirror), with silver coating, copper protective coating complying with CS27, and 2 mil thick painting coating, ¼-inch thick.
   6. Tornado Resistant Glass: Types specified, conforming to ASTM 330 and ASTM E1886 performance requirements specified. Laminated glass reinforced with interlayer polycarbonate or polyvinyl butryal PVB material in thickness and configuration to meet impact resistance design criteria.

B. Insulated-Glass Units, General: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, and complying with ASTM C1249 for Class CBA units

and the requirements specified.

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 lites and to comply with glass design requirements specified.
2. Provide Kind FT (fully tempered) glass lites where safety glass is indicated or required.
3. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated for insulating-glass units are nominal and the overall thickness of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.
4. Insulated Unit Construction: 1 inch thick, composed of 1/4" thick exterior pane of glass type specified, 1/2 inch air space, and 1/4 inch thick interior pane of glass type specified. Air space purged dry hermetic air. Edge with sealing system.
5. Impact Resistant Insulated Units: Glazing fabrication manufacturer's tested insulated assembly conforming to performance requirements specified.
6. Sealing System: Comply with requirements of Section 07 92 00 – Joint Sealants. Dual seal, with primary and secondary sealants of polyisobutylene and silicone.
7. Spacer Specifications: Manufacturer's standard spacer material and construction complying with the following requirements:
   a. Spacer Material: Aluminum with mill or clear anodic finish.
   b. Desiccant: Molecular sieve or silica gel, or blend of both.
   c. Corner Construction: Manufacturer's standard corner construction.
8. Sealed Insulating Glass Unit Surface Designations:
   a. Surface 1: Exterior surface of the outer glass lite.
   b. Surface 2: Interspace surface of the outer glass lite.
   c. Surface 3: Interspace surface of the inner glass lite.
   d. Surface 4: Interior surface of the inner glass lite.

2.03 GLAZING SCHEDULE

A. Schedule: Refer to drawing glazing schedule for types, combinations and locations.

2.04 GLAZING ACCESSORIES

A. Provide materials with proven record of compatibility with surfaces contacted in installation.

B. Glazing Sealants: Elastomeric type. Tremco "Proglaze". Bostik "Chem-Calk 1200", Pecora "836", Sonneborn "Omniglaze", or other approved by system manufacturer.

C. Glazing Tape: Preformed type. Bostik "Chem Tape 60", Pecora "Shim-Seal", or Tremco "Pre-shimmed Tremco 440 Tape".

D. Setting Blocks: Neoprene or other resilient blocks of 70 to 90 Shore A durometer hardness, adhesively backed on one face only, tested for compatibility with specified glazing sealants.

E. Spacers: Neoprene or other resilient blocks of 40 to 50 Shore A durometer hardness, tested for compatibility with specified glazing sealant.

F. Compressible Filler Rod: Closed-cell or waterproof-jacketed foam of polyethylene, butyl rubber, neoprene, polyurethane or vinyl, tested for compatibility with specified glazing sealants, of 5 to 10 psi compression strength (25% deflection), recommended by sealant manufacturer for use in glazing channel to prevent sealant exudation from the channel.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Comply with FGMA "Glazing Manual" and manufacturers instructions and recommendations. Use manufacturer's recommended spacers, blocks, primers, sealers, gaskets and accessories.

B. Clean channel surfaces and prime as recommended by sealant manufacturer.

C. Cut glass to size as required for measured opening, provide adequate edge clearance and glass bite all around. Cut prior to tempering.

D. Do not install sheets which have edge damage or face imperfections. Install glass with uniformity of pattern, draw, bow and roller marks.

E. Miter-cut and bond (weld) ends of channel gaskets at corners to provide a continuous gasket.

F. Install sealants to provide complete wetting and bond and to create a substantial wash away from glass.

G. Seal face gaskets at corners with liquid elastomeric sealant to close openings and prevent withdrawal of gaskets from corners.

H. Remove and replace damaged glass and glazing. Wash, polish and protect all glass supplied under this section.

END OF SECTION

SECTION 09 21 16

GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.01 SUMMARY

A. Provide gypsum board assemblies complete. (Note: Cold-Formed Metal Framing specified under Section 05 40 00):

1.02 SUBMITTALS

A. Comply with Section 01 33 00.

B. Submit for approval shop drawings and product data.

C. Submit texture samples, 12”x12” minimum, for smooth type texture.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

B. Standards: Comply with the provisions of the following specifications and standards, except as otherwise noted or specified.
   1. ASTM C475, Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
   2. ASTM C840, Standard Specification for Application and Finishing of Gypsum Board.
   3. ASTM C1002, Standard Specifications for Steel Self Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
   4. ASTM C1047, Standard Specification for Accessories for Gypsum Wall Board and Gypsum Veneer Base.
   5. ASTM C1280, Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing.
   6. ASTM C1396, Standard Specification for Gypsum Board.
   7. ASTM D3273, Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
   8. ASTM E119, Standard Test Methods for Fire Tests of Building Construction and Materials.

C. Moisture and Mold-Resistant Assemblies: Provide moisture and mold-resistant gypsum board products with surfaces complying with ASTM C1396 and ASTM C1177 in all locations subject to moisture exposure.

D. Performance: Structural and seismic performance meeting requirements of building code.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Manufacturers of Gypsum Board: CertainTeed Gypsum, Georgia-Pacific Corp., National Gypsum Co., United States Gypsum Co., Temple-Inland, or approved equal.

B. Board Materials: (Refer to drawings for material thickness requirements.)
   1. Gypsum Wallboard: ASTM C1396, Type X fire rated, tapered edges.
   2. Moisture and Mold Resistant Gypsum Backing Board: ASTM C1396, Type X fire rated, tapered edges.

C. Joint Treatment Materials: ASTM C475 and ASTM C840, 2-coat joint compound, and other materials, paper or fiberglass tape.

D. Trim Accessories: ASTM C1047. Provide manufacturer's standard trim accessories of types indicated for drywall work, formed of galvanized steel unless otherwise indicated, with either knurled and perforated or expanded flanges for attachment, and beaded for concealment of flanges in joint compound. Provide all corner beads, edge trim-beads, and one-piece control joint beads. Provide decorative profiles factory primed of types indicated.

E. Fasteners: ASTM C1002, self-drilling, self tapping screws for power driving with special head design for gypsum board attachment (Type S), producing surface depression for proper concealment; 1 inch long for single ply, 1 5/8 inch long for double ply, 2 inch long for multiple plies. Use other fasteners as required.

F. Textures: Spray application for splatter, knock-down and orange peel type textures. Submit samples for Architect's review and approval.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Inspection: Coordinate with carpenter and insulator in placing of backing, blocking, bracing, and insulation where required in walls for acoustical treatment, millwork, fixtures, fittings, and accessories. Examine substrates for proper application of gypsum board systems. Beginning work means acceptance of conditions.

B. General: Install gypsum board assemblies in compliance with ASTM C840 and per manufacturer's recommendations. Install gypsum board assemblies true, plumb, level and in proper relation to adjacent surfaces.

C. Tolerances: Not more than 1/16 inch difference in true plane at joints between adjacent boards before finishing. After finishing, joints shall be not be visible. Not more than 1/8 inch in 10 feet deviation from true plane, plumb, level and proper relation to adjacent surfaces in finished work.

D. Ceilings and Soffits: Install boards across framing members in manner which minimizes number of end-butt joints, and which avoids end joints in central area of each ceiling and soffit. Stagger end joints at least 24 inches.

E. Fastening: Fasten gypsum board to metal studs with specified screws 12 inches on center for ceilings of single layer application.

F. Expansion/Control Joints: Install expansion/control joints in ceilings exceeding 2500 sq. ft. in area unless otherwise indicated. Do not exceed a distance of 50 feet in either direction, between ceiling control joints and install a control joint where ceiling framing of furring changes direction.

G. Transitions, Trim and Corners:
   1. Provide casing beads where edges of gypsum board meet dissimilar materials.
   2. Treat all internal angles formed by the intersection of either wallboard surfaces with metal trim and/or a taped joint system as indicated or required.
   3. Treat all horizontal external corners with metal bead corner reinforcement applied in accordance with manufacturer's recommendations.

3.02 FINISHING

A. Finishing: Comply with ASTM C840. Refer to drawings for finish types and locations.
   1. Level 1: Concealed areas, plenums, service corridors, above ceilings. Except provide higher level of finish as required to comply with fire resistance ratings and acoustical ratings.
   2. Level 2: Areas of water-resistant gypsum backing board under tile, exposed areas where appearance is not critical.
   3. Level 3: Areas to receive heavy or medium textured coatings, heavy-grade wall coverings.
   4. Level 4: Areas to receive flat sheen or satin paint finish, light textured coatings, lightweight wall coverings.
   5. Level 5: Areas to receive gloss, semi-gloss sheen paints, critical lighting conditions.

END OF SECTION

SECTION 09 51 00

ACOUSTICAL TILE CEILINGS

PART 1 - GENERAL

1.01 SUMMARY

A. Provide acoustical ceilings, complete, including elements of the suspension system, trim, and facilities for the support and attachment of lighting fixtures, air diffusers, grills and registers. (Refer to interior finish schedule and reflected ceiling plan for locations.)

1.02 SUBMITTALS

A. Comply with Section 01 33 00.

B. Product Data: Submit manufacturer’s technical data for each type of acoustical ceiling unit and suspension system required.

C. Shop Drawings: Submit shop drawings indicating location of ceiling units and items of work which are to be coordinated with the ceilings and framing and support details for all work supported by the suspension system.

D. Samples: Submit one 12" x 12" sample of each type of acoustical material and one sample each of main runner, cross tee, and wall molding specified.

E. Extra Material: Provide 2% of extra replacement tile matching each type of material used to Owner at substantial completion. Minimum of (1) box of each tile.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

B. Standards: Comply with the provisions of the following specifications and standards, except as otherwise noted or specified.
   1. ASTM A641, Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
   2. ASTM A635, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
   3. ASTM C423, Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
   4. ASTM C635, Standard Specification for Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
   5. ASTM C636, Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
   6. ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials.
   7. ASTM E119, Standard Test Methods for Fire Testes of Building Construction and

Materials.
8. ASTM E1264, Standard Classification of Acoustical Ceiling Products.
9. ASTM E1414, Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum.
10. ASTM E1477, Standard Test Method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers.
11. Underwriters Laboratories (UL) Fire Resistance Directory.

C. Performance Requirements:
1. Surface Burning Characteristics: Tested per ASTM E84 and complying with ASTM E1264 Classification.
2. Fire Resistance: Tested per ASTM E119 and UL listed.
3. Structural and Seismic: Refer to drawings for project building code and seismic classification. Performance shall be based on project requirements.

D. Manufacturer's Warranty:
1. Acoustical Panels: One (1) year from date of substantial completion for sagging and warping.
2. Suspension System and Grid: Ten (10) years from date of substantial completion from rusting and manufacturer's defects.

PART 2 - PRODUCTS

2.01 ACOUSTICAL LAY-IN PANELS

A. Manufacturers: Armstrong, Celotex, CertainTeed, Conwed, USG Interiors, or approved equal.

B. Panel Types (Refer to drawings interior finish plan and schedule for additional requirements):

1. Type Marked: C2
a. ASTM E1264 Classification: Type III, Form 2, Pattern C E, sag resist.
b. Composition: Mineral Fiber, Wet-formed.
c. Texture: Fine.
d. Surface Finish: Factory applied latex paint.
e. Color: White
f. Size: 24 by 24 inches by 5/8 inch.
g. Edge Profile: Angled tegular.
h. Noise Reduction Coefficient (NRC) ASTM C423: 0.50.
i. Ceiling Attenuation Class (CAC) ASTM E1414: 35.
j. Articulation Class (AC) ASTM E1111:
k. Light Reflectance ASTM E1477: 0.81.
l. Fire Performance: Class A, Type I, flame spread rating of 25 or less, smoke development rating of 0 to 450 or less.
m. Insulation Value: Average R-Value of 1.6 at 75 degrees.
n. Weight: 0.75 lbs./sq. ft..
o. Product: Equal to Armstrong "Dune No. 1774" (Basis of design).

2.02 SUSPENSION SYSTEM MATERIALS

A. Manufacturers: Armstrong, Chicago Metallic, Donn, National Rolling Mills, or approved equal.

B. Ceiling Grid Types (Refer to drawings interior finish plan and schedule for additional requirements):

1. Type Marked: C2
   a. Structural Classification ASTM C35: Exposed grid system, direct-hung double-web intermediate-duty system.
   b. Materials ASTM A653: Aluminum members, factory finished with backed on vinyl enamel, polyester, or anodized.
   c. Color: White.
   d. Fire Performance: Class A, Type I, flame spread rating of 25 or less, smoke development of 0 to 450 or less.
   e. Product: Equal to Armstrong “Prelude Plus XL Aluminum 15/16" Exposed Tee System” (Basis of design).

C. Attachment Devices ASTM C635: Table 1, direct hung, unless otherwise indicated. Type recommended by suspension system manufacturer for attachment or anchorage of ceiling hangers to structure above ceiling, sized for not less than 5 times the hanger design load for the structural classification indicated.

D. Wire for Hanger and Ties ASTM A641: Minimum No. 12 gage, galvanized annealed steel wire.

E. Seismic Bracing: Provide bracing, reinforcing, and accessories as recommended by suspension system manufacturer for project seismic conditions.

F. Edge Molding and Trim: Provide wall molding, of types and profiles indicated, of same material and finish as suspension system.

G. Hold-Down Accessories: Provide hold-down clips, impact clips and bracing of type recommended by manufacturer for compliance with local building code.

2.03 MISCELLANEOUS MATERIALS

A. Tile adhesive, staples, and sealant: Provide type recommended by manufacturer for specific project conditions.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install materials and suspension systems in accordance with manufacturer's instructions and ASTM C636. Coordinate installation with location of mechanical and electrical work to ensure proper locations.

B. Center locate system on room axis, leaving equally spaced border along perimeter. Lay directional pattered units one way with pattern parallel to longest room axis Level ceiling to within 1/8" in 10' in both directions. Scribe and cut panels to fit accurately. Measure and layout to avoid less than half panel units unless otherwise indicated.

C. Suspend main beam from overhead construction with hanger wires spaced 48 inches on center

along the length of the main runner. Install hanger wires plumb and straight.

D. Seismic Bracing (Refer Drawings): Unless otherwise indicated, located at 12 feet on center with the first line of bracing 4 feet or less from wall boundary. Seismic bracing shall consist of (4) splay wires at 45 degrees to runner connections and 45 degrees to plan of ceiling, (1) vertical connection wire provided with compression bracing of ½" rigid conduit extending full height between connection points. Coordinate with building official for inspection requirements.

E. Install wall moldings at intersections of suspended ceiling and vertical surfaces. Miter corners where wall moldings intersect or install corner caps.

F. For revel edge panels: Cut and reveal or rabbet edges of ceiling panels at border areas and vertical surfaces.

G. Install acoustical panels in coordination with suspended system, with edges resting on flanges of main runner and cross tees. Cut and fit panels neatly against abutting surfaces. Support edges by wall moldings.

H. Provide hold down clips at all units within 8 feet minimum of an exterior door and locations indicated on drawings.

3.02 ADJUSTING AND CLEANING

A. Replace damaged and broken panels.

B. Clean exposed surfaces of acoustical ceilings, including trim, edge moldings, and suspension members. Comply with manufacturer's instructions for cleaning and touch up of minor finish damage. Remove any ceiling products that cannot be successfully cleaned and or repaired. Replace with attic stock or new product to eliminate evidence of damage.

END OF SECTION

SECTION 09 67 23

RESINOUS FLOORING

PART 1 - GENERAL

1.01 SUMMARY

A. Provide resinous floor coating systems for concrete floors with cove base, complete.

1.02 SUBMITTALS

A. Comply with Section 01 33 00.

B. Product Data: Submit manufacturer’s technical data for each coating, including generic description, surface preparation, installation procedures and maintenance information.

C. Samples: Submit 12"x12" minimum manufacturer’s standard samples showing full range of colors and texture to be selected by Architect.

D. Manufacturer’s Certification: Submit manufacturer’s quality assurance certification.

E. Installer Certification: Submit manufacturer’s certification of Installers qualifications.

F. Warranty: Submit manufacturer’s standard warranty.

G. Mock-Ups: Prepare 4'x4' mock-up for each coating system specified using same materials, tools, equipment, and procedures intended for actual surface preparation and application. Include 4’ length of integral cove base with inside and outside corner. Approved mock-up may become part of the completed work if acceptable at time of substantial completion. Obtain Architect’s approval of mock-ups.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for five years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

B. Standards: Comply with the provisions of the following specifications and standards, except as otherwise noted or specified.
   1. ASTM C307, Standard Test Method for Tensile Strength of Chemical-Resist Mortar, Grouts, and Monolithic Surfacings.
   2. ASTM C413, Standard Test Method for Absorption of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.
   3. ASTM C531, Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grout, Monolithic Surfacings, and Polymer Concretes.
   4. ASTM C579, Standard Test Method for Compressive Strength of Chemical-Resistant Mortars, Grout, Monolithic Surfacings, and Polymer Concretes.

5. ASTM C580, Standard Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grout, Monolithic Surfacings, and Polymer Concretes.
6. ASTM C882, Standard Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete By Slant Shear.
7. ASTM C1583, Standard Test Method for Tensile Strength of Concrete Surfaces and the Bond Strength or Tensile Strength of Concrete Repair and Overlay Materials by Direct Tension (Pull-off Method).
8. ASTM D412, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers – Tension.
9. ASTM D638, Standard Test Method for Tensile Properties of Plastics.
10. ASTM D1308, Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes.
11. ASTM D2240, Standard Test Method for Rubber Property – Durometer Hardness.
12. ASTM D2794, Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
13. ASTM D4060, Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser.
14. ASTM D4263, Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.
15. ASTM D7234, Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers.
16. ASTM E96, Standard Test Methods for Water Vapor Transmission of Materials.
17. ASTM F1869, Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
18. ASTM F2170, Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in Situ Probes.
19. Definitions: Dry Film Thickness (DFT): Thickness of a coating of paint in fully cured state measured in mils (1/1000).

C. Manufacturer's Quality Assurance: Certification that coatings comply with specified requirements and are suitable for intended application. Manufacturer shall provide technical assistance, conduct inspections, and provide field reports prior, during, and after installation documenting condition and completed work.

D. Installer Qualifications: Certificated by manufacturer and experienced in application of specified coatings for a minimum of five years on projects of similar size and complexity. Employ persons trained for application of specified coatings.

E. Preapplication Meeting: Convene a preapplication meeting within Four (4) weeks prior to installation of substrate construction. Require attendance of parties directly affecting work of this Section, including Contractor, Architect, Installer, and Manufacturer's representative.

1.04 TESTING AND INSPECTIONS

A. Material Sampling: Owner may, at any time and any number of times during resinous flooring application, require material samples for testing for compliance with requirements.
   1. Owner may provide the services of a qualified independent testing agency to take samples of materials being used. Material samples will be taken, identified, sealed, and certified in presence of Contractor.

2. Testing agency will test samples for compliance with requirements, using applicable referenced testing procedures or, if not referenced, using testing procedures listed in manufacturer's product data.
3. If test results show applied materials do not comply with specified requirements, contractor shall pay for testing, remove noncomplying materials, prepare surfaces coated with unacceptable materials, and reapply flooring materials to comply with requirements.

B. Core Samples: At the direction of Owner and at locations designated by Owner, take one core sample per 1000 sq. ft. of resinous flooring, or portion of, to verify thickness. For each sample that fails to comply with requirements, take two additional samples. Repair damage caused by coring. Correct deficiencies to installed flooring as indicated by testing.

C. Contractor shall coordinate the testing and inspection services with the progress of the work. The contractor shall provide sufficient notice to allow proper scheduling of all personnel. The contractor shall provide safe access to work for performing testing and inspections.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers:
1. Dur-A-Flex, Elite Crete Systems, Key Resin Company, Laticrete, Stauf USA, Tnemec, or approved equal.
2. Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from a single source from single manufacturer. Obtain secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from manufacturer recommended in writing by manufacturer of primary materials.

2.02 SYSTEM DESCRIPTION AND PERFORMANCE PROPERTIES

A. Description:
1. System Type: Polyaspartic resinous coating system to be abrasion, impact and chemical resistant, high-performance, resin-based, monolithic floor surfacing designed to produce a seamless floor and integral cove base finish. Equipped with anti-microbial additive to protect the coating from degradation caused by bacterial growth.
2. Color and Pattern: As selected by Architect from manufacturer's full range.
3. Wearing Surface: Textured for slip resistance.
4. Overall System Thickness: 1/8" to 3/16" minimum.
5. Cove Height: Refer drawings.

B. Body Base Coat:
1. Resin: Polyaspartic.
2. Formulation Description: Low VOC, low odor, fast curing, two-part polaspartic aliphatic polyurea coating with 100 percent solids.
3. Type: Pigmented (Colors as selected).
4. Application Method: Self-leveling slurry with broadcast aggregates
5. Number of Coats: As required to achieve required DFT.
6. Thickness of Coats: 1/8" DFT.
7. Aggregates: Colored quartz and colored vinyl flakes.

C. Grout Coat:
   1. Resin: Polyaspartic.
   2. Formulation Description: Low VOC, low odor, fast curing, two-part polaspartic aliphatic polyurea coating with 100 percent solids.
   3. Type: Clear.
   4. Thickness of Coats: 14.0 to 16.0 mils. DFT.

D. Topcoats (Sealing or Finish Coats):
   1. Resin: Polyaspartic.
   2. Formulation Description: Low VOC, minimum odor, fast curing, two-part polaspartic aliphatic polyurea sealer/finish coating with antimicrobial properties and 100 percent solids.
   3. Type: Clear.
   4. Number of Coats: Two.
   5. Thickness of Coats: 8 mils. DFT each coat.
   6. Finish: Matt with traction additive and high performance abrasive resistance additive.

E. Performance Properties: Provide resinous flooring system with the following minimum physical property requirements when tested according to test methods indicated.
   1. Tensile Strength, ASTM D638: 4,500 – 5,000 psi.
   2. Abrasion Resistance, ASTM D4060: 38 Liters Sand / 1 mil (pigmented).
   3. Impact Resistance, ASTM D2794: Direct / Reverse 160/160.
   4. System Chemical Resistance: Test specimens of cured resinous flooring system are unaffected in the following reagents for no fewer than seven days.

2.03 MATERIALS

A. Moisture Vapor Control: Single-coat, 100% solids, liquid applied two-part epoxy coating specifically designed for controlling moisture vapor emission rate for new or existing concrete slabs.
   1. Vapor Permeance @ 12 mil thickness, ASTM E96: 0.052 grains/hr/ft^2/in. Hg.
   2. Tensile Strength, ASTM C1583: >410 psi Concrete failure.
   3. Pull Off Adhesion, ASTM D7234: >480psi.
   4. Alkalinity Resistance, ASTM D1308: Pass (Resist up to 14 pH).
   5. Total VOC Emissions: ≤0.22 mg/m$^{3.}$

B. Concrete Repair / Crack & Joint Filler: Fast set two-component hybrid urethane. Ultra-low viscosity properties allow for deep penetration into concrete and a thorough wetting of selected aggregate to form a high-strength permanent concrete repair:
   1. Hardness, ASTM D2240-Shore D: 74.
   2. Compressive Strength (with sand) : <4,250 psi.
   3. Tensile Strength, ASTM D412: >4,000 psi.
   4. Elongation, ASTM D412: <7%.
   5. Bond Strength, ASTM C882: 1,500 psi.

C. Traction Additive: Ultra-durable, high strength pulverized resin designed to improve traction coefficients, increase durability and abrasion resistance of finished floor coatings, and available in 3 separate mesh sizes:
   1. Specific gravity: 1.3.

2. Hardness (Rockwell): M95 – M110.
3. Density: 10.9.
4. Chemical resistance (Excellent): Alkali, Strong and weak acids, alcohols, aliphatic hydrocarbons, aromatic hydrocarbons, detergents, gasoline, and anti-freeze.

D. Aggregate Additive: Uniformly shaped and sized color quartz granules with a UV stable urethane coating which will enhance appearance and provide increased traction:
1. Chemical resistance (Excellent): Alkali, Strong and weak acids, alcohols, aliphatic hydrocarbons, aromatic hydrocarbons, detergents, gasoline, and anti-freeze.
2. Compatible with polyaspartic, urethane and epoxy coatings.

E. Vinyl Color Flake Additive: Vinyl (with or without mica), random shapes, sized within a standardized range and custom blended which will offer a high quality finish, improve durability and increase longevity.
1. Size: 1/8” – 1/4".
2. Thickness: 5 mils.

F. High Performance Abrasive Resistance Additive: Product for heavy-duty environments requiring maximum abrasion resistance:
1. Size: 220 Mesh.
2. Microns: 165 – 170 Mesh.
3. Load Factor: 2 lbs. per gallon.
4. Hardness, ASTM D2240: 94.

G. Pigments: Manufacturer’s standard processed raw material compatible with resinous coating system specified.

H. Primer: Type as recommend by resinous flooring manufacturer for substrate and project use conditions.
1. Formulation Description: High solids.

I. Reinforcing Membrane: Flexible resin formulation of type as recommend by resinous flooring manufacturer for substrate and project use conditions that inhibits substrate cracks from reflecting through resinous flooring.

2.04 ACCESSORIES

A. Coating Application Accessories:
1. Accessories required for application of specified coatings in accordance with manufacturer’s instructions, including thinners.
2. Products recommended by coating manufacturer.

B. Perimeter Terminations: 8 inch rolled radius cove is to be installed prior to flooring system, using “J” strip at the top of the cove. Use terrazzo strips at all door terminations.

PART 3 - EXECUTION

3.01 GENERAL

A. Install materials and systems in accordance with manufacturer's instructions and approved

submittals. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.

B. Field Quality Control: Manufacturer's representative shall provide technical assistance, approve testing requirements, and provide inspection for surface preparation and application of coating systems and submit the following:
   1. Verify coatings and other materials are as specified. Document delivered product packing, handling, storage, labels, batch or lot numbers, date of manufacturer, mixing and thinning instructions.
   2. Verify surface preparation and application are as specified.
   3. Verify DFT of each coat and total DFT of each coating system are as specified using wet film and dry film gauges.
   4. Coating Defects: Check coatings for film characteristics or defects that would adversely affect performance or appearance of coating systems.
   5. Report: Submit written reports describing inspections made and actions taken to correct nonconforming work. Report nonconforming work not corrected. Submit copies of reports to Architect and Contractor.

3.02 ENVIRONMENTAL REQUIREMENTS

A. Weather:
   1. Air and Surface Temperatures: Prepare surfaces apply and cure coatings within air and surface temperature range in accordance with manufacturer's instructions.
   2. Surface Temperature: Minimum of 5 degrees F above dew point.
   3. Relative Humidity: Prepare surfaces apply and cure coatings within relative humidity range in accordance with manufacturer's instructions.
   4. Precipitation: Do not prepare surfaces or apply coatings in rain, snow, fog, or mist.
   5. Wind: Do not spray coatings if wind velocity is above manufacturer's limit.

B. Ventilation: Provide ventilation during coating evaporation stage in confined or enclosed areas in accordance with manufacturer's instructions.

C. Dust and Contaminations:
   1. Schedule coating work to avoid excessive dust and airborne contaminates.
   2. Protect work areas from excessive dust and airborne contaminates during coating application and curing.

3.03 EXAMINATION

A. Examine areas and conditions under which coatings systems are to be applied. Notify Architect of areas or conditions not acceptable. Do not proceed with work until unsatisfactory conditions are corrected.

3.04 PREPARATION

A. Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry substrate for resinous flooring application.

B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust dirt, grease, oil, and other contaminates

incompatible with resinous flooring.

C. Roughen concrete substrates as follows:
   1. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
   2. Comply with NACE No. 6/SSPC-SP13, with a Concrete Surface Profile (CSP) of 3 or greater in accordance with the International Concrete Repair Institute (ICRI) Technical Guideline No. 310.2.R, unless manufacturer's written instructions are more stringent.

D. Repair damaged and deteriorated concrete according to resinous floor manufacturer's written instructions.

E. Verity that substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.
   1. Anhydrous Calcium Test, ASTM F1869: Proceed with application of resinous flooring only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft..
   2. Relative Humidity Test, ASTM F2170: Use in situ probes. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

F. Alkalinity and Adhesion Testing: Verify the concrete substrates have pH within acceptable range. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.

G. Patching and Filling: Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.

H. Control Joint Treatment: Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written instructions.

3.05 APPLICATION

A. Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.
   1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
   2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing process.
   3. Expansion and Isolation Joint Treatment: At substrate expansion and isolation joints, comply with resinous flooring manufacturer's written instructions.

B. Primer: Apply primer over prepared substrate at manufacturer's recommend spread rate.

C. Moisture Vapor Control Coating System: Apply moisture vapor control coating system to substrates at rates and thickness according to manufacturer's written instructions.

D. Reinforcing Membrane: Apply reinforcing membrane to substrate cracks and surfaces.

E. Integral Cove Base: Apply cove base mix to wall surfaces before applying flooring. Apply according to manufacturer's written instructions and details, including those for taping, mixing,

priming, troweling, sanding and top coating of cove base. Round internal and external corners. Refer to drawings for cove base height.

F. Self-Leveling Body Coats: Apply self-leveling slurry body coats in thickness indicated for flooring system.
   1. Aggregates: Broadcast aggregates at rate recommended by manufacturer and, after resin is cured, remove excess aggregates to provide surface texture indicated.
   2. Colored Vinyl Flakes: Broadcast colored vinyl flakes at rate recommended by manufacturer and, after resin is cured, remove excess aggregates to provide surface texture indicated.

G. Troweled or Screeded Body Coats: Apply troweled or screeded body coats in thickness indicated for flooring system. Hand or power trowel and grout to fill voids. When body coats are cured, removed trowel marks and roughness using method recommended by manufacturer.

H. Grout Coat: Apply grout coat, of type recommended by resinous flooring manufacturer, to fill voids in surface or final body coat.

I. Topcoats: Apply topcoats with additives in number and indicated for flooring system and at spread rates recommended in writing by manufacturer and to produce wearing surface indicated.

3.06 REPAIR

A. Materials and Surfaces Not Scheduled To Be Coated: Repair or replace damaged materials and surfaces not scheduled to be coated.

B. Damaged Coatings: Touch-up or repair damaged coatings. Touch-up of minor damage shall be acceptable where result is not visibly different from adjacent surfaces. Recoat entire surface where touch-up result is visibly different, either in sheen, texture, or color.

C. Coating Defects: Repair in accordance with manufacturer’s instructions coatings that exhibit film characteristics or defects that would adversely affect performance or appearance of coating systems.

3.07 CLEANING AND PROTECTION

A. Remove temporary coverings and protection of surrounding areas and surfaces.

B. Protect surfaces of coating systems from damage during construction.

END OF SECTION

SECTION 09 90 00

PAINTING

PART 1 - GENERAL

1.01 SUMMARY

A. Provide surface preparation and painting of interior and exterior surfaces throughout the project, except as otherwise indicated. Provided touch-up of pre-finished items as required to match original finish.

1.02 SUBMITTALS

A. Comply with Section 01 33 00.

B. Product Data: Submit manufacturer’s technical data sheets on each paint or coating product to be used and shall include:
   1. Product characteristics.
   2. Surface preparation instructions and recommendations.
   3. Primer requirements and finish specification (including recommended dry mil thickness).
   4. Storage and handling requirements and recommendations.
   5. Application methods.
   6. Clean-up information.
   7. Maintenance recommendations and instructions.
   8. Safety data sheets.

C. Samples: Submit samples of finish sheen and color(s) specified.

D. Manufacturer’s Warranty: Submit warranty specified.

E. Installer Warranty: Submit warranty specified.

F. Extra Material: Submit to Owner one gallon of each product type and color used on the project.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

B. Standards: Comply with the provisions of the following specifications and standards, except as otherwise noted or specified.
   1. Occupational Safety and Health Act (OSHA) – Safety Standards.
   2. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
   3. Architectural Painting Specification Manual by the Master Painters Institute (MPI), including identifiers, evaluation, system, preparation and approved product list.
   4. Test Method for Measuring Total Volatile Organic Compound (VOC) Content of

Consumer Products, Method 24 (for Surface Coatings) of the Environmental Protection Agency (EPA).

C. Environmental Regulations: Comply with U.S. Environmental Protection Agency (USEPA) for VOC, application, and disposal regulations.

D. Installer Qualifications: Painting contractor shall have a minimum of five (5) years proven satisfactory experience and maintain direct supervision and qualified personnel throughout duration of the work. Upon request, provide a list of three (3) comparable projects including name, location, designer / specifier, general contractor, value of painting work, and dates of commencement and completion.

1.04 WARRANTIES

A. Installer Warranty: Provide Two (2) year installation warranty that all painting work has been performed in accordance with Master Painters Institute (MPI) Painting Manual requirements for project conditions and material manufacturer's instructions.

B. Manufacturer Warranty: Provide Fifteen (10) year material warranty that products installed per manufacturer's instructions shall be free of peels, blisters, or performance defects and signed by an authorized representative. Inspection of all surfaces to be coated must be done by the manufacturer's representative to insure proper preparation prior to application. All thinners, fillers, primers, and finish coatings shall be from the same manufacturer to support product warranty. Products other than those submitted shall be accompanied by a letter stating the fitness for use and compatibility.

1.05 TESTING AND INSPECTIONS

A. Owner may provide the services of a qualified independent testing agency to perform testing, inspections, and documentation of materials used and work performed to confirm adherence to accepted trade practices, standards and specifications.

B. Contractor shall coordinate the testing and inspection services with the progress of the work. The contractor shall provide sufficient notice to allow proper scheduling of all personnel. The contractor shall provide safe access to work for performing testing and inspections.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Manufacturers: Benjamin Moore, Pratt and Lambert, PPG Industries, Sherwin Williams or approved equal. First-line commercial-quality products for all coating systems. All paint and coating materials shall be from a single manufacturer for each system used.

B. Environmental: All materials used shall be lead and mercury free and shall have low VOC content in compliance with EPA standards and regulations for project conditions.

C. Flame Spread and Smoke Development Ratings: Comply with ASTM E84, flame spread rating of 0 to 25, smoke development rating of 0 to 450.

D. Compatibility: All materials used shall be compatible with substrate materials and service use environmental exposure conditions.

E. Coatings: Ready mixed except field catalyzed coatings of good flow and brushing properties, capable of drying or curing free of blemishes, streaks, sags, or air entrapment.

F. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners, and other materials required to achieve the finishes specified for project conditions as recommended by material manufacturer.

2.02 FINISHES, MIXING AND TINTING

A. Finish and Colors: Refer to drawing interior and exterior finish schedules for colors, gloss / sheen, and locations.

B. Mixing and Tinting: All paint shall be ready-mixed and pre-tinted. Re-mix all paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and color and gloss uniformity. Mix in accordance with manufacturer's instructions. Where thinner is used, addition shall not exceed paint manufacturer's recommendations. Do not use kerosene or any such organic solvents to thin water-based paints.

PART 3 - EXECUTION

3.01 EXAMINATION AND PREPARATION

A. Manufacturer's representative and installer shall examine the areas and conditions under which painting work is to be preformed. Do not proceed with the work until unsatisfactory conditions have been corrected. Starting of painting work will be construed as acceptance of the surfaces within any particular areas.

B. Preform all preparation and cleaning procedures in strict accordance with the coating manufacturer's instructions and as herein specified. Remove all hardware, plates, lighting fixtures, and similar items in place and not to be finish painted, or provide protection prior to surface preparation and painting operations. Remove, if necessary, for the complete painting of the items and adjacent surfaces. Reinstall the removed items by workmen skilled in the trades involved, after painting is complete.

C. Cementitious Materials: Prepare cementitious surfaces to be painted by removing all, chalk, dust, dirt, grease, oils, and by roughening as required to remove glaze. Determine the alkalinity and moisture content of the surfaces to be painted by performing appropriate test. If the surfaces are found to be sufficiently alkaline to cause blistering and burning of the finish paint, correct this condition before application of paint.

D. Wood: Clean wood surfaces to be painted of all dirt, oil, or other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sandpaper smooth those surfaces exposed to view, and dust off. Prime, stain, or seal wood required to be job painted immediately upon delivery to job. Prime edges, ends, faces, undersides, and backsides of such wood, including cabinets, counters, cases, etc. Scrape and clean small, dry seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer, before application of the priming coat. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler.

Sandpaper smooth when dried.

E. Gypsum Wall Board: Do not paint over gypsum wallboard work until taped joints are throughly dry.

F. Ferrous Metals: Touch-up shop applied prime coats which have damaged or bare areas. Wire-brush, solvent clean, and touch up with the same primer as the shop coat.

G. 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:
   a. SSPC-SP 2, "Hand Tool Cleaning."
   b. SSPC-SP 3, "Power Tool Cleaning."
   c. SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."
   d. SSPC-SP 11, "Power Tool Cleaning to Bare Metal."

H. Galvanized Surfaces: Clean free of oil and surface contaminates with an acceptable non-petroleum based solvent.

I. Aluminum: Remove film of oil and grease before painting by washing with mineral spirits.

J. Existing Materials to Remain: At existing areas to be repainted, remove blistered or peeling paint to sound substrates. Remove chalk deposits and mildew and wash all surfaces with mild detergent. Perform related minor preparation including caulk and glazing compounds. Spot prime bare areas before priming and painting as specified.

3.02 APPLICATION

A. Apply paint by brush, roller, spray, or other acceptable practice in accordance with the manufacturer's directions. Use brushes best suited for the type of material being applied. Use rollers or carpet, velvet back, or high pile sheep wood as recommended by the manufacturer for material and texture required.

B. The number of coats and paint film thickness required is the same regardless of the application method. Do not apply succeeding coats until previous coat has completely dried. Sand between each enamel or varnish coat application with fine sand paper or rub surfaces with pumice stone where required to produce an even smooth surface in accordance with coating manufacturer's directions.

C. Apply additional coats when undercoats, stains, or other conditions show through the final coat of paint, until the paint film is of uniform finish, color and appearance.

D. Give special attention to insure all surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a film thickness equivalent of that of flat surfaces.

3.03 STANDARD SCHEDULE OF TREATMENTS

A. Interior gypsum board or plaster walls and ceilings:
   1. One coat of latex primer sealer.
   2. Two coats of acrylic latex paint.

B. Interior wood - Transparent:
   1. Filler coat (for open grained wood only).
   2. One coat of stain.
   3. One coat of sealer.
   4. Two coats of varnish, satin.

C. Exterior and interior wood - Painted:
   1. One coat of acrylic primer sealer.
   2. Two coats of exterior acrylic paint.

D. Exterior and interior ferrous metal (Unless otherwise indicated):
   1. One coat of rust-inhibiting primer.
   2. Two coats exterior alkyd paint.

E. Exterior and interior galvanized metal (Unless otherwise indicated):
   1. Chemical wash.
   2. Galvanized iron primer.
   3. Two coats exterior alkyd paint.

F. Exterior and interior concrete, concrete masonry units:
   1. General Application
      a. One coat interior/exterior latex block filler.
      b. Two coats elastometric coating.
   2. Cold Weather Application
      a. One coat Acrylic resin block surfacer.
      b. Two coats solvent borne masonry coating (waterproof sealer).

3.04 FIELD QUALITY CONTROL AND STANDARD OF ACCEPTANCE

A. Quality Assurance:
   1. Refer to Testing and Inspection for additional requirements.
   2. Contractor shall utilize industry standard measuring devices during paint and coating applications to verify minimum coverage rates and thickness specified are being provided.

B. Painted surfaces shall be considered to lack uniformity and soundness if any of the following defects are apparent:
   1. Brush / roller marks, streaks, laps, runs, sags, drips, heavy stippling, hiding or shadowing by inefficient application methods, skipped or missed areas, and foreign materials in paint coatings.
   2. Evidence of poor coverage at rivet heads, plate edges, lap joints, crevices, pockets, corners and reentrant angles.
   3. Damage due to touching before paint is sufficiently dry or any other contributory cause.
   4. Damage due to application on moist surfaces or caused by inadequate protection from the weather.
   5. Damage and/or contamination of paint due to blown contaminates (dust, spray paint, etc.).

C. Painted surfaces shall be considered unacceptable if any of the following are evident under natural lighting source for exterior surfaces and final lighting source (including daylight) for interior surfaces:

1. Visible defects are evident on vertical surfaces when viewed at normal viewing angles from a distance of not less than Thirty-Nine (39) inches.
2. Visible defects are evident on horizontal surfaces when viewed at normal viewing angles from a distance of not less than Thirty-Nine (39) inches.
3. Visible defects are evident on ceiling, soffit, or other overhead surfaces when viewed at normal viewing angles.
4. When the final coat of any surface exhibits a lack of uniformity of color, sheen, texture, and hiding across full surface area.

3.05 REPAIR, PROTECTION AND CLEAN-UP

A. Repair:
   1. Follow MPI standards and paint manufacturer's instructions for repair and painting of existing finishes.
   2. Use finish coat of respective new surface paint or coating system for minor repair of existing finishes. Use system primer where existing finishes are damaged down to substrate surface.

B. Protection:
   1. Protect all surfaces and areas, including landscaping, walks, drives, and adjacent building surfaces (including glass, aluminum surfaces, etc.) and equipment and any labels and signage from painting operations and damage by drop cloths, shields, masking, templates, or other suitable protective means and repair damage caused by failure to provide such protection.
   2. Erect barriers or screens and post signs to warn of or limit or direct traffic away or around work area as required.

C. Clean-Up:
   1. Remove all paint where spilled, splashed, splattered or sprayed as work progresses using means and materials that are not detrimental to affected surfaces.
   2. Keep work area free from an unnecessary accumulation of tools, equipment, surplus materials and debris.
   3. Remove combustible rubbish materials and empty paint containers each day and safely dispose in accordance with requirements of authorities having jurisdiction.
   4. Clean equipment and dispose of wash water / solvents and other cleaning and protective materials (e.g. rags, drop cloths, masking papers, etc.), paints thinners, paint removers and strippers in accordance with safety requirements.

END OF SECTION

SECTION 10 21 13

TOILET COMPARTMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Provide solid phenolic toilet partitions, screens and hardware, complete.

1.02 SUBMITTALS

A. Comply with Section 01 33 00.

B. Product Data: Submit manufacturer's technical data for materials, fabrication, and installation, including catalog cuts of anchors, hardware, fastening, and accessories.

C. Shop Drawings: Submit shop drawings for the fabrication and erection of toilet partition assemblies not fully described by manufacturer's data. Show all anchorages, gages of materials, hardware, fittings and fastenings. Submit setting drawings, templets and instructions for the installation of anchorage devices built into other work. Take field measurements prior to preparation of shop drawings and fabrication where possible, to ensure proper fitting of work. However, allow for adjustments within specified tolerances where taking of field measurements before fabrication might delay work.

D. Samples: Submit 2" x 2" minimum finish samples for Architect's approval.

E. Warranty: Submit warranty specified.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for five years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

B. Comply with current ADA and ANSI A117.1 accessibility standards. Notify Architect of conditions which deviate from governing standards prior to fabrication and installation of construction.

C. Warranty: Provide five (5) year warranty of material and installation defects, including corrosion or discoloration of finishes.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Manufacturers: American Specialties (ASI), Ampco, Bobrick, Bradly, General Partitions, or approved equal.

B. Toilet Compartment Type and Mounting:
   1. Refer to drawings for partition layout.
   2. Compartments: Floor-anchored, overhead braced.
   3. Screens: Wall-hung.
   4. Comply with ANSI A117.1 and ADA accessibility standards.

C. Toilet Compartment Materials:
   1. Phenolic Core: Compressed cellulose impregnated with phenolic resins. Provide smooth material, without creases or ripples.
   2. Phenolic Core Finish: Manufacturer's standard impregnated, with two colors. Colors as selected by Architect from manufacturer's full range of products.
   3. Door, Panel, Pilaster Construction: Form edges with 15 degree bevel without crown bolding. Finish edged smooth.
   4. Door Construction: 1 inch thick.
   5. Panel Construction: 1 inch thick.
   6. Pilaster Construction: 1 inch thick. Provide pilaster with mechanically fastened leveling bar reinforcement with zinc-plated jack bolt for leveling.
   7. Headrail: Extruded anodized aluminum headrail with anti-grip profile. Provide clamps for attachment to pilaster and stainless steel brackets to secure to wall.
   8. Shoes: 4 inch high minimum, Type 304 stainless steel with No. 4 satin brushed finish. Provide concealed retainer clips to attach to pilaster.
   9. Brackets (Fittings):
      a. Stirrup Type: Ear or U-brackets, stainless steel.
      b. Full-Height (Continuous) Type: Manufacturer's standard design, stainless steel.

D. Hardware and Accessories:
   1. Hardware: Manufacturer's heavy-duty stainless steel castings, including stainless steel torque type headed fasteners.
   2. Hinges: Self-closing surface mounted, through bolted, with gravity cams, adjustable to hold doors open at any angle up to 90 degrees, with emergency access for lifting door. Mount with stainless steel through-bolts.
   3. Latch and Keeper: Surface-mounted slide latch with flat rubber-faced combination door strike and keeper, with provisions for emergency access, meeting requirements for accessibility at accessible compartments.
   4. Coat Hook: Combination hook and rubber-tipped stop, sized to prevent door from hitting compartment-mounted accessories. Provide wall bumper where door abuts wall. Provide formed L-shaped hook without stop at outswing doors. Mount with stainless steel through-bolts.
   5. Door Pull: Standard unit on outside of inswing doors. Provide pulls on both sides of outswing doors.
   6. General Anchorages and Fasteners: Use torque type headed stainless steel for exposed fasteners. Use hot-dip galvanized, cadmium plated, or other rust resistant protective-coated steel for concealed anchors.

2.02 FABRICATION

A. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.

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

3.01 INSTALLATION

A. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction, plumb, level and with uniform appearance.

B. Provide blocking and backing for proper anchoring. Coordinate with work of other sections.

C. Attach with anchoring devices and brackets as recommended by manufacturer to suit supporting structure. Set units to provide support and resist lateral impact.

D. Limit openings between panels, doors and pilasters to less than ½", and not more than 1" between panels and walls.

E. Adjust hardware, lubricate, clean, and protect work.

END OF SECTION

SECTION 10 28 13

TOILET ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

A. Provide toilet accessories and metal framed mirrors, complete.

1.02 SUBMITTALS

A. Comply with Section 01 33 00.

B. Product Data: Submit manufacturer’s technical data and installation instruction for each product provided. Provide cross reference identification associated with toilet accessory schedule.

C. Shop Drawings: Submit shop drawings indicating dimensions, mounting requirements, and fastener types and locations.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

B. Standards: Comply with the provisions of the following specifications and standards, except as otherwise noted or specified.
   1. ANSI A117.1, Accessible and Usable Building and Facilities.
   2. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

C. Accessibility Requirements: Comply with ANSI and ADA accessibility standards.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Manufacturers: American Specialties (ASI), Bobrick, Bradley Corp., Gamco Commercial, Fort Howard, or approved equal. Obtain toilet accessories from single source from single manufacturer.

B. General:
   1. Schedule: Refer drawing toilet accessories schedule for types and locations.
   2. Quality Standards: All accessories shall be commercial grade.
   3. Materials: All accessories shall be stainless steel, Type 302 or 304, construction, unless otherwise indicated.
   4. Finishes: All stainless steel finished to be No. 4 brushed finish, unless otherwise indicated.
   5. Compatibility: Provide products compatible with substrate conditions.

C. Materials:
   1. General: Comply with Section 05 50 00.
   2. Stainless Steel: ASTM A167, AISI Type 302 or 304, No. 4 brushed finish. 22 gauge minimum.
   3. Tubing: ASTM A269 stainless steel.
   4. Adhesive: Contact, waterproof, as recommended by accessory manufacturer.
   5. General Anchorages and Fasteners: Use torque type headed stainless steel for exposed fasteners. Use hot-dip galvanized, cadmium plated, or other rust resistant protective-coated steel for concealed anchors.
   6. Glazing: Mirror glass, 1/4 inch thick, ASTM C1036, safety type. Comply with Section 08 80 00.

2.02 ACCESSORIES

A. Marked A – Tissue Paper Dispensers:
   1. Mounting: Surface.
   2. Type: Double roll, stacked, roll-in-reserve type dispenser with hinged front secured with tumbler lockset.
   3. Operation: Noncontrolled delivery with standard spindle.
   4. Capacity: Designed for 5 inch diameter tissue.

B. Marked B, C, D, and E – Grab Bars:
   1. Mounting: Surface.
   2. Mounting Flanges: Concealed fastener type.
   3. Finish: Smooth, ASTM A480, No. 4 finish on ends and slip resistant texture in grip area.
   4. Outside Diameter: 1 1/2 inches.

C. Marked F – Soap Dispensers:
   1. Mounting: Surface.
   2. Type: (By Owner).

D. Marked G – Sanitary Napkin Receptacle:
   1. Mounting: Surface.
   2. Door or Cover: Self-closing, disposal-opening cover.
   3. Receptacle: Removable.

E. Marked H and I – Accessible Restroom Signs:
   1. Mounting: Surface.
   2. Gender: Men, Women, or Unisex as indicated.
   3. Graphics: Tactile (Braille Grade 2 Contracted) with pictograms in compliance with ANSI A117.1 and ADA standards.
   4. Colors: White text and symbols on Blue (No. 15090 In Federal Standard 595B).

F. Marked J – Paper Towel Dispensers:
   1. Mounting: Surface.
   2. Minimum Capacity: 400 C-fold.
   3. Lockset: Tumbler type.
   4. Refill Indicator: Pierced slots at sides or front.

G. Marked K – Paper Towel Dispenser / Waste Receptacle:
   1. Mounting: Semi-recessed, maximum 4” wall projection.
   2. Minimum Capacity: 800 C-fold.
   3. Minimum Waste Capacity: 12 gallons.
   4. Liner: Reusable.
   5. Lockset: Tumbler type.

H. Marked L – Mirrors:
   1. Mounting: Surface.
   2. Frame: Stainless steel channel.
   3. Hangers: Produce rigid, tamper resistant installation, using wall bracket.
   4. Size: Refer drawings.

I. Marked N and O – Double Robe Hooks:
   1. Mounting: Surface.
   2. Type: Double-prong unit.

J. Marked P – Soap Dish:
   1. Mounting: Surface.
   2. Type: With washcloth bar.

K. Marked Q – Shower Curtain Rod:
   1. Mounting: Surface.
   2. Size: 1 1/4 inch outside diameter by length required, fabricated from nominal 0.05 inch thick stainless steel.
   3. Mounting Flanges: Stainless steel flanges designed for exposed fasteners.

L. Marked R – Fold-UP Shower Seat:
   1. Mounting: Surface.
   2. Configuration: L-shaped seat, designed for wheelchair access.
   3. Seat: Stainless steel with single-piece, pan-type construction and edge seams welded and ground smooth.
   4. Mounting Mechanism: Stainless steel.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Refer to drawings for accessory mounting requirements. Comply with ANSI A117.1 mounting heights and locations, unless otherwise indicated.

B. Install materials and systems in accordance with manufacturer's instructions. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.

C. Install units plumb and level, firmly anchored in location and at heights indicated or directed by Architect.

D. Coordinate with carpenter for installation of required fire treated blocking in framing.

E. Restore damaged finishes and test for proper operation. Clean and protect work from damage.

END OF SECTION

SECTION 10 80 00

MISCELLANEOUS SPECIALITIES

PART 1 - GENERAL

1.01 SUMMARY

A. Provide miscellaneous specialties, complete:
   1. Fire extinguishers.
   2. Interior building “Exit” signage.
   3. Exterior vinyl building address lettering.
   4. First Aid Kits.
   5. Exterior “Tornado Shelter” and “Tornado Shelter Access Route” signs.

1.02 SUBMITTALS

A. Comply with Section 01 33 00.

B. Product Data: Submit manufacturer’s technical data and installation instructions for accessory item specified.

C. Shop Drawings: Submit shop drawings indicating details of installation.

D. Samples: Submit manufacturer’s standard samples indicating color, finish and texture.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

B. Standards: Comply with the provisions of the following specifications and standards, except as otherwise noted or specified.
   1. ANSI A117.1, Accessible and Usable Building and Facilities.
   2. ANSI Z308.1, Minimum Requirements for Workplace First Aid Kits.
   3. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
   4. NFPA 10, Standard for Portable Fire Extinguishers.
   5. Underwriters Laboratories (UL).

C. Accessibility Requirements: Comply with ANSI and ADA accessibility standards.

PART 2 - PRODUCTS

2.01 FIRE EXTINGUISHERS

A. Manufactures: Larsen’s Manufacturing specified; equivalent by Ansul Sentry, J. L. Industries, Potter-Roemer or approved equal.

B. Fire Extinguisher:
   1. Model: MP10 A4-60B:C
   2. Type: Multipurpose dry chemical type.
   3. Rating: UL Listed ABC
   4. Capacity: 10 lbs heavy duty steel extinguisher.

2.02 INTERIOR SIGNS - EXIT

A. Manufactures: Seton specified; equivalent by American Specialties (ASI), APCO, Best, Kroy, Kaltech, Mohawk, National Signage, or approved equal.

B. Interior signs:
   1. Type: "Exit" complying with building code.
   2. Size: 8 inch by 8 inch.
   3. Copy: Helvetica Medium 5/8 inch height lettering.
   4. Graphics: Tactile (Braille Grade 2 Contracted) with pictograms in compliance with ANSI A117.1 and ADA standards.
   5. Colors: White text and symbols on Blue (No. 15090 In Federal Standard 595B).
   6. Fasteners, Tape and Adhesive: As recommended by sign manufacturer for substrate attached.

2.03 EXTERIOR VINYL BUILDING ADDRESS LETTERING

A. Vinyl lettering indicating building address number, white Helvetica Medium 6 inch high copy. Attached to glazing per lettering manufacturers recommendations with non-staining or non-yellowing adhesive.

2.04 FIRST AID KITS

A. Manufacturers: Subject to compliance with performance standards specified.

B. Performance Standards:
   1. Quality: Commercial grade, ANSI Z308.1, Class B certified by recognized independent testing agency.
   2. Contents: Comply with ANSI Z308.1, Class B.
   3. Container: Type 1, metal, shelf interior, wall mounted.
   4. Color: To be selected by Architect from manufacturer's standard samples.

2.05 TORNADO SHELTER SIGNS

A. Manufacturers: Subject to compliance with performance standards specified.

B. Performance Standards:
   1. Construction: Glow aluminum, exterior use, UV resistant.
   2. Graphics: Tactile (Braille Grade 2 Contracted) with pictograms and text in compliance with 2014 ICC 500 standards.
   3. Colors: White text and symbols on Blue (No. 15090 In Federal Standard 595B).
   4. Fasteners: Stainless steel, type as recommended by sign manufacturer for substrate attached.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install materials and systems in accordance with manufacturer's instructions. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.

B. Install fire extinguishers and cabinets at locations and heights indicated and acceptable to authorities having jurisdiction.

C. Install interior and exterior signs at locations and heights indicated and acceptable to authorities having jurisdiction. Comply with ADA and ANSI A117.1 specifications.

D. Install exterior vinyl lettering per manufacturers recommendations. Ensure attachment to withstand local wind load requirements.

E. Install first aid kits and cabinets at locations and heights indicated and acceptable to authorities having jurisdiction.

F. Restore damaged finishes and test for proper operation. Clean and protect work from damage.

END OF SECTION

SECTION 12 21 00

WINDOW BLINDS

PART 1 - GENERAL

1.01 SUMMARY

A. Provide horizontal louver blind systems, complete.

1.02 SUBMITTALS

A. Comply with Section 01 33 00.

B. Product Data: Submit manufacturer’s product technical data and installation instructions.

C. Samples: Submit manufacturer’s full range of material color and finish samples for selection by Architect.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.02 MATERIALS

A. Manufacturers: Bali, Hunter Douglas, Levolor, or approved equal.

B. Horizontal Louver Blinds:
   1. Finish Colors: To be selected by Architect from manufacturer’s standard colors.
   2. Operation: Manual tilting and lifting mechanisms.
   3. Head Rail: 1 5/8 inch high by 2 ¼ inch deep, U-shaped channel with light blocking lip on bottom center line, fabricated from 0.022 inch thick phosphate-treated steel with polyester primer and top coat of polyester-baked enamel.
   4. Bottom Rail: 9/16 inch high by 2 inch deep, fabricated from 0.040 inch thick aluminum, fully enclosed dust cover slat.
   5. Slats: Cold rolled aluminum allow, 0.008 inch thick, 2 inch width, finished with polyester-baked enamel with durable anti-static, antimicrobial paint finish.
   6. Wand Tilter: Zinc die cast worm and gear arrangement in low-friction thermoplastic gear case. Wand clear plastic.
   7. Cord Lock: Metal snap-in design incorporating a floating shaft-type locking pin and is crash proof.
   8. Tilt Rod: Electro-zinc coated solid steel measuring ¼ inch square.
   9. Tilt Rod Supports: Low friction thermoplastic and support tilt rod, centering ladder drums over ladder holes incorporating metal lift cord rollers to guide lift cords for smoother

operation.

10. Ladder Drums: High strength thermoplastic securely attaching braided ladders.
11. Braided Ladders: High tenacity polyester yarn.
12. Lift Cords: Braided polyester, 1.8 mm diameter.
13. Installation Brackets: Phosphate treated steel with polyester primer and polyester-baked enamel finish. Provide intermediate support brackets for blinds over 48 inches wide.
14. Accessories: Manufacturer’s standard anchors and accessories for project specific substrate mounting conditions.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.

B. Restore damaged finishes and test for proper operation. Clean and protect work from damage.

END OF SECTION

SECTION 21 05 00

COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Mechanical Sleeve Seals: Modular rubber sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

B. Galvanized-Steel Sheet: 24 Ga. (0.0239-inch) minimum thickness; round tube closed with welded longitudinal joint.

C. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

D. PVC Pipe: ASTM D 1785, Schedule 40.

2.2 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Stamped-Steel Type: With spring clips and chrome-plated finish.

2.3 GROUT

A. Description: ASTM C 1107, Grade B, non-shrink and nonmetallic, dry hydraulic-cement grout.

PART 3 - EXECUTION

3.1 GENERAL PIPING INSTALLATIONS

A. Install piping free of sags and bends.

B. Install fittings for changes in direction and branch connections.

C. Install sleeves for pipes passing through concrete and masonry walls, gypsum board partitions, and concrete floor and roof slabs.

D. Exterior Wall, Pipe Penetrations: Mechanical sleeve seals installed in steel or cast-iron pipes for wall sleeves.

E. Install unions at final connection to each piece of equipment.

F. Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals in water piping.

3.2 GENERAL EQUIPMENT INSTALLATIONS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components, unless otherwise indicated.

C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.3 BASES, SUPPORTS, AND ANCHORAGES

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor fire-suppression materials and equipment.

END OF SECTION 210500

SECTION 21 13 13

WET FIRE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data for valves, sprinklers, specialties, and alarms.

1. Submit sprinkler system drawings identified as "working plans" and calculations according to NFPA 13. Submit required number of sets to authorities having jurisdiction for review, comment, and approval. Include system hydraulic calculations.
2. Submit test reports and certificates as described in NFPA 13.

B. Design and Installation Approval: Acceptable to authorities having jurisdiction.

C. Hydraulically design sprinkler systems according to NFPA 13.

D. Comply with NFPA 13 and NFPA 70.

E. UL-listed and -labeled and FM-approved pipe and fittings.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795.

B. Cast-Iron Threaded Flanges: ASME B16.1, Class 250, raised ground face, bolt holes spot faced.

C. Cast-Iron Threaded Fittings: ASME B16.4, Class 250, standard pattern.

D. Grooved-End Fittings: UL-listed and FM-approved, ASTM A 536, Grade 65-45-12 ductile iron or ASTM A 47 Grade 32510 malleable iron, with grooves or shoulders designed to accept grooved couplings.

E. Grooved-End Couplings: UL 213, ASTM A 536 ductile-iron or ASTM A 47 malleable-iron housing, with enamel finish. Include gaskets, bolts, and accessories.

F. Provide hangers, supports, and seismic restraints with UL listing and FM approval for fire-protection systems.

G. Manufacturers: Viking, Reliable or approved equal.

2.2 VALVES

A. Fire-Protection Service Valves: UL listed and FM approved, with 175-psig non-shock minimum working-pressure rating. Indicating valves shall be butterfly or ball type, bronze body, and integral indicating device with visual indicator.

B. Gate Valves: UL 262, cast bronze, solid wedge, outside screw and yoke, rising stem.

C. Swing Check Valves, NPS 2 and Smaller: UL 312 or MSS SP-80, Class 150; bronze body with bronze disc.

D. Swing Check Valves, NPS 2-1/2 and Larger: UL 312, cast-iron body and bolted cap, with bronze disc or cast-iron disc with bronze-disc ring.

E. Alarm Check Valves: UL 193, 175-psig working pressure, designed for horizontal or vertical installation, with cast-iron, bronze grooved seat with O-ring seals, and single-hinge pin and latch design. Include trim sets for bypass, drain, electric sprinkler alarm switch, pressure gages, retarding chamber, fill-line attachment with strainer, and drip cup assembly.

F. Ball Drip Valves: UL 1726, automatic drain valve, NPS 3/4, ball check device.

2.3 SPRINKLERS

A. Automatic Sprinklers: With heat-responsive element complying with the following:

1. UL 199, for applications except residential.
2. UL 1626, for residential applications.
3. UL 1767, for early-suppression, fast-response applications.

B. Sprinkler Types and Categories: Nominal 1/2-inch orifice for "Ordinary" temperature classification rating unless otherwise indicated or required by application.

C. Sprinkler types include the following:

1. Upright, pendent, and sidewall sprinklers.
2. Extended coverage sprinklers.
3. Quick-response sprinklers.
4. Pendent and sidewall, dry-type sprinklers.

D. Sprinkler Guards: Wire-cage type, including fastening device.

E. Sprinkler Cabinets: Finished steel cabinet and hinged cover, with space for minimum of six spare sprinklers plus sprinkler wrench, suitable for wall mounting. Include number of sprinklers required by NFPA 13 and one wrench for sprinklers. Include separate cabinet with sprinklers and wrench for each style sprinkler on Project.

PART 3 - EXECUTION

3.1 WATER SERVICE

A. Contractor shall include in his bid the installation of the required underground water service line at the location(s) indicated on the drawing. The contractor must consult the City Water department and local authorities, provide necessary materials and labor to conform with all local requirements and include the cost of all work and materials in connection with the service. This contractor shall perform necessary hydraulic calculations required to size the line in accordance with applicable provisions of NFPA including NFPA 13.

3.2 DESIGN AND CALCULATION

A. Contractor shall perform necessary calculations required for proper design and installation of the sprinkler system for the entire building. All design calculations and layout of the sprinkler system network shall be based on the Specifications and accompanying drawings. Request for HVAC duct and equipment relocations shall be submitted to the Engineer one week before the bid opening date. No sprinkler pipe penetration will be allowed through HVAC duct system.

B. Contractor shall perform fire flow test on hydrant on water main that shall be tapped for new fire service. Test shall be performed per NFPA 291 and witnessed by local fire authorities and a copy of the test results shall be submitted to the Architect and Engineer for their records.

3.3 PIPE AND FITTING APPLICATION

A. Use steel pipe with threaded, press-seal, roll-grooved, or cut-grooved joints; copper tube with wrought-copper fittings and brazed joints; or CPVC plastic pipe and fittings and metal-to-plastic transition fittings with solvent-cemented joints.

1. For steel pipe joined by threaded fittings, use Schedule 40.
2. For steel pipe joined by welding or roll-grooved pipe and fittings, use Schedule 10.

3.4 PIPING INSTALLATION

A. Install "Inspector's Test Connections" in sprinkler piping, complete with shutoff valve.

B. Install sprinkler zone control valves, test assemblies, and drain headers adjacent to standpipes.

C. Install ball drip valves to drain piping between fire department connections and check valves. Drain to floor drain or outside building.

D. Install alarm devices in piping systems and connect to fire-alarm system.

E. Protect piping from earthquake damage as required by NFPA 13.

F. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Install gages to permit removal, and install where they will not be subject to freezing.

G. Install fire-protection service valves supervised-open, located to control sources of water supply except from fire department connections. Where there is more than one control valve, provide permanently marked identification signs indicating portion of system controlled by each valve.

H. Install check valve in each water supply connection. Install backflow preventers in potable-water supply sources.

I. Install alarm check valves for proper direction of flow, including bypass check valve and retard chamber drain line connection.

J. Hangers, supports, anchors, etc. located in the attic or crawlspaces for the dry pipe system shall be hot dipped galvanized for corrosion protection.

3.5 SPRINKLER APPLICATIONS

A. Rooms without Ceilings: Chromeplated upright sprinkler heads.

B. Rooms with Suspended or Drywall Ceilings: Concealed mount brass, unplated sprinklers with white cover plate and trim in areas with white ceilings. Provide black covers and black trim in areas with wood or dark colored ceilings. Verify sprinkler head colors with Architect.

C. Wall Mounting: White polyester coated semi-recessed (sidewall) sprinkler heads with white trim.

D. Sprinklers Subject to Freezing: Upright, pendent, or sidewall, dry type sprinkler heads.

E. Special Applications: Extended coverage or quick-response sprinklers.

F. Sprinkler heads located in Gymnasiums, or other locations where they are likely to be damaged shall be furnished with wire guards. Sprinkler heads located in wet areas or subject to corrosion shall be furnished with a corrosion resistant coating equal to Electroless Nickel PTFE (ENT). This shall include concealed type heads.

G. Install sprinklers in suspended ceilings in center of ceiling panels.

3.6 TESTING

A. Flush, test, and inspect sprinkler piping systems according to NFPA 13.

END OF SECTION 211313

SECTION 22 00 00

COMMON REQUIREMENTS FOR PLUMBING SYSTEMS AND EQUIPMENT

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Mechanical Sleeve Seals: Modular rubber sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

B. Galvanized-Steel Sheet: 24 Ga. (0.0239-inch) minimum thickness; round tube closed with welded longitudinal joint.

C. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

D. PVC Pipe: ASTM D 1785, Schedule 40.

2.2 GROUT

A. Description: ASTM C 1107, Grade B, non-shrink and nonmetallic, dry hydraulic-cement grout.

2.3 HANGERS AND SUPPORTS

A. Hanger and Pipe Attachments: Factory fabricated with galvanized coatings; nonmetallic coated for hangers in direct contact with copper tubing.

B. Powder-Actuated Fasteners: Threaded-steel stud, with pull-out and shear capacities appropriate for supported loads and building materials where used.

C. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated or stainless steel, with pull-out and shear capacities appropriate for supported loads and building materials where used.

2.4 PRESSURE GAGES AND TEST PLUGS

A. Pressure Gages: Direct-mounting, indicating-dial type complying with ASME B40.100. Dry metal case, minimum 2-1/2-inch diameter with red pointer on white face, and plastic window. Minimum accuracy 3 percent of middle half of range. Range two times operating pressure.

B. Test Plug: Corrosion-resistant brass or stainless-steel body with two self-sealing rubber core inserts and gasketed and threaded cap, with extended stem for units to be installed in insulated piping. Minimum pressure and temperature rating 500 psig at 200 deg F.

PART 3 - EXECUTION

3.1 GENERAL PIPING INSTALLATIONS

A. Install piping free of sags and bends.

B. Install fittings for changes in direction and branch connections.

C. Install sleeves for pipes passing through concrete and masonry walls, gypsum board partitions, and concrete floor and roof slabs.

D. Exterior Wall, Pipe Penetrations: Mechanical sleeve seals installed in steel or cast-iron pipes for wall sleeves.

E. Comply with requirements in Division 07 Section "Penetration Firestopping" for sealing pipe penetrations in fire-rated construction.

F. Install unions at final connection to each piece of equipment.

G. Install dielectric unions and flanges to connect piping materials of dissimilar metals in gas piping.

H. Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals in water piping.

3.2 GENERAL EQUIPMENT INSTALLATIONS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components, unless otherwise indicated.

C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.3 HANGERS AND SUPPORTS

A. Comply with MSS SP-69 and MSS SP-89. Install building attachments within concrete or to structural steel.

B. Install hangers and supports to allow controlled thermal and seismic movement of piping systems.

C. Install powder-actuated fasteners and mechanical-expansion anchors in concrete after concrete is cured. Do not use in lightweight concrete or in slabs less than 4 inches thick.

D. Load Distribution: Install hangers and supports so piping live and dead loading and stresses from movement will not be transmitted to connected equipment.

E. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Adjustable Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated stationary pipes, NPS 1/2 to NPS 30.
2. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
3. Adjustable Steel Band Hangers (MSS Type 7): For suspension of non-insulated stationary pipes, NPS 1/2 to NPS 8.
4. Adjustable Band Hangers (MSS Type 9): For suspension of non-insulated stationary pipes, NPS 1/2 to NPS 8.
5. Adjustable Swivel-Ring Band Hangers (MSS Type 10): For suspension of non-insulated stationary pipes, NPS 1/2 to NPS 2.

F. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.

END OF SECTION 22 00 00

SECTION 22 05 23

VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

B. NSF Compliance: NSF 61 for valve materials for potable-water service.

PART 2 - PRODUCTS

2.1 GENERAL-DUTY VALVES

A. Valve Sizes: Same as upstream piping unless otherwise indicated.

B. Valves in Insulated Piping: With 2-inch stem extensions.

C. End Connections: Threads shall comply with ANSI B1.20.1. Flanges shall comply with ANSI B16.1 for cast-iron valves and with ANSI B16.24 for bronze valves. Solder-joint connections shall comply with ANSI B16.18.

D. Copper-Alloy Ball Valves: Brass or bronze body with full-port, stainless steel or chrome-plated bronze ball; PTFE or TFE seats; and 600-psig minimum CWP rating and blowout-proof stem.

E. Bronze, Swing Check Valves: Class 125, bronze body with bronze disc and seat.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Use ball valves for shut-off and globe valves for throttling duty.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves for each fixture and item of equipment.

D. Install three-valve bypass around each pressure-reducing valve using throttling-type valves.

E. Install valves in horizontal piping with stem at or above center of pipe.

F. Install valves in a position to allow full stem movement.

G. Install check valves for proper direction of flow in horizontal position with hinge pin level.

END OF SECTION 22 05 23

SECTION 22 07 19

PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following plumbing piping services:

1. Domestic hot-water piping.

1.2 ACTION SUBMITTALS

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

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties, equipment connections, and access panels.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

B. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Mineral-Fiber, Preformed Pipe Insulation:

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. Fibrex Insulations Inc.; Coreplus 1200.
b. Johns Manville; Micro-Lok.
c. Knauf Insulation; 1000-Degree Pipe Insulation.
d. Manson Insulation Inc.; Alley-K.
e. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 Deg F (454 Deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 INSULATING CEMENTS

A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

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. Ramco Insulation, Inc.; Ramcote 1200 and Quik-Cote.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
   b. Eagle Bridges - Marathon Industries; 225.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
   d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
   b. Eagle Bridges - Marathon Industries; 225.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-20.
   d. Mon-Eco Industries, Inc.; 22-25.
   e. One or both subparagraphs below may be required to comply with Project requirements or authorities having jurisdiction. Retain first subparagraph below if required for LEED-NC, LEED-CI, or LEED-CS Credit IEQ 4.1.
   f. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   g. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. PVC Jacket Adhesive: Compatible with PVC jacket.

1. 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; 739, Dow Silicone.

b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
c. P.I.C. Plastics, Inc.; Welding Adhesive.
d. Speedline Corporation; Polyco VP Adhesive.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
b. Vimasco Corporation; 749.

2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
b. Eagle Bridges - Marathon Industries; 550.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
d. Mon-Eco Industries, Inc.; 55-50.
e. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms (1.2 metric perms) at 0.0625-inch (1.6-mm) dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
4. Solids Content: 60 percent by volume and 66 percent by weight.

5. Color: White.

2.5 SEALANTS

A. Joint Sealants:

B. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
5. Color: White.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Polyester Fabric: Approximately 1 oz./sq. yd. (34 g/sq. m) with a thread count of 10 strands by 10 strands/sq. in. (4 strands by 4 strands/sq. mm), in a Leno weave, for pipe.

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. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Mast-A-Fab.
   b. Vimasco Corporation; Elastafab 894.

2.8 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. Johns Manville; Zeston.
   b. P.I.C. Plastics, Inc.; FG Series.
   c. Proto Corporation; LoSmoke.
   d. Speedline Corporation; SmokeSafe.

2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White.
4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

   a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
5. Finish and thickness are indicated in field-applied jacket schedules.
6. Factory-Fabricated Fitting Covers:

   a. Same material, finish, and thickness as jacket.
   b. Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
   c. Tee covers.
   d. Flange and union covers.
   e. End caps.
   f. Beveled collars.
   g. Valve covers.
   h. Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.9 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. ABI, Ideal Tape Division; 428 AWF ASJ.
   b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
   c. Compac Corporation; 104 and 105.
   d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches (75 mm).

3. Thickness: 11.5 mils (0.29 mm).
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. ABI, Ideal Tape Division; 370 White PVC tape.
b. Compac Corporation; 130.
c. Venture Tape; 1506 CW NS.

2. Width: 2 inches (50 mm).
3. Thickness: 6 mils (0.15 mm).
4. Adhesion: 64 ounces force/inch (0.7 N/mm) in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch (3.3 N/mm) in width.

2.10 SECUREMENTS

A. Aluminum Bands: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, 1/2 inch (13 mm) wide with wing seal.

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. ITW Insulation Systems; Gerrard Strapping and Seals.
b. RPR Products, Inc.; Insul-Mate Strapping and Seals.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

   1. Install insulation continuously through hangers and around anchor attachments.
   2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
   3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
   4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

   1. Draw jacket tight and smooth.
   2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
   3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches (50 mm) o.c.

a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Cleanouts.

3.3 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

D. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.

3.4 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.5 FIELD-APPLIED JACKET INSTALLATION

A. Where PVC jackets are indicated, install with 1-inch (25-mm) overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

3.6 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099123 "Interior Painting."

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of

inspection shall be limited to two locations of straight pipe, two locations of welded fittings, and two locations of threaded valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.8 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.9 INDOOR PIPING INSULATION SCHEDULE

A. Domestic, Cold, Hot and Recirculated Hot Water: Insulation shall be the following:
1. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm).

END OF SECTION 22 07 19

SECTION 22 11 10

PIPING FOR PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes under-building-slab and aboveground domestic water pipes, tubes, and fittings inside buildings.

1.2 ACTION SUBMITTALS

A. Product Data: For transition fittings and dielectric fittings.

1.3 INFORMATIONAL SUBMITTALS

A. System purging and disinfecting activities report.

B. Field quality-control reports.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

B. Potable-water piping and components shall comply with NSF 14 and NSF 61. Plastic piping components shall be marked with "NSF-pw."

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B) water tube, drawn temper.

B. Soft Copper Tube: ASTM B 88, Type K (ASTM B 88M, Type A) and ASTM B 88, Type L (ASTM B 88M, Type B) water tube, annealed temper.

C. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

D. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

E. Copper Unions:

1. MSS SP-123.
2. Cast-copper-alloy, hexagonal-stock body.
3. Ball-and-socket, metal-to-metal seating surfaces.
4. Solder-joint or threaded ends.

2.3 PIPING JOINING MATERIALS

A. Solder Filler Metals: ASTM B 32, lead-free alloys.

B. Flux: ASTM B 813, water flushable.

C. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

D. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

2.4 TRANSITION FITTINGS

A. General Requirements:

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

2.5 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. 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. Capitol Manufacturing Company; member of the Phoenix Forge Group.
b. Central Plastics Company.
c. Hart Industries International, Inc.
d. Jomar International.
e. Matco-Norca.
f. McDonald, A. Y. Mfg. Co.
g. Watts; a division of Watts Water Technologies, Inc.
h. Wilkins; a Zurn company.

2. Standard: ASSE 1079.

3. Pressure Rating: 150 psig (1035 kPa)
4. End Connections: Solder-joint copper alloy and threaded ferrous.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance.

D. Install shutoff valve immediately upstream of each dielectric fitting.

E. Install water-pressure-reducing valves downstream from shutoff valves.

F. Install domestic water piping level and plumb.

G. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

H. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

I. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

J. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

K. Install piping to permit valve servicing.

L. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

M. Install piping free of sags and bends.

N. Install fittings for changes in direction and branch connections.

O. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

P. Install sleeves for piping penetrations of walls, ceilings, and floors.

Q. Install sleeve seals for piping penetrations of concrete walls and slabs.

R. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.2 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.

E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

F. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.3 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Aboveground Domestic Water Piping NPS 2 (DN 50) and Smaller: Plastic-to-metal transition fittings or unions.

3.4 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 (DN 50) and Smaller: Use dielectric couplings or unions.

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger, support products, and installation in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."

1. Vertical Piping: MSS Type 8 or 42, clamps.
2. Individual, Straight, Horizontal Piping Runs:

a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
c. Longer Than 100 Feet (30 m) if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support vertical piping and tubing at base and at each floor.

C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch (10 mm).

D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 (DN 20) and Smaller: 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
2. NPS 1 and NPS 1-1/4 (DN 25 and DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.

E. Install supports for vertical copper tubing every 10 feet (3 m).

F. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
1. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
2. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 (DN 65) and larger.

3.7 IDENTIFICATION

A. Identify system components. Match existing piping identification materials and methods.

B. Label pressure piping with system operating pressure.

3.8 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Piping Inspections:

   a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
   b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

      1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
      2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

   c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
   d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

   a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
   b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
   c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
   d. Cap and subject piping to static water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
   e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
   f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.9 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.

2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

    a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
    b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

    a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    b. Fill and isolate system according to either of the following:

        1) Fill system or part thereof with water/chlorine solution with at least 50 ppm (50 mg/L) of chlorine. Isolate with valves and allow to stand for 24 hours.
        2) Fill system or part thereof with water/chlorine solution with at least 200 ppm (200 mg/L) of chlorine. Isolate and allow to stand for three hours.

    c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
    d. Repeat procedures if biological examination shows contamination.
    e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.11 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

D. Refer to Piping Material Schedule on Drawings.

END OF SECTION 22 11 10

SECTION 22 11 19

PLUMBING PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Comply with NSF 61 for potable domestic water piping and components.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. Hard Copper Tubing: ASTM B 88, Types K and L, water tube, drawn temper with wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.

1. Copper Unions: Cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.

2. Joining Materials: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder.

B. Soft Copper Tubing: ASTM B 88, Types K and L, water tube, annealed temper with copper pressure fittings, cast-copper-alloy or wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.

1. Joining Materials: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder.

C. Special-Duty Valves:

1. Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty metal valves.

2. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves, drain valves, backflow preventers, and vacuum breakers.

D. Transition Fittings: Manufactured piping coupling or specified piping system fitting. Same size as pipes to be joined and pressure rating at least equal to pipes to be joined.

E. Flexible Connectors: Stainless-steel, corrugated-metal tubing with wire-braid covering. Working-pressure rating a minimum of 200 psig.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with requirements in Division 22 Section "Common Work Results for Plumbing" for basic piping installation requirements.

B. Install domestic water piping without pitch for horizontal piping and plumb for vertical piping.

C. Comply with requirements in Division 22 Section "Common Work Results for Plumbing" for basic piping joint construction.

1. Soldered Joints: Comply with procedures in ASTM B 828 unless otherwise indicated.

D. Comply with requirements in Division 22 Section "Common Work Results for Plumbing" for pipe hanger and support devices.

E. Support vertical piping at each floor.

3.2 INSPECTING AND CLEANING

A. Inspect and test piping systems as follows:

1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.

2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.

B. Clean and disinfect domestic water piping by filling system with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.

3.3 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shut-off Duty: Use bronze ball valves for piping NPS 2 and smaller. Use cast-iron ball valves with flanged ends for piping NPS 2-1/2 and larger.

2. Throttling Duty: Use bronze globe valves for piping NPS 2 and smaller. Use cast-iron globe valves with flanged ends for piping NPS 2-1/2 and larger.

3. Hot-Water-Piping, Balancing Duty: Calibrated balancing valves.

4. Drain Duty: Hose-end drain valves.

B. Install ball valves on inlet to each plumbing equipment item, on each supply to each plumbing fixture not having stops on supplies, and elsewhere as indicated.

C. Install drain valve at base of each riser, at low points of horizontal runs, and where required to drain water distribution piping system.

D. Install swing check valve on discharge side of each pump and elsewhere as indicated.

E. Install ball valves in each hot-water circulating loop and discharge side of each pump.

END OF SECTION 22 11 19

SECTION 22 13 16

SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Minimum Pressure Requirement for Soil, Waste, and Vent: 10-foot head of water.

B. Comply with NSF 14, "Plastic Piping Components and Related Materials," for plastic piping components.

PART 2 - PRODUCTS

2.1 PIPES AND FITTINGS

A. Copper Drainage Tube and Fittings: ASTM B 306, Type DWV drawn temper with wrought-copper, Type DWV drainage fittings.

B. Hub-and-Spigot Cast-Iron Soil Pipe and Fittings: ASTM A 74, Service class; ASTM C 564 rubber gaskets.

C. Hubless Cast-Iron Soil Pipe and Fittings: ASTM A 888 or CISPI 301, with ASTM C 1277 shielded couplings.

D. PVC Plastic, DWV Pipe and Fittings: ASTM D 2665, Schedule 40, plain ends with PVC socket-type, DWV pipe fittings.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Comply with requirements in Division 22 Section "Common Work Results for Plumbing" for basic piping installation requirements.

B. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

C. Install wall penetration system at each pipe penetration through foundation wall. Make installation watertight. Comply with requirements in Division 22 Section "Common Work Results for Plumbing" for wall penetration systems.

1. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

D. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn,

double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

E. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

F. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:

1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

G. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.

H. Install underground PVC soil and waste drainage piping according to ASTM D 2321.

I. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

J. Comply with requirements in Division 22 Section "Common Work Results for Plumbing" for basic piping joint construction.

K. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure unless otherwise indicated.

L. Comply with requirements in Division 22 Section "Common Work Results for Plumbing" for pipe hanger and support devices.

3.2 PIPE SCHEDULE

A. Refer to construction drawings

END OF SECTION 22 13 16

SECTION 22 14 00
PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 1 Specification Sections, section 220100 - General Mechanical Requirements, section 22 05 00 – Basic Mechanical Materials and Methods shall apply to this Section.

PART 2 - PRODUCTS

2.1 Equivalent fixtures and accessories by the following manufacturers will be acceptable.

A. Toilet Seats: Church, Olsonite, Toto, or Beneke.

B. Fittings and Supports: Josam, Smith, Zurn or Wade.

C. Traps, Supplies and Stops: Dearborn, Sanitary Dash or as specified under plumbing fixtures.

D. Supplies and Stops: Dearborn Figure No. 2407CW 1-1/2" compression inlet with angle compression stop and 3/8" O.D. risers in length required. Provide deep chrome plated brass escutcheons.

E. Traps: Dearborn #FS510 (1-1/2") and/or #FS507 (1-1/4") cast brass body with clean-out "P" trap. Provide deep chrome plated brass escutcheon with set screw.

2.2 Refer to **PLUMBING FIXTURE SCHEDULE** on construction drawings for fixture types to be installed under this section.

PART 3 - EXECUTION

3.1 PLUMBING FIXTURES:

A. Provide plumbing fixtures as shown on drawings and as specified complete including piping and connections. China fixtures shall be of best grade vitreous ware, without pit holes or blemishes and outlines shall be generally true. Architect reserves right to reject any piece which in his opinion is faulty. Fixtures fitting against walls shall have ground backs. Exposed piping and fitting shall be chrome plated.

B. Set fixtures true and level with all necessary supports for fixtures installed before plastering is done. Nipples through wall to fixture connection shall be chrome plated brass. Contractor may use copper stubouts to stops under lavatories provided deep escutcheons are used and no copper is visible in lieu of chrome nipples.

3.2 FIXTURE INSTALLATION

A. Assemble fixtures, trim, fittings, and other components according to manufacturers' written instructions.

B. For wall-hanging fixtures, install off-floor supports affixed to building substrate.
   1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
   2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
   3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.

C. Install back-outlet, wall-hanging fixtures onto waste fitting seals and attach to supports.

D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.

E. Install wall-hanging fixtures with tubular waste piping attached to supports.

F. Install counter-mounting fixtures in and attached to casework.

G. Install fixtures level and plumb according to manufacturers' written instructions and roughing-in drawings.

H. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
   1. Exception: Use ball, gate, or globe valve if stops are not specified with fixture. Refer to Division 22 Section "Valves" for general-duty valves.

I. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

J. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.

K. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.

L. Install toilet seats on water closets.

M. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

N. Install water-supply, flow-control fittings with specified flow rates in fixture supplies at stop valves.

O. Install faucet, flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

P. Install shower, flow-control fittings with specified maximum flow rates in shower arms.

Q. Install traps on fixture outlets.
   1. Exception: Omit trap on fixtures with integral traps.

R. Install disposer in outlet of sinks indicated to have disposer. Install switch where indicated or in wall adjacent to sink if location is not indicated.

S. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Refer to Division 22 Section "Basic Mechanical Materials and Methods" for escutcheons.

T. Set shower receptors service basins in leveling bed of cement grout.

U. Seal joints between fixtures and walls, floors, and counters using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Refer to Division 7 Section "Joint Sealants" for sealant and installation requirements.

3.3 CONNECTIONS

A. Connect water supplies from water distribution piping to fixtures.

B. Connect drain piping from fixtures to drainage piping.

C. Supply and Waste Connections to Plumbing Fixtures: Connect fixtures with water supplies, stops, risers, traps, and waste piping. Use size fittings required to match fixtures. Connect to plumbing piping.

D. Supply and Waste Connections to Fixtures and Equipment Specified in Other Sections: Connect fixtures and equipment with water supplies, stops, risers, traps, and waste piping specified. Use size fittings required to match fixtures and equipment. Connect to plumbing piping.

3.4 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 14 00

SECTION 22 14 23

DRAINAGE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Backwater Valves: As scheduled.

B. Cleanouts: As scheduled:

C. Floor Drains: As scheduled.

D. Roof Flashing Assemblies: Manufactured assembly made of 4.0-lb/sq. ft., 0.0625-inch-thick, lead flashing collar and skirt extending at least 10 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.

E. Air-Gap Fittings: ASME A112.1.2, chrome-plated brass cover.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.

B. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

C. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor unless otherwise indicated.

1. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
2. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

D. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.

E. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

END OF SECTION 22 14 23

SECTION 22 31 16

COMMERCIAL DOMESTIC WATER SOFTENERS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

PART 2 - GENERAL DESCRIPTION

2.1 WATER SOFTENER SYSTEM

A. Provide as indicated a vertical pressure type water softener system complete with pressure vessel, softening resin, control valve, brine maker and electronic controller. The system will be of an approved design as fabricated by a manufacturer regularly engaged in the production of water treatment equipment. All equipment and material will be supplied in compliance with the specifications as intended for a complete and operational system.

B. Manufacturer's:
   1. Basis of Design: Culligan International Company
   2. Easy Water.
   3. Kinetico.
   4. Pure Aqua.

C. Qualified manufacturers will have the entire softener certified as a system to NSF/ANSI 61, NSF/ANSI 372, CSA 483.1, UL/CUL and CE.

PART 3 - EQUIPMENT SPECIFICATION

3.1 SOFTENER TANK(S)

A. Each system shall include (1) tank(s). Each softener tank shall be sufficient size to allow for a proper freeboard space above the resin bed for adequate expansion of the resin during backwashing

B. Tank(s) shall be manufactured of polyester reinforced by a continuous roving glass filament overwrap. The top opening will be 4"-8 UN threaded and the tank bottom will be supported on a molded structural base.

3.2 INTERNAL DISTRIBUTION

A. The upper distribution system shall be of the single point diffuser type to dispense water laterally to avoid channeling within the resin bed.

B. The lower distribution system shall be of the single point distributor type, constructed of PVC pipe and a fine slotted strainer to provide even flow distribution through the resin bed. The distribution system shall be embedded in a two layer subfill of washed inorganic material to support the resin bed.

3.3 MAIN OPERATING VALVE

A. The main operating valve shall be of a top mount design constructed of thermoplastic resistant to attack by substances found in natural water supplies. Inlet and outlet connections to be 1.5" or 2 inch NPTE. The Cv (flow coefficient) of the main operating valve shall be equal to/greater than 32.

B. A vacuum breaker and pressure regulating valve shall be integrated in the design of the main operating valve.

C. The main operating valve will be of the motor driven, mechanically activated design with 5 positions to accomplish the regeneration steps of backwash, brine draw/rinse, fast rinse and brine refill in addition to the service position. The internal seals will be of a modular design for ease of replacement and service.

D. The main operating valve will be fitted with a fixed orifice eductor to control brine draw/slow rinse.

E. The main operating valve shall be designed by the same manufacturer as the water softener system and tested prior to shipment.

3.4 FLOW CONTROL

A. The backwash flow controller shall be a pressure-compensating orifice capable of providing and maintaining proper backwash flows over the entire listed operating pressure range of the system. The backwash flow controller shall be easily serviced without special tools and design so that service to the flow controller can be performed without disassembly of the valve body or the sequencing controller and without disconnecting existing inlet and outlet piping connections.

3.5 CONTROLS

A. A fully integrated programmable microprocessor driven electronic controller shall be provided to automatically cycle the main operating valve through the regeneration sequence. The electronic controller shall be designed and manufactured by the same manufacturer as the water treatment equipment.

B. The controller shall be capable of initiating a regeneration by accepting an internal signal from the controller time keeping device. The controller shall sequence all steps of an automatic regeneration and automatically return the softener to a service or stand-by mode. The initiating time and/or volume setpoints shall automatically reset upon completion of the regeneration sequence.

C. The controller shall include a sealed keypad, capable of programming all controller functions, located on the face of the controller. The controller display shall be a multi-line OLED display capable of full text readouts of operating status and codes. The firmware shall be capable of being updated to the latest version.

D. An audible alarm beeper capable of emitting a tone of ~70 dBA shall be available but capable of being disabled if so desired.

E. The controller shall allow for a manual initiation of the automatic regeneration sequence by utilizing a regeneration selection from the controller menu.

F. The controller shall operate on a low voltage electrical system. The system shall include a UL/CUL listed transformer. The entire electronic control package and its associated inputs/outputs shall require not more than 24 VAC @ 50VA. The control shall be rated for web environments and certified to NEMA 3R.

G. The controller shall utilize EEPROM to save pertinent programmed data and statistical functions. The controller must retain all functionality for power interruptions of less than 72 hours. A battery backup shall be installed and capable of maintaining the time of day for a minimum of 5 years.

H. System control options; One or a combination of below control options shall be available:

1. Timeclock - An operator selected program of a time-initiated reconditioning for single units shall be available. The controller shall be capable of being entirely programmed in the field without additional interface devices. The operator shall be able to select reconditioning to occur after a specified number of hours or days or specific day of the week. The electronic controller shall indicate various data that includes number of reconditionings in the last 14 days, days since last reconditioning, total number of reconditionings for the life of the unit, current day of the week, time of day, and unit in reconditioning.

I. In addition the following functions shall be provided as part of the system controller:

1. The controller shall have the capability of providing communications with the following external devices:
   a. Serial Communications (RS-232 & RS-485)
   b. USB
   c. Modbus RTU
   d. Profibus Communications
   e. BACnet Communications
   f. Modem (cell modem or land-line modem)
   g. Dry Contact Alarm Relay
   h. Wireless Remote (local RF wireless remote, 200 ft range)

2. Regeneration sequence timers: The controller shall allow control customization of individual regeneration cycle times, each programmable from 1 - 99 minutes. The regeneration cycle and time of cycle remaining shall be displayed when in regeneration.

3. Lockout function: The controller shall include a lockout to prevent unauthorized personnel from altering program data.

4. Regeneration override: The controller shall include a function to direct pre-programmed regeneration after a user determined period of time (hours or 24 hour intervals) without an input signal from another regeneration initiation device.

5. Alarm status indicator: The controller shall monitor operation of internal functions. If a fault is identified, the need for operator intervention will be signaled visually within the controller display.

6. Two Auxiliary Outputs: Two Auxiliary Outputs shall be integral to the controller circuit board. Each Output shall be capable of being programmed to provide power to a

"Normally Open" or "Normally Closed" contact (user choice). These 24VAC outputs shall be used only for the purpose of energizing a relay coil.

7. Flow rate indication: The controller shall be capable of indicating the flow rate of the treated water.

8. Totalizer: The controller shall include a totalizer function and a display capacity to 99,999,999 units before resetting to zero. The totalizer value shall be displayed through the controller display during operation.

9. The controller shall have the availability to be wall- or remote-mounted for greater accessibility.

J. FLOW SENSOR(S)

1. Each softener will include a turbine-type Hall Effect flow sensor.

2. The sensor shall be integral to the control valve. A cable shall be provided for direct connection to the system controller.

3. The flow sensor package provided shall be functional within the flow range of 1.5 to 180.0 gpm.

4. The flow sensor shall have an accuracy of +/- 2% over the full range.

K. REGENERATION SENSOR CONTROL PROBE

1. A regeneration sensor control probe will be inserted into the resin bed and will sense the need for regeneration based on an electrical imbalance within the resin bed and will signal the circuit board to initiate regeneration after a continuous 6 minute imbalance. The system will compensate for variations in water hardness and temperature and will require no field adjustments when operated within the normal temperature range of the softener. The controller shall be capable of being programmed in the field without additional interface devices. The Aqua-Sensor will also be capable of determining when the brine solution is rinsed from the resin bed during the Brine Draw /Slow Rinse cycle, triggering the control to move to Fast Rinse cycle.

M. EXCHANGE RESIN

1. The ion exchange resin shall be virgin high capacity "standard mesh" of sulfonated polystyrene type stable over the entire pH range with good resistance to bead fracture from attrition or osmotic shock. Each cubic foot of resin will be capable of removing 30000.0 grains of hardness as calcium carbonate when regenerated with 15.0 pounds of salt. The resin shall be solid, of the proper particle size of 16x40 mesh, U.S. standard screen and will contain no agglomerates, shells, plates or other shapes that might interfere with the normal function of the water softener. The resin shall be manufactured to comply with the food additive regulation 21 CFR 173.25 as set forth by the USFDA.

2. The system shall include 10 cubic feet of exchange resin per vessel and a total of 10 cubic feet of resin for the system.

N. BRINE SYSTEM

1. Provide a complete brine system consisting of a plastic tank, cover, salt platform, brine well, an automatic brine valve and all necessary fittings for operation with the water softening system. The system shall consist of a combined brine measuring and salt storage tank with salt platform. The recommended tank will be sized 24.0 in. x 50.0 in.; the system will include a total of one (1) brine tank(s). This brine tank can hold 1800 of salt which provides for 30 per salt fill.

2. The brine tank will be equipped with a float operated non-corrosive field serviceable brine float valve for automatic control of brine withdrawal and fresh water refill.

3. The brine valve will automatically open to admit brine to the resin tank during eduction and close automatically providing positive shut-off to prevent air from entering the system. The brine valve will also regulate the flow of soft water into the brine tank during refill. The brine valve works with the timed fill feature of the main operating valve controls to admit the correct volume of fresh water to the brine tank in accordance with the refill time setting in the control program. The brine valve will include a float operated safety shut-off valve as a back up to the timed refill from the main operating valve control to prevent brine tank overflow.

PART 4 - EXECUTION

A. One (1) complete sets of installation, operating and maintenance manuals shall be provided. The Contractor shall familiarize installing personnel with manufacturer's requirements and follow all installation instructions.

B. FIELD SERVICE

1. Provide (4) hours for the services of a factory authorized service representative to supervise, inspect and provide operator training as required for initial start-up and system operation. Contact your local dealer for scheduling.

C. WARRANTY

1. A single written warranty must be provided from the manufacturer of the water softener system covering workmanship and materials.

END OF SECTION 22 31 16

SECTION 22 34 36

COMMERCIAL GAS DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

1.2 REGULATORY REQUIREMENTS

A. ASME Compliance: Where indicated, fabricate and label commercial water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

B. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," for all components that will be in contact with potable water.

C. Water heaters shall meet ASHRAE/IESNA 90.1.

PART 2 - PRODUCTS

2.1 GAS FIRED WATER HEATERS

A. The tank construction shall be of high strength steel with a triple pass flue design for increased heat transfer efficiency. The tank shall be constructed in accordance with (Standard/ASME) construction requirements and shall be designed to withstand a hydrostatic test pressure of two times the working pressure without leakage. The tank shall have a working pressure of 150 psi. The tank shall be furnished with a handhole for ease of inspection, cleanout and service. The interior of the tank shall be glass lined and fired to 1600°F to ensure a molecular fusing of glass and steel. The tank shall be furnished with four magnesium anodes to provide electrolytic protection (except 400 which has 2 powered anodes and 1 magnesium anode) and shall carry a three (3) year limited warranty.

B. The water heater shall be constructed with a heavy gauge steel jacket assembly. The tank shall be completely encased in high density polyurethane foam insulation to maximize heat retention and lower standby heat loss. The exterior of the jacket assembly shall be finished with a 3 coat acrylic enamel finish. The water heater shall be approved for zero clearance to combustible materials.

C. The water heater shall be equipped with a sealed combustion system for direct venting using PVC or CPVC vent pipe.

D. The water heater shall have an electronic ignition system and an ASME temperature and pressure relief valve. It shall be factory assembled and tested and require no special calibrations or start up. The water heater shall be approved to provide 180°F water for sanitation, commercial and industrial operation. In the case of an overheat condition the water heater will employ an energy cut off that shuts off all gas.

E. The entire water heater shall be certified and listed by C.S.A. International under the latest edition of the ANSI Z21.10.3 test standard for water heaters. The water heater shall comply with the energy efficiency requirements for standby loss and thermal efficiency as specified in the latest edition of the ASHRAE 90.1 Standard.

F. Refer to WATER HEATER SCHEDULE on construction drawings.

G. Manufacturer's; Basis of Design by A.O. Smith. Alternate equivalent by Bradford White, State, Lochinvar.

PART 3 - INSTALLATION

A. Install commercial water heaters on concrete bases. Omit concrete bases for water heaters installed on a stand, bracket, or suspended platform.

B. Install water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

C. Install piping adjacent to water heaters to allow service and maintenance. Arrange piping for easy removal of water heaters.

D. Install thermometer on outlet piping of water heaters where indicated on plans.

E. Fill water heaters with water. Charge expansion tanks with air.

F. Install piping-type heat traps on inlet and outlet piping of water heater storage tanks without integral or fitting-type heat traps.

G. Coordinate grounding of the water heater with the electrical contractor.

END OF SECTION 22 34 36

SECTION 23 05 00

GENERAL HVAC REQUIREMENTS

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 shall apply to this Section.

1.2 SPECIFICATION FORM AND DEFINITIONS:

A. These Specifications are abbreviated form and contain incomplete sentences. Omissions of words or phrases such as "the Contractor shall", "shall be", "as noted on the Drawings", "according to the drawings", "a", "an", "the", and "all" are intentional. Omitted words and phrases shall be supplied by inference.

B. When a word such as "proper", "satisfactory", "equivalent", and "as directed" is used, it requires Engineer's review.

C. "Provide" means furnish and install.

D. "Working Day" wherever used in these specifications shall mean the normal working days, Monday through Friday, exclusive of Saturday, Sunday and federally observed holidays.

E. Architect - Engineer hereinafter abbreviated A/E shall mean both the Design Architects and the Design Engineers.

F. Design Engineer hereinafter abbreviated D/E shall mean the engineering firm.

G. Electrical Contractor hereinafter abbreviated E/C shall mean the person or company and their subcontractors who enter into contract with the Owner to perform the electrical division work.

H. Mechanical Contractor hereinafter abbreviated M/C shall mean the person or company and their subcontractors who enter into contract with the Owner to perform the mechanical division work.

I. General Contractor hereinafter abbreviated G/C shall mean the person or company and their subcontractors who enter into contract with the Owner to perform the general division work.

J. Equipment and/or materials manufacturer hereinafter abbreviated E/M shall mean the manufacturer of equipment or materials specified or referred to.

1.3 GENERAL EXTENT OF WORK:

A. Provide mechanical systems indicated on drawings, specified or reasonably implied. Provide every device and accessory necessary for proper operation and completion of mechanical systems. In no case will claims for "Extra Work" be allowed for work about which M/C could have informed himself before bids were taken.

B. M/C shall familiarize himself with equipment provided by other Contractors, which require mechanical connections and controls.

1.4 LOCAL CONDITIONS:

A. Visit site and determine existing local conditions affecting work in contract.

B. Failure to determine site conditions or nature of existing or new construction will not be considered a basis for granting additional compensation.

1.5 CODES, ORDINANCES, RULES AND REGULATIONS:

A. Provide work in accordance with applicable codes, rules, ordinances, and regulations of Local, State and Federal Governments and other authorities having lawful jurisdiction.

B. Conform to latest editions and supplements of following codes, standards or recommended practices as adopted by the authority having jurisdiction.

1. LOCAL CODES:
   a. 2015 International Building Code.
   b. 2015 International Plumbing Code.
   c. 2015 International Fuel Gas Code.
   d. 2015 International Mechanical Code.
   e. 2015 International Fire Protection Code.
   f. 2012 International Energy Conservation Code

2. SAFETY CODES:

   a. National Electric Safety Code Handbook H30- National Bureau of Standards.
   b. Occupational Safety and Health Standards - Department of Labor.
   c. Specifications for Making Buildings and Facilities Accessible To, and Usable By, the Physically Handicapped - American National Standards Institute ANSI Al 17.1

3. NATIONAL FIRE CODES:

   a. NFPA No. 54 Gas Appliance and Gas Piping Code.
   b. NFPA No. 70 National Electric Code - 2005 Edition.
   c. NFPA No. 89M Clearances, Heat Producing Appliances.
   d. NFPA No. 90A Air Conditioning and Ventilation Systems.
   e. NFPA No. 91 Blower and Exhaust Systems.
   f. NFPA No. 101 Life Safety Code.

C. Where following standards are applicable to equipment specified, equipment shall conform to requirements of standard and shall display the appropriate seal or seals:

1. AGA - The American Gas Association Laboratories.
2. ASME - American Society of Mechanical Engineers.
3. NSF National Sanitation Foundation.
4. UL Underwriters Laboratories Inc.

D. Drawings and specifications indicate minimum construction standards, but should any work indicated be sub-standard to any ordinances, laws, codes, rules or regulations bearing on work,

Contractor shall execute work in accordance with such ordinances, laws, codes rules or regulations without increased cost to Owner, but not until he has referred such variances to A/E for approval.

E. M/C shall secure and pay for necessary permits and certificates of inspection required by governmental ordinances, laws, rules or regulations. Keep a written record of all permits and inspection certificates and submits two copies to A/E with request for final inspection.

1.6 CONTRACT CHANGE:

A. Changes or deviations from contract; including those for extra or additional work must be submitted in writing for review of A/E. No verbal orders will be recognized.

B. Changes in the work shall be submitted in accordance with AIA Document A201. General Conditions of the Contract for Construction.

C. All change proposals shall be itemized indicating separately the costs for materials, labor, restocking changes, freight, bonds, insurance, overhead and profit. All materials shall be listed separately with quantities and individual unit prices. Labor factors shall be from a nationally recognized source with appropriate adjustment factors.

1.7 LOCATIONS AND INTERFERENCES:

A. Locations of equipment, piping and other mechanical work is indicated diagrammatically by mechanical drawings. Determine exact locations on job, subject to structural conditions, work of other Contractors, access requirements for installation and maintenance and to approval of A/E.

B. Study and become familiar with contract drawings of other trades and in particular the general construction plans and details to obtain necessary information for figuring installation. Cooperate with other workmen and install work to avoid interference with their work. Minor deviations, not affecting design characteristics, performance or space limitations may be permitted if reviewed by A/E prior to installation.

C. Any pipe, apparatus, appliance or other item interfering with proper placement of other work as indicated on drawings, specified, or required, shall be removed and if so shown, relocated and reconnected without extra cost. Damage to other work caused by this Contractor, his subcontractor, or his workmen shall be restored as specified for new work.

D. Do not scale mechanical and electrical drawings for dimensions. Accurately lay out work from dimensions indicated on architectural drawings unless such be found in error.

1.8 SYSTEM PERFORMANCE:

A. Final acceptance of work shall be subject to the condition that all systems, equipment, apparatus and appliances operate satisfactorily as designed and intended, work shall include required adjustment of systems and control equipment installed under this specification.

1.9 WARRANTY:

A. M/C warrants to Owner and Architect the quality of materials, equipment, workmanship and operation of equipment provided under this specification division for a period of one year from

and after date of substantial completion of building and acceptance of mechanical systems by Owner.

B. Where manufacturers' warranties expire during the one year warranty period, M/C shall include provisions for extending warranty for the full one year period and shall include cost for warranty extension in his base bid. Where warranty extentions are not available from manufacturer, supplier or installer, M/C shall provide labor, parts and material warranty services equal to the requirements of these specifications and the terms of the manufacturer, supplier and installer warranties.

C. M/C warrants to Owner and Architect that on receipt of written notice from either of them within one year warranty period following date of acceptance all defects that have appeared in materials and /or workmanship, shall be promptly corrected to condition required by contract documents at M/C's expense.

D. The above warranty shall not supersede any separately stated warranty or other requirements required by law or by these specifications.

1.10 MATERIALS, EQUIPMENT AND SUBSTITUTIONS:

A. The intent of these specifications is to allow ample opportunity for M/C to use his ingenuity and abilities to perform the work to his and the Owner's best advantage, and to permit maximum competition in bidding on standards of materials and equipment required.

B. Material and equipment installed under this contract shall be first class quality, new, unused and without damage.

C. In general these specifications identify required materials and equipment by naming first the manufacturer whose product was used as the basis for the project design and specifications. The manufacturers product, series, model, catalog and/or identification numbers shall set quality and capacity requirements for comparing the equivalency of other manufacturer's products. Where other manufacturer's names are listed they are considered an approved manufacturer for the product specified, however, the listing of their names implies no prior approval of any product they may propose to furnish as equivalent to the first named product unless specific model or catalog numbers are listed in these specifications or in subsequent addenda. Where other than first named products are used for M/C's base bid proposal it shall be his responsibility to determine prior to bid time that his proposed materials and equipment selections are products of approved manufacturers, that will meet or exceed the specifications and are acceptable to the D/E.

D. Where materials or equipment are described but not named, provide required items of first quality, adequate in every respect for intended use. Such items shall be submitted to A/E for review prior to procurement.

E. Prior to receipt of bids, if M/C wishes to incorporate products other than those named in Specifications in his bid, he shall submit a written request for review of substitutions to D/E not less than **five working days** prior to bid date. D/E will review requests and acceptable items will be listed in an addendum issued to principal bidders.

F. Materials and equipment proposed for substitutions shall be equal to or superior to that specified in construction, efficiency, utility, aesthetic design, and color as determined by A/E whose decision shall be final and without further recourse. Physical size of substitute brand shall be no

larger than space provided including allowances for access for installation and maintenance. Requests must be accompanied by two copies of complete descriptive and technical data including E/M's name, model, and catalog number, photographs or cuts, physical dimensions, operating characteristics and any other information needed for comparison.

G. In proposing a substitution prior to or subsequent to receipt of bids, include in such proposal cost of altering other elements of Project, including adjustments in mechanical-electrical service requirements necessary to accommodate such substitution; whether such affected elements be under this contract or under separate contracts.

H. Within seven working days after bids are received, apparent low bidder shall submit to A/E for approval three copies of a list of all major items of equipment he intends to provide. As soon as practicable and within 30 working days after award of Contract, M/C shall submit shop drawings for equipment and materials to be incorporated in work, for A/E review. Where 30 day limit is insufficient for preparation of detailed shop drawings on major equipment or assemblies, M/C shall submit manufacturer's descriptive catalog data and indicate date such detailed shop drawings will be submitted along with manufacturer's certification that order was placed within 30 working day limit.

I. After execution of contract, substitution of product brands for those named in Specifications will be considered, only if; 1) request is received within thirty days after Contract date and request includes statement showing credit due Owner, if any, if substitution products are used, or 2) Owner requests consideration be given to substitute brands.

1.11 SHOP DRAWINGS, OPERATION AND MAINTENANCE INSTRUCTION:

A. M/C shall furnish digital shop drawings to A/E for review. All shop drawings submitted to engineer for review shall comply with the requirements below and the bid documents. Any shop drawings requiring more that two reviews to comply will be subject to a $500 review charge by engineer.

B. Where catalog cuts are submitted for review, conspicuously mark or provide schedule of equipment, capacities, controls, fittings, sizes, etc. that are to be provided. Mark each submitted item with applicable section and paragraph numbers of these specifications, OR PLAN SHEET NUMBER when item does not appear in specifications. Where equipment submitted does not appear in base specifications of specified equivalent, mark submittals with applicable alternate numbers, change order numbers, change order number or letters of authorization. Each submittal shall contain at least two sets of original catalog cuts. Each catalog sheet shall bear E/M's name and address. All shop drawings on materials and equipment listed by UL shall indicate UL approval on submittal.

C. M/C shall check all shop drawings to verify that they meet specifications and/or drawing requirements before forwarding submittals to the A/E for their review. All shop drawings submitted to A/E shall bear M/C approval stamp which shall indicate that M/C has reviewed submittals and that they meet specification and/or drawing requirements. M/C's submittal review shall specifically check for but not be limited to the following: equipment capacities, physical size in relation to space allowed; electrical characteristics, provisions for supply, return and drainage connections to building systems. All shop drawings not meeting M/C's approval shall be returned to his supplier for resubmittal.

D. No shop drawings submittals will be considered for review by the A/E without M/C's approval stamp, or that have extensive changes made on the original submittal as a result of Contractor's

review. All comments or minor notations on shop drawings shall be flagged as follows to indicate originator of comment or notation: 1 Contractor, 2 Construction Manager, 3 Architect, 4 Engineer.

E. A/E will not be responsible for the cost of returning shop drawing submittals that are submitted to them without M/C's review and approval stamp. A letter will be sent to M/C by either the Architect or Engineer indicating receipt of an improper submittal. M/C shall acknowledge receipt of letter and indicate his plans for pick-up or resubmitting. A/E will hold improper submittals for pick-up by M/C or supplier for 15 working days after date of receipt. If not picked up by the 16th working day, submittals will be disposed of by A/E.

F. A/E's review of shop drawings will not relieve M/C of responsibility for deviations from drawings and specifications unless such deviations have been specifically approved in writing by Owner of his representative, nor shall it relieve M/C of responsibility for errors in shop drawings. No work shall be fabricated until A/E's review has been obtained. Any time delay caused by correcting and resubmitting shop drawings will be M/C's responsibility.

G. Operating and Maintenance Instructions:

1. Submit with shop drawings of equipment three copies of installation, operating, maintenance instructions, and parts lists for equipment provided. Instructions shall be prepared by E/M.

2. Keep in safe place, keys and wrenches furnished with equipment under this contract. Present to Owner and obtain a receipt for same upon completion of project.

3. Prepare a complete brochure, covering systems and equipment provided and installed under this contract. Submit brochures to A/E for review before delivery to Owner. Contractor at his option may prepare this brochure or retain an individual to prepare it for him. Include cost of this service in bid. Brochures shall contain following:

4. Certified equipment drawings and/or catalog data with equipment provided clearly marked as outlined under this specification.

5. Complete installation, operating, maintenance instructions and parts lists for each item of equipment.

6. Special emergency operating instructions with a list of service organizations (including addresses and telephone numbers) capable of rendering emergency service to various parts of mechanical systems.

H. Provide brochures bound in black vinyl three-ring binders with metal hinge. Reinforce binding edge of each sheet of looseleaf type brochure to prevent tearing from continued usage. Clearly print on label insert of each brochure:

1. Project name and address.

2. Section of work covered by brochure, i.e., "Heating Ventilating and Air Conditioning", and "Plumbing" etc.

1.12 RECORD DOCUMENTS:

A. Record Drawings: Maintain a reproducible set of contract drawings and shop drawings in clean, undamaged condition, with mark-up of actual installations which vary substantially from the work as originally shown. Mark whichever drawing is most capable of showing "field" condition fully and accurately; however, where shop drawings are used for mark-up, record a cross-reference at corresponding location on working drawings. Mark with red erasable red pencil and, where feasible, use other colors to distinguish between variations in separate categories of work. Markup new information which is recognized to be of importance to Owner, but was for some reason not shown on either contract drawings of shop drawings. Give particular attention to concealed work, which would be difficult to measure and record at a later date. Note related change-order numbers where applicable. Organize record drawing sheers into manageable sets, bind with durable paper cover sheets, and prints suitable titles, dates and other identification on cover of each sheet.

B. Record Specifications: Maintain one copy of specifications, including addenda, change orders, and similar modifications issued in printed form during construction, and mark-up variations (of substance) in actual work in comparison with text of specifications and modifications as issued. Give particular attention to substitutions, selection of option, and similar information on work where it is concealed or cannot otherwise by readily discerned at a later date by direct observation. Note related record drawing information and product data, where applicable. upon completion of mark-up submit to Architect/Engineer for Owner's records.

C. The contractor shall provide a full set of photographs showing the entire underground equipment. The photographs shall be taken prior to any concrete being poured. The underground equipment shall consist of, but not be limited to, the following: Piping, conduits, ductwork.

D. The contractor shall provide the photographs in an 8.5” x 11” format for record keeping purposes with the maintenance manuals. The photos shall all be digital and a disk or C.D. shall be provided to the Owner as a permanent record.

1.13 ELECTRICAL REQUIREMENTS:

A. Consult Division 26 electrical specifications for work to be provided by E/C in conjunction with installation of mechanical equipment.

B. Electrical work required to install and control mechanical equipment which is not shown on plans or specified under Division 26 shall be included in M/C's base bid proposal,

C. The cost of larger wiring, conduit, control and protective devices resulting from installation of equipment which was not used for basis of design as outlined in these specifications shall be paid by M/C at no cost to Owner or A/E.

D. M/C shall be responsible for providing supervision to E/C to insure that required connections, interlocking and interconnection of mechanical and electrical equipment are made to attain intended control sequences and system operation.

E. Furnish six complete sets of electrical wiring diagrams to A/E and three complete sets to E/C. Diagrams shall show factory and field wiring of components and controls. Control devices and field wiring to be provided by E/C shall be clearly indicated by notation and drawing symbols on wiring diagrams.

F. M/C shall obtain complete electrical data on mechanical shop drawings and shall list this data on an approval form which shall be presented monthly, or on request, to E/C. Data shall be complete with wiring diagrams received to date and shall contain necessary data on electrical components of mechanical equipment such as HP, voltage, amperes, watts, locked rotor current to allow E/C to order electrical equipment required in his contract.

G. Safety disconnect switches and manual and magnetic motor starters shall be provided by E/C. Exceptions will be allowed where mechanical equipment is provided with these devices installed as part of factory built control systems.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION 23 05 00

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Balancing Air Systems:

a. Constant-volume air systems.

1.2 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, adjusting, and balancing.

D. TABB: Testing, Adjusting, and Balancing Bureau.

E. TAB Specialist: An entity engaged to perform TAB Work.

1.3 INFORMATIONAL SUBMITTALS

A. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article 3.2.

B. Certified TAB reports.

1.4 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC, NEBB or TABB.

1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC, NEBB or TABB.
2. TAB Technician: Employee of the TAB contractor and who is certified by AABC, NEBB or TABB as a TAB technician.

B. Certify TAB field data reports and perform the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.

2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

C. TAB Report Forms: Use standard TAB contractor's forms approved by Designer.

D. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

E. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

F. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

F. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

G. Examine test reports specified in individual system and equipment Sections.

H. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

I. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

J. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.

K. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.

L. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

M. Examine operating safety interlocks and controls on HVAC equipment.

N. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Complete system-readiness checks and prepare reports. Verify the following:

1. Permanent electrical-power wiring is complete.
2. Hydronic systems are filled, clean, and free of air.
3. Automatic temperature-control systems are operational.
4. Equipment and duct access doors are securely closed.
5. Balance, smoke, and fire dampers are open.
6. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in ASHRAE 111 and in this Section.

1. Comply with requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling-unit components.

L. Verify that air duct system is sealed as specified in Section 23 31 13 "Metal Ducts."

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

   a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.

2. Measure fan static pressures as follows to determine actual static pressure:

   a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
   b. Measure static pressure directly at the fan outlet or through the flexible connection.
   c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.

d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.

a. Report the cleanliness status of filters and the time static pressures are measured.

4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
6. Obtain approval from Designer for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure airflow of submain and branch ducts.

a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure air outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.7 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.

1. Measure and record the operating speed, airflow, and static pressure of each fan.
2. Measure motor voltage and amperage. Compare the values to motor nameplate information.
3. Check the refrigerant charge.
4. Check the condition of filters.
5. Check the condition of coils.
6. Check the operation of the drain pan and condensate-drain trap.
7. Check bearings and other lubricated parts for proper lubrication.
8. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.

B. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished. Verify the following:

1. New filters are installed.
2. Coils are clean and fins combed.
3. Drain pans are clean.
4. Fans are clean.
5. Bearings and other parts are properly lubricated.
6. Deficiencies noted in the preconstruction report are corrected.

C. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.

1. Compare the indicated airflow of the renovated work to the measured fan airflows, and determine the new fan speed and the face velocity of filters and coils.
2. Verify that the indicated airflows of the renovated work result in filter and coil face velocities and fan speeds that are within the acceptable limits defined by equipment manufacturer.

3. If calculations increase or decrease the air flow rates and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated rates. If increase or decrease is 5 percent or less, equipment adjustments are not required.
4. Balance each air outlet.

3.8 TOLERANCES

A. Set HVAC system's air flow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.
3. Cooling-Water Flow Rate: Plus or minus 10 percent.

3.9 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

3.10 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Fan curves.
2. Manufacturers' test data.
3. Field test reports prepared by system and equipment installers.
4. Other information relative to equipment performance; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB contractor.
3. Project name.
4. Project location.
5. Designer's name and address.
6. Contractor's name and address.
7. Report date.
8. Signature of TAB supervisor who certifies the report.

9. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
10. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

11. Nomenclature sheets for each item of equipment.
12. Notes to explain why certain final data in the body of reports vary from indicated values.
13. Test conditions for fans performance forms including the following:

    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Inlet vane settings for variable-air-volume systems.
    g. Settings for supply-air, static-pressure controller.
    h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Water and steam flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.
5. Terminal units.
6. Balancing stations.
7. Position of balancing devices.

3.11 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during summer conditions, perform additional TAB during summer conditions.

END OF SECTION 23 05 93

SECTION 23 07 00

HVAC INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 1 Specification Sections, section 220100 - General Mechanical Requirements, section 220500 – Basic Mechanical Materials and Methods shall apply to this Section.

PART 2 - PRODUCTS

2.1 PIPING INSULATION:

A. Provide necessary materials and accessories for installation of insulation for plumbing and mechanical systems as specified and/or detailed on drawings insulation type, jacket, and thickness for specific piping systems or equipment shall be as listed in insulation schedule.

B. Provide insulation materials manufactured by Certain Teed, Knauf, Dow Chemical, Johns Manville or Owen/Corning Fiberglas.

C. Insulation, except where specified otherwise, shall have composite fire and smoke hazard ratings as tested by ASTM E-84, NFPA 255, and UL 723 procedures not exceeding:

FLAME SPREAD	25	
SMOKE DEVELOPED		50
FUEL CONTRIBUTED		50

D. Provided insulation accessories such as adhesives, mastics, cements, tape and glass fabric with same component ratings as listed above. Products or their shipping cartons shall bear label indicating their flame and smoke ratings. Treatment of jackets or facings for impart flame and smoke safety shall be permanent. Use of water soluble treatments such as corn paste or wheat paste is prohibited. This does not exclude approved lagging adhesives.

E. Where glass is specified in the following insulation methods provide resin impregnated with open weave glass fabric with 10/20 thread count.

F. Abbreviations for manufacturers of adhesives, mastics and coating specified shall be C.M. for Chicago Mastic Company and B.F. for Benjamin Foster Company.

G. Pipe insulation materials and application methods by type shall be as follows:

1. TYPE 2-PC: Insulation for cold surface piping system with -40 degrees F to +220 degrees F operating temperature range shall be Armstrong AP Armaflex Elastomeric Pipe insulation average thermal conductivity shall not exceed .27 BTU/Hr. at 75 degrees F mean temperature. To greatest extent possible apply insulation without longitudinal joint

by slipping insulation over piping. Seal all seams and butt joints with Armstrong 520 adhesive. Insulate fittings as follows:

a. Insulate fittings with Miter-Cut pieces of AP/Armaflex pipe insulation equal to thickness of adjoining pipe insulation. Insulate fittings too large to cover with pipe insulation with insulation from fabricated/Armaflex sheet insulation using Armstrong templates. Join and seal all fittings joints with Armstrong 520 adhesive. Finish insulation as soon as possible with two coats of Armstrong Armaflex vinyl-lacquer finish in color selected by Architect. All insulation used outdoors shall be painted to prevent ultra violet deterioration of insulation.

2. TYPE 2-PHC: Insulation for hot and cold surface piping systems with -60 degrees F to +850 degrees F operating range shall be Owens-Corning Fiberglass SSL II pipe insulation with fire retardant ASJ jacket. Average 75 degrees F mean temperature. Seal longitudinal jacket laps and butt strips with C.M. No. 17-465 or B.F. No. 85-75 vapor barrier adhesive. Insulate valves and fittings as follows:

a. Insulate exposed and concealed valves and fittings with PVC premolded fitting covers. Provide “Zeston” Series 300 fitting covers as manufactured by Johns Manville.

H. Insulation materials and application methods for piping hangers supports, anchors, guides, expansion joints, etc., shall be as follows:

I. Insulate hangers and supports from direct contact with cold surfaces with Styrofoam HD- 300 plastic foam inserts of half or full sections of premolded pipe insulation equal in thickness to adjoining insulation. Provide inserts with vapor barrier jacket for lapping 2" over adjacent pipe insulation jacket. Protect insulation with insulation shields supporting lower 180 degrees of pipe insulation sized so that pipe compressive load does not exceed one third of insulation insert compressive strength. Seal joints with vapor barrier sealer specified for insulation type used.

J. Insulate pipe anchors in direct contact with cold piping for a distance of 12" or as detailed on drawings from contact point with piping. Anchor insulation shall be one half the thickness of adjoining pipe insulation with vapor barrier. Seal and finish joints with vapor barrier sealer specified for insulation type used.

K. Insulate pipe guides from direct contact with cold surfaces piping with Styrofoam HD-300 plastic foam full section inserts of premolded pipe insulation equal in thickness to adjoining pipe insulation. Provide inserts with vapor barrier jacket for overlapping 2" over adjoining pipe insulation. Insert jacket shall be equal in performance and appearance to adjacent insulation jacket. Seal and finish joints with vapor barrier sealer specified for insulation type used.

L. Insulate pipe expansion joints on cold surface piping with over-sized section of premolded pipe insulation equal in thickness to adjoining pipe insulation. Cover shall float free one end with expansion and contraction of piping system. Seal free end with 4 mil thick PVC vinyl sheet attached to adjoining insulation. Provide sufficient slack in vinyl material to allow for maximum pipe movement.

M. Where piping hanger can not be isolated from cold pipe surfaces insulate piping at hanger locations with extra thickness of pipe insulation. Insulate hanger rod to point 12" above pipe

with minimum insulation thickness equal to one-half thickness of pipe insulation. Seal and finish joints with vapor barrier sealer specified for insulation type used.

PIPING INSULATION SCHEDULE

Service	Size	Type	Thickness.
Air Conditioning Condensate Drain	All	2-PHC	1”
Refrigerant Lines (Interior)	All	2-PC	½”
Refrigerant Lines (Exterior)**	All	2-PC	½”

*Provide Elastomeric in block wall in same thickness as listed.
**All exterior piping insulation shall be painted with ultraviolet-resistant paint, Color as selected by architect.
***Install hard PVC covering over insulation where piping insulaiton is exposed (not concealed above ceiling)

PART 3 - EXECUTION

3.1 Install insulation over clean dry surfaces with joints firmly butted together. Insulation at equipment, flanges, fittings, etc., shall have straight edges with box type joints with corner beads as required. Where plumbing and heating insulation terminates at equipment or unions, taper insulation at 30 degrees angle to pipe with one coat finishing cement and finish same as fittings. Total insulation system shall have neat smooth appearance with no wrinkles, or folds in jackets, joint strips or fitting covers. Seal butt joints at maximum intervals of 45 feet to prevent vapor barrier failures from being transmitted to adjoining insulation sections.

3.2 Undamaged insulation systems on cold surface piping and equipment shall perform their intended functions as vapor barriers and thermal insulation without premature deterioration or vapor barrier. Contractor shall take every reasonable precaution to provide insulation systems with continuous unbroken vapor barriers.

3.3 All pipe insulation shall be continuous through walls, ceiling or floor openings, or sleeves; except where firestop or firesafing materials are required.

3.4 Insulation of removable heads and valves, manholes access covers, HVAC and plumbing pumps, etc., shall be fabricated to allow removal without damage to insulation. Provide removable units with vapor-proof cover fabricated to be sealed to equipment vapor barrier.

3.5 Insulation failing to meet workmanship and appearance standards shall be replaced with an acceptable installation before final acceptance of project will be given. Insulation failing to meet performance requirements of this specification for a period of one year after date of final acceptance or through one heating season and one cooling season, whichever is longer shall be replaced with an acceptable installation. All costs to correct insulation deficiencies and costs to repair damages to other work shall be at M/C's expense at not cost to Owner.

END OF SECTION 23 07 00

SECTION 23 07 13

DUCT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following duct services:

1. Indoor, concealed supply and outdoor air.
2. Indoor, exposed supply and outdoor air.
3. Indoor, concealed return located in unconditioned space.
4. Indoor, exposed return located in unconditioned space.

B. Related Sections:

1. Section 23 07 19 "HVAC Insulation."
2. Section 23 31 00 "HVAC Ducts and Casings" for duct liners.

1.2 ACTION SUBMITTALS

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

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
3. Detail application of field-applied jackets.
4. Detail application at linkages of control devices.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type I or Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. CertainTeed Corp.; SoftTouch Duct Wrap.
b. Johns Manville; Microlite.
c. Knauf Insulation; Friendly Feel Duct Wrap.
d. Manson Insulation Inc.; Alley Wrap.
e. Owens Corning; SOFTR All-Service Duct Wrap.

G. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation without factory-applied jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. CertainTeed Corp.; Commercial Board.
b. Fibrex Insulations Inc.; FBX.
c. Johns Manville; 800 Series Spin-Glas.
d. Knauf Insulation; Insulation Board.
e. Manson Insulation Inc.; AK Board.
f. Owens Corning; Fiberglas 700 Series.

H. Internal acoustical and thermal duct insulation: Mineral or glass fibers firmly bonded together with a thermosetting resin overlaid with tough and durable fire-resistant black composite surface on the airstream side. Duct liner with .021 average air friction and .23 BTUH thermal conductivity at 75 degrees F mean temperature. Facing shall have a maximum vapor transmission rate of 0.02 perms.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. CertainTeed Corp.; Toughgard R.
   b. Johns Manville; Linacoustic RC.
   c. Knauf Insulation; Atmospheric Duct Liner.
   d. Manson Insulation Inc.; Akousti-Liner.
   e. Owens Corning; QuietR.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
   b. Eagle Bridges - Marathon Industries; 225.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
   d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
   b. Eagle Bridges - Marathon Industries; 225.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.
   d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
   b. Vimasco Corporation; 749.

2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
   b. Eagle Bridges - Marathon Industries; 550.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
   d. Mon-Eco Industries, Inc.; 55-50.
   e. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms (1.2 metric perms) at 0.0625-inch (1.6-mm) dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

2.4 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
   b. Eagle Bridges - Marathon Industries; 405.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
   d. Mon-Eco Industries, Inc.; 44-05.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
5. Color: Aluminum.
6. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. ASJ Flashing Sealants, and Vinyl and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
5. Color: White.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.5 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
5. Vinyl Jacket: White vinyl with a permeance of 1.3 perms (0.86 metric perm) when tested according to ASTM E 96/E 96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.6 FIELD-APPLIED JACKETS

A. Aluminum Jacket: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005, Temper H-14.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
   b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
   c. RPR Products, Inc.; Insul-Mate.

2. Sheet and roll stock ready for shop or field sizing or Factory cut and rolled to size.
3. Finish and thickness are indicated in field-applied jacket schedules.
4. Moisture Barrier for Indoor Applications: 1-mil- (0.025-mm-) thick, heat-bonded polyethylene and kraft paper.

2.7 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. ABI, Ideal Tape Division; 428 AWF ASJ.
   b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
   c. Compac Corporation; 104 and 105.
   d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches (75 mm).
3. Thickness: 11.5 mils (0.29 mm).
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. ABI, Ideal Tape Division; 491 AWF FSK.
    b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
    c. Compac Corporation; 110 and 111.
    d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.

2. Width: 3 inches (75 mm).
3. Thickness: 6.5 mils (0.16 mm).
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. ABI, Ideal Tape Division; 488 AWF.
    b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
    c. Compac Corporation; 120.
    d. Venture Tape; 3520 CW.

2. Width: 2 inches (50 mm).
3. Thickness: 3.7 mils (0.093 mm).
4. Adhesion: 100 ounces force/inch (1.1 N/mm) in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch (6.2 N/mm) in width.

2.8 SECUREMENTS

A. Aluminum Bands: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, 3/4 inch (19 mm) wide with wing seal.

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. ITW Insulation Systems; Gerrard Strapping and Seals.
    b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.

B. Insulation Pins and Hangers:

1. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

    a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1) AGM Industries, Inc.; Tactoo Perforated Base Insul-Hangers.
2) GEMCO; Perforated Base.
3) Midwest Fasteners, Inc.; Spindle.

b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch (0.76 mm) thick by 2 inches (50 mm) square.
c. Spindle: Aluminum, fully annealed, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated.
d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick, aluminum sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.

a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1) AGM Industries, Inc.; RC-150.
2) GEMCO; R-150.
3) Midwest Fasteners, Inc.; WA-150.
4) Nelson Stud Welding; Speed Clips.

b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.

2.9 CORNER ANGLES

A. Aluminum Corner Angles: 0.040 inch (1.0 mm) thick, minimum 1 by 1 inch (25 by 25 mm), aluminum according to ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches (100 mm) o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

O. Install interior duct liner insulation cut to insure tight fitting corner, and longitudinal joints. Apply liner to sheet metal with 100% coverage of C.M. No. 17-477, B.F. No. 81-18 or 3M manufacturers recommended applications rate. Coat all edges of liner with adhesive. Provide mechanical fasteners on surfaces 18" or wider in addition to liner adhesive with fastener clips set flush with duct liner surface. Provide fasteners as follows:

1. Low Velocity Ductwork (Velocities less than 2000 FPM): Provide fasteners within 3" of leading edge of each section 12" O.C. around joint perimeter and 3" from longitudinal joints 12" O.C. Elsewhere space fasteners 18" O.C. except not more than 6" from longitudinal joints nor 12" from corner break

3.3 PENETRATIONS

A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches (50 mm).

3.4 INSTALLATION OF MINERAL-FIBER INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches (450 mm) and smaller, place pins along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.
    b. On duct sides with dimensions larger than 18 inches (450 mm), place pins 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not overcompress insulation during installation.
    e. Impale insulation over pins and attach speed washers.

f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward-clinching staples, 1 inch (25 mm) o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
   b. Install vapor stops for ductwork and plenums operating below 50 deg F (10 deg C) at 18-foot (5.5-m) intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches (75 mm).

5. Overlap unfaced blankets a minimum of 2 inches (50 mm) on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches (450 mm) o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- (150-mm-) wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches (150 mm) o.c.

B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

   a. On duct sides with dimensions 18 inches (450 mm) and smaller, place pins along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.
   b. On duct sides with dimensions larger than 18 inches (450 mm), space pins 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
   c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
   d. Do not overcompress insulation during installation.
   e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward-clinching staples, 1 inch (25 mm) o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

    a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    b. Install vapor stops for ductwork and plenums operating below 50 deg F (10 deg C) at 18-foot (5.5-m) intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches (75 mm).

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- (150-mm-) wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches (150 mm) o.c.

3.5 FIELD-APPLIED JACKET INSTALLATION

A. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch (38-mm) laps at longitudinal seams and 3-inch- (75-mm-) wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

B. Where metal jackets are indicated, install with 2-inch (50-mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches (300 mm) o.c. and at end joints.

3.6 FINISHES

A. Do not field paint aluminum or stainless-steel jackets.

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.8 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation or Internal Lining:

1. Indoor, concealed supply and outdoor air.
2. Indoor, exposed supply and outdoor air.
3. Indoor, transfer boots.

B. Items Not Insulated:

1. Fibrous-glass ducts.
2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
3. Factory-insulated flexible ducts.
4. Factory-insulated plenums and casings.
5. Flexible connectors.
6. Vibration-control devices.
7. Factory-insulated access panels and doors.

3.9 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, Supply-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches (50 mm) thick and 1.5-lb/cu. ft. (24-kg/cu. m) nominal density.

B. Concealed, Return-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches (50 mm) thick and 1.5-lb/cu. ft. (24-kg/cu. m) nominal density.

C. Mechanical Room - Exposed, Supply-Air Duct and Plenum Insulation: Mineral-fiber board, 2 inches (50 mm) thick and 1.5-lb/cu. ft. (24-kg/cu. m) nominal density.

D. Barracks Rooms and Lounge Room - Exposed, Supply-Air and Return-Air Duct Liner: Glass fiber or Mineral-fiber board, 1” inches (25 mm) thick and 1.5-lb/cu. ft. (24-kg/cu. m) nominal density.

E. Transfer Air Boots - Duct Liner: Glass fiber or Mineral-fiber board, 1” inches (25 mm) thick and 1.5-lb/cu. ft. (24-kg/cu. m) nominal density

END OF SECTION 23 07 13

SECTION 23 11 23

FACILITY NATURAL GAS PIPING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

B. Quality Assurance: Comply with NFPA 54 and International Fuel Gas Code.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Minimum Operating-Pressure Ratings:

1. Piping and Valves: 100 psig minimum unless otherwise indicated.

B. Gas System Pressure: 0.5 psig or less.

2.2 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
4. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.

B. Corrugated, Stainless-Steel Tubing: Comply with ANSI/IAS LC 1; include flame-retardant PE coating, copper-alloy threaded ends, and striker plates.

2.3 SPECIALTIES

A. Appliance Flexible Connectors:

1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
4. Corrugated stainless-steel tubing with polymer coating.

B. Strainers: ASTM A 126, Class B, cast-iron body, Y-pattern, full size of connecting piping, CWP rating of 125 psig. Include 40-mesh startup strainer, and perforated stainless-steel basket.

C. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

D. Service Meters: Comply with gas company requirements.

2.4 VALVES

A. General Requirements for Metallic Manual Gas Shutoff Valves: Comply with ASME B16.33.

1. CWP Rating: 125 psig.

B. Bronze Plug Valves: MSS SP-78.

1. Body: Bronze, complying with ASTM B 584.
2. Plug: Bronze.
3. Operator: Square head or lug type with tamperproof feature where indicated.
4. Pressure Class: 125 psig.
5. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
6. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

C. Cast-Iron, Non-lubricated Plug Valves: MSS SP-78.

1. Body: Cast iron, complying with ASTM A 126, Class B.
2. Plug: Bronze or nickel-plated cast iron.
3. Seat: Coated with thermoplastic.
4. Stem Seal: Compatible with natural gas.
5. Operator: Square head or lug type with tamperproof feature where indicated.
6. Pressure Class: 125 psig.
7. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
8. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

2.5 PRESSURE REGULATORS

A. General Requirements: Single stage, steel jacketed, and corrosion resistant. Include elevation compensator.

B. Service-Pressure Regulators: Comply with gas company requirements.

C. Line Pressure Regulators: ANSI Z21.80; 2-psig maximum inlet pressure. Factory- or field-installed, stainless-steel screen in vent opening if not connected to vent piping.

D. Appliance Pressure Regulators: ANSI Z21.18; 2-psig maximum inlet pressure. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.

PART 3 - EXECUTION

3.1 OUTDOOR PIPING INSTALLATION

A. Comply with requirements in Division 23 Section "Common Work Results for HVAC" for basic piping installation requirements.

B. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Comply with requirements in Division 23 Section "Common Work Results for HVAC" for wall penetration systems.

C. Paint all natural gas piping on roof with two coats of yellow enamel. All other exterior natural gas piping shall be painted with two coats of grey enamel.

3.2 INDOOR PIPING INSTALLATION

A. Comply with requirements in Division 23 Section "Common Work Results for HVAC." for basic piping installation requirements.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install escutcheons at penetrations of interior walls, ceilings, and floors.

D. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

E. Install service meters to comply with gas company requirements.

F. Install gas stops for shut-off to appliances with low-pressure gas supply.

G. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.

H. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

I. Connect branch piping from top or side of horizontal piping.

J. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.

K. Install strainer on inlet of each line pressure regulator and automatic or electrically operated valve.

L. Connect gas piping to equipment and appliances with shutoff valves and unions. Install gas valve upstream from and within 72 inches of each appliance using gas. Install union or flanged connections downstream from valves.

M. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to the outdoors and terminate with weatherproof vent cap.

N. Do not use natural-gas piping as grounding electrode.

3.3 PIPING JOINT CONSTRUCTION

A. Threaded Joints: Thread pipe with tapered pipe threads complying with ASME B1.20.1.

B. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators.

C. Joints in Steel Piping with Protective Coating: Apply joint cover kits to pipe after joining to cover, seal, and protect joints.

D. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.

3.4 VALVE INSTALLATION

A. Install manual gas shut-off valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.

B. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

3.5 OUTDOOR PIPING SCHEDULE

A. Aboveground natural-gas piping shall be the following:

1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with wrought-steel fittings and welded joints.

B. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

3.6 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG

A. Aboveground, branch piping NPS 1 and smaller shall be the following:

1. Steel pipe with malleable-iron fittings and threaded joints.

B. Aboveground, distribution piping shall be the following:

1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with wrought-steel fittings and welded joints.

C. Underground, below building, shall be one of the following:

1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with wrought-steel fittings and welded joints.

D. Containment Conduit: Steel with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

E. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

3.7 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Valves for pipe sizes NPS 2 and smaller shall be the following:

1. Bronze plug valve.

B. Valves for pipe sizes NPS 2-1/2 and larger shall be the following:

1. Cast-iron, non-lubricated plug valve.

C. Valves in branch piping for single appliance shall be the following:

1. Bronze plug valve.

END OF SECTION 23 11 23

SECTION 23 31 13

HVAC DUCTS AND CASINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rectangular ducts and fittings.
2. Round ducts and fittings.
3. Sheet metal materials.
4. Sealants and gaskets.
5. Hangers and supports.
6. Seismic-restraint devices.

B. Related Sections:

1. Section 23 05 93 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 23 33 00 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports 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."

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.3 ACTION SUBMITTALS

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

B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.

3. Duct layout indicating sizes, configuration, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment and vibration isolation.

C. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Suspended ceiling components.
3. Structural members to which duct will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Penetrations of smoke barriers and fire-rated construction.
6. Items penetrating finished ceiling including the following:

   a. Lighting fixtures.
   b. Air outlets and inlets.
   c. Speakers.
   d. Sprinklers.
   e. Access panels.
   f. Perimeter moldings.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.

3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."

C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

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. Lindab Inc.
   b. McGill AirFlow LLC.
   c. SEMCO Incorporated.
   d. Sheet Metal Connectors, Inc.

e. Spiral Manufacturing Co., Inc.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90 (Z275).
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.

D. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.

E. Aluminum Sheets: Comply with ASTM B 209 (ASTM B 209M) Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

F. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

G. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.4 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Tape Width: 3 inches (76 mm).
3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.
6. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
10. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
11. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.

6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

F. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg (0.14 L/s per sq. m) and shall be rated for 10-inch wg (2500-Pa) static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.5 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch (25 mm), plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches (38 mm).

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 23 33 00 "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Outdoor, Supply-Air Ducts: Seal Class A.
3. Outdoor, Exhaust Ducts: Seal Class C.
4. Outdoor, Return-Air Ducts: Seal Class C.
5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg (500 Pa) and Lower: Seal Class B.
6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg (500 Pa): Seal Class A.
7. Unconditioned Space, Exhaust Ducts: Seal Class C.
8. Unconditioned Space, Return-Air Ducts: Seal Class B.
9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg (500 Pa) and Lower: Seal Class C.
10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg (500 Pa): Seal Class B.
11. Conditioned Space, Exhaust Ducts: Seal Class B.
12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches (100 mm) thick.

4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches (610 mm) of each elbow and within 48 inches (1200 mm) of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet (5 m).

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 23 33 00 "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 DUCT CLEANING

A. Clean duct system(s) before testing, adjusting, and balancing.

B. Use service openings for entry and inspection.

1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 23 33 00 "Air Duct Accessories" for access panels and doors.
2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.7 START UP

A. Air Balance: Comply with requirements in Section 23 05 93 "Testing, Adjusting, and Balancing for HVAC."

3.8 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated.

B. Supply Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

a. Pressure Class: Positive 2-inch wg (500 Pa).
b. Minimum SMACNA Seal Class: B.
c. SMACNA Leakage Class for Rectangular: 24.

d. SMACNA Leakage Class for Round and Flat Oval: 24.

2. Ducts Connected to Constant-Volume Air-Handling Units:

a. Pressure Class: Positive 3-inch wg (750 Pa).
b. Minimum SMACNA Seal Class: B.
c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round and Flat Oval: 12.

3. Ducts Connected to Variable-Air-Volume Air-Handling Units:

a. Pressure Class: Positive 3-inch wg (750 Pa).
b. Minimum SMACNA Seal Class: B.
c. SMACNA Leakage Class for Rectangular: 6.
d. SMACNA Leakage Class for Round and Flat Oval: 6.

4. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive 3-inch wg (750 Pa).
b. Minimum SMACNA Seal Class: B.
c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round and Flat Oval: 12.

C. Return Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

a. Pressure Class: Positive or negative 2-inch wg (500 Pa).
b. Minimum SMACNA Seal Class: B.
c. SMACNA Leakage Class for Rectangular: 24.
d. SMACNA Leakage Class for Round and Flat Oval: 24.

2. Ducts Connected to Air-Handling Units:

a. Pressure Class: Positive or negative 3-inch wg (750 Pa).
b. Minimum SMACNA Seal Class: B.
c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round and Flat Oval: 12.

3. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive or negative 3-inch wg (750 Pa).
b. Minimum SMACNA Seal Class: B.
c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round and Flat Oval: 12.

D. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:

a. Pressure Class: Negative 2-inch wg (500 Pa).
b. Minimum SMACNA Seal Class: C if negative pressure, and A if positive pressure.

c. SMACNA Leakage Class for Rectangular: 24.
d. SMACNA Leakage Class for Round and Flat Oval: 24.

2. Ducts Connected to Air-Handling Units:

a. Pressure Class: Positive or negative 3-inch wg (750 Pa).
b. Minimum SMACNA Seal Class: B if negative pressure, and A if positive pressure.
c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round and Flat Oval: 12.

3. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive or negative 3-inch wg (750 Pa).
b. Minimum SMACNA Seal Class: B if negative pressure, and A if positive pressure.
c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round and Flat Oval: 12.

E. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

a. Pressure Class: Positive or negative 2-inch wg (500 Pa).
b. Minimum SMACNA Seal Class: B.
c. SMACNA Leakage Class for Rectangular: 24.
d. SMACNA Leakage Class for Round and Flat Oval: 24.

2. Ducts Connected to Air-Handling Units:

a. Pressure Class: Positive or negative 3-inch wg (750 Pa).
b. Minimum SMACNA Seal Class: B.
c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round and Flat Oval: 12.

3. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive or negative 3-inch wg (750 Pa).
b. Minimum SMACNA Seal Class: B.
c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round and Flat Oval: 12.

F. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel or carbon steel coated with zinc-chromate primer.
2. PVC-Coated Ducts:

a. Exposed to Airstream: Match duct material.
b. Not Exposed to Airstream: Match duct material.

3. Stainless-Steel Ducts:

a. Exposed to Airstream: Match duct material.

b. Not Exposed to Airstream: Match duct material.

4. Aluminum Ducts: Aluminum or galvanized sheet steel coated with zinc chromate.

G. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Velocity 1000 fpm (5 m/s) or Lower:

1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
2) Mitered Type RE 4 without vanes.

b. Velocity 1000 to 1500 fpm (5 to 7.6 m/s):

1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

c. Velocity 1500 fpm (7.6 m/s) or Higher:

1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."

a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

1) Velocity 1000 fpm (5 m/s) or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.

2) Velocity 1000 to 1500 fpm (5 to 7.6 m/s): 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
3) Velocity 1500 fpm (7.6 m/s) or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
4) Radius-to Diameter Ratio: 1.5.

b. Round Elbows, 12 Inches (305 mm) and Smaller in Diameter: Stamped or pleated.
c. Round Elbows, 14 Inches (356 mm) and Larger in Diameter: Standing seam.

H. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."

a. Rectangular Main to Rectangular Branch: 45-degree entry.
b. Rectangular Main to Round Branch: Spin in.

2. Round: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.

a. Velocity 1000 fpm (5 m/s) or Lower: 90-degree tap.
b. Velocity 1000 to 1500 fpm (5 to 7.6 m/s): Conical tap.
c. Velocity 1500 fpm (7.6 m/s) or Higher: 45-degree lateral.

END OF SECTION 23 31 13

SECTION 23 33 00

AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   a. Manual volume dampers.
   b. Flange connectors.
   c. Turning vanes.
   d. Flexible connectors.
   e. Flexible ducts.
   f. Duct accessory hardware.
   g. Louvers.

B. Related Requirements:

   a. Section 23 31 13 "Metal Ducts".

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.

   a. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:

      a. Special fittings.
      b. Manual volume damper installations.
      c. Control-damper installations.
      d. Fire-damper and smoke-damper installations, including sleeves; and duct-mounted access doors.
      e. Louver Installations.
      f. Wiring Diagrams: For power, signal, and control wiring.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 MATERIALS

A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

a. Galvanized Coating Designation: G90 (Z275).
b. Exposed-Surface Finish: Mill phosphatized.

B. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish for concealed and exposed ducts.

C. Aluminum Sheets: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

D. Extruded Aluminum: Comply with ASTM B 221 (ASTM B 221M), Alloy 6063, Temper T6.

E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

F. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.3 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Air Balance Inc.; a division of Mestek, Inc.
b. American Warming and Ventilating; a division of Mestek, Inc.
c. Flexmaster U.S.A., Inc.
d. McGill AirFlow LLC.
e. Nailor Industries Inc.
f. Pottorff.
g. Ruskin Company.

h. Trox USA Inc.
i. Vent Products Company, Inc.

b. Standard leakage rating, with linkage outside airstream.
c. Suitable for horizontal or vertical applications.
d. Frames:

a. Frame: Hat-shaped, 0.094-inch- (2.4-mm-) thick, galvanized sheet steel.
b. Mitered and welded corners.
c. Flanges for attaching to walls and flangeless frames for installing in ducts.

e. Blades:

a. Multiple or single blade.
b. Parallel- or opposed-blade design.
c. Stiffen damper blades for stability.
d. Galvanized-steel, 0.064 inch (1.62 mm) thick.

f. Blade Axles: Galvanized steel.
g. Bearings:

a. Oil-impregnated bronze.
b. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

h. Tie Bars and Brackets: Galvanized steel.

B. Standard, Aluminum, Manual Volume Dampers:

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Air Balance Inc.; a division of Mestek, Inc.
b. American Warming and Ventilating; a division of Mestek, Inc.
c. McGill AirFlow LLC.
d. Nailor Industries Inc.
e. Pottorff.
f. Ruskin Company.
g. Trox USA Inc.
h. Vent Products Company, Inc.

b. Standard leakage rating.
c. Suitable for horizontal or vertical applications.
d. Frames: Hat-shaped, 0.10-inch- (2.5-mm-) thick, aluminum sheet channels; frames with flanges for attaching to walls and flangeless frames for installing in ducts.
e. Blades:

a. Multiple or single blade.
b. Parallel- or opposed-blade design.
c. Stiffen damper blades for stability.

d. Roll-Formed Aluminum Blades: 0.10-inch- (2.5-mm-) thick aluminum sheet.
e. Extruded-Aluminum Blades: 0.050-inch- (1.2-mm-) thick extruded aluminum.

f. Blade Axles: Galvanized steel.
g. Bearings:

a. Oil-impregnated bronze.
b. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

h. Tie Bars and Brackets: Aluminum.

C. Jackshaft:

a. Size: 0.5-inch (13-mm) diameter.
b. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
c. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

D. Damper Hardware:

a. Zinc-plated, die-cast core with dial and handle made of 3/32-inch- (2.4-mm-) thick zinc-plated steel, and a 3/4-inch (19-mm) hexagon locking nut.
b. Include center hole to suit damper operating-rod size.
c. Include elevated platform for insulated duct mounting.

2.4 FLANGE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Ductmate Industries, Inc.
b. Nexus PDQ; Division of Shilco Holdings Inc.
c. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

C. Material: Galvanized steel.

D. Gage and Shape: Match connecting ductwork.

2.5 TURNING VANES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Ductmate Industries, Inc.

b. Duro Dyne Inc.
c. Elgen Manufacturing.
d. METALAIRE, Inc.
e. SEMCO Incorporated.
f. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

a. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

C. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

D. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."

E. Vane Construction: Double wall.

2.6 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Ductmate Industries, Inc.
b. Duro Dyne Inc.
c. Elgen Manufacturing.
d. Ventfabrics, Inc.
e. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches (89 mm) wide attached to two strips of 2-3/4-inch- (70-mm-) wide, 0.028-inch- (0.7-mm-) thick, galvanized sheet steel or 0.032-inch- (0.8-mm-) thick aluminum sheets. Provide metal compatible with connected ducts.

E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

a. Minimum Weight: 26 oz./sq. yd. (880 g/sq. m).
b. Tensile Strength: 480 lbf/inch (84 N/mm) in the warp and 360 lbf/inch (63 N/mm) in the filling.
c. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).

F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

a. Minimum Weight: 24 oz./sq. yd. (810 g/sq. m).
b. Tensile Strength: 530 lbf/inch (93 N/mm) in the warp and 440 lbf/inch (77 N/mm) in the filling.
c. Service Temperature: Minus 50 to plus 250 deg F (Minus 45 to plus 121 deg C).

2.7 FLEXIBLE DUCTS

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:

a. Flexmaster U.S.A., Inc.
b. McGill AirFlow LLC.
c. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Insulated, Flexible Duct: UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor-barrier film.

a. Pressure Rating: 10-inch wg (2500 Pa) positive and 1.0-inch wg (250 Pa) negative.
b. Maximum Air Velocity: 4000 fpm (20 m/s).
c. Temperature Range: Minus 20 to plus 210 deg F (Minus 29 to plus 99 deg C).
d. Insulation R-value: Comply with ASHRAE/IESNA 90.1.

C. Flexible Duct Connectors:

a. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches (75 through 460 mm), to suit duct size.

2.8 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

2.9 LOUVERS

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:

a. Greenheck.
b. Pottorff.
c. Ruskin.

B. Construction:
a. Material: Aluminum.

b. Frame: 5½" deep x 0.25" thick (140 mm x 6 mm), flanged.
c. Blades: Inverted V, 1/4" (6 mm) thick.
d. Screen: ½" x 0.063" (12.7 mm x 1.6 mm) expanded and flattened aluminum.

C. Performance Data:
a. Based on testing 48 inch x 48 inch (1219 mm x 1219 mm) size unit in accordance with AMCA 500L.
b. Free Area: 49% nominal
c. Free Area Size: 7.9 ft^2 (0.73 m^2)
d. Maximum Recommended Air Flow thru Free Area: 555 fpm (2.82m/s).
e. Air Flow: 4,385 cfm (2.07m^3/s).

D. Design Load:
a. UL Classified windstorm rated assembly.
b. Wind Load:
a. 300 psf.
b. Impact tested using 15 lb. 2 x 4 timber launched at 100 mph.
c. Seismic Performance: Louvers, including attachments to other construction, shall withstand seismic effects determined by ASCE-7.

E. Finishes:
a. Finish louvers after assembly as follows:

Baked Enamel or Polyester Powder Coat finish: Immediately after cleaning and pretreating, apply manufacturer's standard 2-coat baked-on finish consisting of prime coat and thermosetting topcoat, with a minimum dry thickness of 1 mil (0.025mm) for topcoat to comply with coating manufacturer's written instructions.

Final finish shall be Clear Anodized, submit color chart to architect.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

a. Install steel volume dampers in steel ducts.
b. Install aluminum volume dampers in aluminum ducts.

E. Set dampers to fully open position before testing, adjusting, and balancing.

F. Install test holes at fan inlets and outlets and elsewhere as indicated.

G. Install fire and smoke dampers according to UL listing.

H. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

a. On both sides of duct coils.
b. Upstream and downstream from duct filters.
c. At outdoor-air intakes and mixed-air plenums.
d. At drain pans and seals.
e. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
f. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
g. At each change in direction and at maximum 50-foot (15-m) spacing.
h. Upstream and downstream from turning vanes.
i. Upstream or downstream from duct silencers.
j. Control devices requiring inspection.
k. Elsewhere as indicated.

I. Install access doors with swing against duct static pressure.

J. Access Door Sizes:

a. One-Hand or Inspection Access: 8 by 5 inches (200 by 125 mm).
b. Two-Hand Access: 12 by 6 inches (300 by 150 mm).
c. Head and Hand Access: 18 by 10 inches (460 by 250 mm).
d. Head and Shoulders Access: 21 by 14 inches (530 by 355 mm).
e. Body Access: 25 by 14 inches (635 by 355 mm).
f. Body plus Ladder Access: 25 by 17 inches (635 by 430 mm).

K. Install flexible connectors to connect ducts to equipment.

L. Connect diffusers or light troffer boots to ducts with maximum 60-inch (1500-mm) lengths of flexible duct clamped or strapped in place.

M. Connect flexible ducts to metal ducts with liquid adhesive plus tape and draw bands

N. Install duct test holes where required for testing and balancing purposes.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

a. Operate dampers to verify full range of movement.
b. Inspect locations of access doors and verify that purpose of access door can be performed.
c. Operate fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
d. Inspect turning vanes for proper and secure installation.

END OF SECTION 23 33 00

SECTION 23 34 23

HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

B. Products shall be licensed to use the AMCA-Certified Ratings Seal.

C. Power ventilators shall comply with UL 705.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 2 - PRODUCTS

2.1 CEILING-MOUNTING OR IN-LINE CENTRIFUGAL VENTILATORS

A. Basis-of-Design Product: Product indicated on construction drawings or comparable product by one of the following:
   1. Greenheck
   2. Loren Cook
   3. Penn Ventilation

B. Housing: Steel, lined with acoustical insulation.

C. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.

D. Grille: Aluminum, louvered or egg-crate grille with flange on intake and thumbscrew attachment to fan housing.

E. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

F. Accessories:

   1. Isolation: Rubber-in-shear vibration isolators.

G. Capacities and Characteristics:

   1. Refer to schedule on construction drawings.

2.2 IN-LINE CENTRIFUGAL FANS

A. Basis-of-Design Product: Product indicated on construction drawings or comparable product by one of the following:
   1. Greenheck

2. Loren Cook
3. Penn Ventilation

B. Housing: The fan shall be of bolted construction utilizing corrosion resistant fasteners. Housing shall be minimum 18 gauge galvanized steel with integral duct collars. Bolted access doors shall be provided on three sides, sealed with closed cell neoprene gasket. Housing shall be pre-drilled to accommodate universal mounting feet for vertical or horizontal installation. Unit shall bear an engraved aluminum nameplate

C. Fan Wheel: Wheel shall be centrifugal backward inclined, constructed of 100% aluminum, including a precision machined cast aluminum hub. Wheel inlet shall overlap an aerodynamic aluminum inlet cone to provide maximum performance and efficiency. Wheel shall be balanced in accordance with AMCA standard 204-05, balance quality and vibration levels for fans.

D. Electrical Requirements: Junction box for electrical connection on housing.

E. Accessories:

1. Refer to fan schedule on construction drawings.

F. Capacities and Characteristics:

1. Refer to schedule on construction drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. In-Line Centrifugal Fans: Suspend units from structural-steel support frame using threaded steel rods and vibration isolation springs.

B. Ceiling-Mounted Units: Suspend units from structure using steel wire or metal straps.

C. Ground power ventilators.

END OF SECTION 23 34 23

SECTION 23 37 13

DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data and color charts for factory finishes.

PART 2 - PRODUCTS

2.1 OUTLETS AND INLETS

A. Basis-of-Design Product: Product indicated on construction drawings or comparable product by one of the following:

1. Anemostat
2. Krueger
3. Nailor
4. Price
5. Titus

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Install return grilles with angle of louvers/blades away from line of sight.

C. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel unless otherwise indicated. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

D. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 23 37 13

SECTION 23 54 00

FURNACES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Gas-fired, condensing furnaces and accessories complete with controls.
2. Air filters.
3. Refrigeration components.

1.2 ACTION SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each of the following:

1. Furnace.
2. Thermostat.
3. Air filter.
4. Refrigeration components.

1.3 INFORMATIONAL SUBMITTALS

A. Warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

C. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

D. Comply with NFPA 70.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace the following components of furnaces that fail in materials or workmanship within specified warranty period:

1. Warranty Period, Commencing on Date of Substantial Completion:

a. Furnace Heat Exchanger: 10 years.
b. Integrated Ignition and Blower Control Circuit Board: Five years.
c. Draft-Inducer Motor: Five years.
d. Refrigeration Compressors: 10 years.
e. Evaporator and Condenser Coils: Five years.

PART 2 - PRODUCTS

2.1 GAS-FIRED FURNACES, CONDENSING

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carrier Corporation
2. Goodman Manufacturing
3. Lennox Industries Inc.
4. Trane.
5. York International Corp.

C. General Requirements for Gas-Fired, Condensing Furnaces: Factory assembled, piped, wired, and tested; complying with ANSI Z21.47/CSA 2.3, "Gas-Fired Central Furnaces," and with NFPA 54.

D. Cabinet: Steel or Galvanized steel.

1. Cabinet interior around heat exchanger shall be factory-installed insulation.
2. Lift-out panels shall expose burners and all other items requiring access for maintenance.
3. Factory paint external cabinets in manufacturer's standard color.
4. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

E. Fan: Centrifugal, factory balanced, resilient mounted, direct drive.

1. Fan Motors: Comply with requirements in Section 23 05 13 "Common Motor Requirements for HVAC Equipment."

2. Special Motor Features: Single speed, Premium (TM) efficiency, as defined in Section 23 05 13 "Common Motor Requirements for HVAC Equipment," and with internal thermal protection and permanent lubrication.
3. Special Motor Features: Multitapped, multispeed with internal thermal protection and permanent lubrication.
4. Special Motor Features: Electronically controlled motor (ECM) controlled by integrated furnace/blower control.

F. Type of Gas: Natural.

G. Heat Exchanger:

1. Primary: Aluminized steel.

H. Burner:

1. Gas Valve: 100 percent safety two-stage main gas valve, main shutoff valve, pressure regulator, safety pilot with electronic flame sensor, limit control, transformer, and combination ignition/fan timer control board.
2. Ignition: Electric pilot ignition, with hot-surface igniter or electric spark ignition.

I. Gas-Burner Safety Controls:

1. Electronic Flame Sensor: Prevents gas valve from opening until pilot flame is proven; stops gas flow on ignition failure.
2. Flame Rollout Switch: Installed on burner box; prevents burner operation.
3. Limit Control: Fixed stop at maximum permissible setting; de-energizes burner on excessive bonnet temperature; automatic reset.

J. Combustion-Air Inducer: Centrifugal fan with thermally protected motor and sleeve bearings prepurges heat exchanger and vents combustion products; pressure switch prevents furnace operation if combustion-air inlet or flue outlet is blocked.

K. Furnace Controls: Solid-state board integrates ignition, heat, cooling, and fan speeds; adjustable fan-on and fan-off timing; terminals for connection to accessories; diagnostic light(s).

L. Accessories:

1. Combination Combustion-Air Intake and Vent: PVC plastic fitting to combine combustion-air inlet and vent through outside wall or roof.
2. CPVC Plastic Vent Materials.

a. CPVC Plastic Pipe: Schedule 40, complying with ASTM F 441/F 441M.
b. CPVC Plastic Fittings: Schedule 40, complying with ASTM F 438, socket type.
c. CPVC Solvent Cement: ASTM F 493.

1) CPVC solvent cement shall have a VOC content of 490 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2) Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3) Solvent cement and adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

3. PVC Plastic Vent Materials:

a. PVC Plastic Pipe: Schedule 40, complying with ASTM D 1785.
b. PVC Plastic Fittings: Schedule 40, complying with ASTM D 2466, socket type.
c. PVC Solvent Cement: ASTM D 2564.

1) PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2) Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3) Solvent cement and adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

M. Capacities and Characteristics:

1. Refer to schedule on Construction Drawings.

2.2 THERMOSTATS

A. Controls shall comply with requirements in ASHRAE/IESNA 90.1, "Controls."

B. Control Wiring: Unshielded twisted-pair cabling.

1. No. 24 AWG, 100 ohm, four pair.
2. Cable Jacket Color: Blue.

2.3 AIR FILTERS

A. Disposable Filters: 1-inch- (25-mm-) thick fiberglass media with ASHRAE 52.2 MERV rating of 6 or higher in sheet metal frame.

2.4 REFRIGERATION COMPONENTS

A. General Refrigeration Component Requirements:

1. Refrigeration compressor, coils, and specialties shall be designed to operate with CFC-free refrigerants.
2. Energy Efficiency: Equal to or greater than prescribed by ASHRAE/IESNA 90.1, "Energy Standard for Buildings except Low-Rise Residential Buildings."

B. Refrigerant Coil: Copper tubes mechanically expanded into aluminum fins. Comply with ARI 210/240, "Unitary Air-Conditioning and Air-Source Heat Pump Equipment." Match size with furnace. Include condensate drain pan with accessible drain outlet complying with ASHRAE 62.1.

1. Refrigerant Coil Enclosure: Steel, matching furnace and evaporator coil, with access panel and flanges for integral mounting at or on furnace cabinet and galvanized sheet metal drain pan coated with black asphaltic base paint.

C. Refrigerant Line Kits: Annealed-copper suction and liquid lines factory cleaned, dried, pressurized with nitrogen, sealed, and with suction line insulated. Provide in standard lengths for installation without joints, except at equipment connections.

1. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I, 1 inch (25 mm) thick.

D. Refrigerant Piping: Comply with requirements in Section 23 23 00 "Refrigerant Piping."

E. Air-Cooled, Compressor-Condenser Unit:

1. Casing: Steel, finished with baked enamel, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
2. Compressor: Hermetically sealed scroll type.

   a. Crankcase heater.
   b. Restrained vibration isolation mounts for compressor.
   c. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
   d. Two-speed compressor motors shall have manual-reset high-pressure switch and automatic-reset low-pressure switch.
   e. Refrigerant: R-410A.

3. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with liquid subcooler.
4. Heat-Pump Components: Reversing valve and low-temperature air cut-off thermostat.
5. Fan: Aluminum-propeller type, directly connected to motor.
6. Motor: Permanently lubricated, with integral thermal-overload protection.
7. Low Ambient Kit: Permits operation down to 45 deg F (7 deg C).
8. Mounting Base: Polyethylene.

F. Capacities and Characteristics:

1. Refer to schedule on Construction Drawings:

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install gas-fired furnaces and associated fuel and vent features and systems according to NFPA 54.

B. Base-Mounted Units: Secure units to substrate. Provide optional bottom closure base if required by installation conditions.

1. Anchor furnace to substrate to resist code-required seismic acceleration.

C. Controls: Install thermostats at mounting height of 60 inches (1500 mm) above floor.

D. Wiring Method: Install control wiring in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Conceal control wiring except in unfinished spaces.

E. Install ground-mounted, compressor-condenser components on mounting base as indicated on Construction Drawings.

3.2 CONNECTIONS

A. Gas piping connections: Per manufacturer's installation instructions. Drawings indicate general arrangement of piping, fittings, and specialties. Connect gas piping with union or flange and appliance connector valve.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Vent and Outside-Air Connection, Condensing, Gas-Fired Furnaces: Connect plastic piping vent material to furnace connections and extend outdoors. Terminate vent outdoors with a cap and in an arrangement that will protect against entry of birds, insects, and dirt.

1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
3. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
b. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
c. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
d. Requirements for Low-Emitting Materials:

1) CPVC solvent cement shall have a VOC content of 490 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2) PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3) Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
4) Solvent cement and adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

4. Slope pipe vent back to furnace or to outside terminal.

D. Connect ducts to furnace with flexible connector. Comply with requirements in Section 23 33 00 "Air Duct Accessories."

E. Connect refrigerant tubing kits to refrigerant coil in furnace and to air-cooled, compressor-condenser unit.

1. Flared Joints: Use ASME B16.26 fitting and flared ends, following procedures in CDA's "Copper Tube Handbook."
2. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
3. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Comply with requirements in Section 23 23 00 "Refrigerant Piping" for installation and joint construction of refrigerant piping.

G. Complete installation and startup checks and start units according to manufacturer's written instructions.

H. Verify proper operation of capacity control device.

I. Adjust airflow and initial temperature and humidity set points.

J. Set controls, burner, and other adjustments for optimum heating performance and efficiency. Adjust heat-distribution features, including shutters, dampers, and relays, to provide optimum heating performance and system efficiency.

K. After completing installation, clean furnaces internally according to manufacturer's written instructions.

L. Install new filters in each furnace within 14 days after Substantial Completion.

3.3 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Perform electrical test and visual and mechanical inspection.

2. Leak Test: After installation, charge systems with refrigerant and oil and test for leaks. Repair leaks, replace lost refrigerant and oil, and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation, product capability, and compliance with requirements.
4. Verify that fan wheel is rotating in the correct direction and is not vibrating or binding.
5. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.

END OF SECTION 23 54 00

SECTION 23 81 26

SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes split-system air-conditioning and heat-pump units consisting of separate evaporator-fan and compressor-condenser components.

1.2 ACTION SUBMITTALS

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

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1.3 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE Compliance:

1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - " Procedures," and Section 7 - "Construction and System Start-up."

C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.

1. Warranty Period:

a. For Compressor: Five year(s) from date of Substantial Completion.
b. For Parts: One year(s) from date of Substantial Completion.
c. For Labor: One year(s) 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. Carrier Corporation
2. Goodman Manufacturing
3. Lennox Industries Inc.
4. Trane.
5. York International Corp.

2.2 INDOOR UNITS (5 TONS (18 kW) OR LESS)

A. Floor-Mounted, Evaporator-Fan Components:

1. Cabinet: Steel or galvanized steel with removable panels on front.
   a. Insulation: Faced, glass-fiber duct liner.
   b. Drain Pans: Galvanized steel, with connection for drain; insulated.

2. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 206/110.

2.3 OUTDOOR UNITS (5 TONS (18 kW) OR LESS)

A. Air-Cooled, Compressor-Condenser Components:

1. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
2. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

   a. Compressor Type: Scroll.

b. Two-speed compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.
c. Refrigerant Charge: R-410A.
d. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 206/110.

3. Heat-Pump Components: Reversing valve and low-temperature-air cutoff thermostat.
4. Fan: Aluminum-propeller type, directly connected to motor.
5. Motor: Permanently lubricated, with integral thermal-overload protection.
6. Low Ambient Kit: Permits operation down to 45 deg F (7 deg C).
7. Mounting Base: Polyethylene.

2.4 ACCESSORIES

A. Thermostat: Low voltage with subbase to control compressor and evaporator fan.

B. Thermostat: Wireless infrared functioning to remotely control compressor and evaporator fan, with the following features:

1. Compressor time delay.
2. 24-hour time control of system stop and start.
3. Liquid-crystal display indicating temperature, set-point temperature, time setting, operating mode, and fan speed.
4. Fan-speed selection including auto setting.

C. Automatic-reset timer to prevent rapid cycling of compressor.

D. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.

E. Drain connection.

F. Additional Monitoring:

1. Monitor constant and variable motor loads.
2. Monitor variable-frequency-drive operation.
3. Monitor economizer cycle.
4. Monitor cooling load.
5. Monitor air distribution static pressure and ventilation air volumes.

2.5 CAPACITIES AND CHARACTERISTICS

A. Refer to schedule on Construction Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

C. Install ground-mounted, compressor-condenser components on mounting base as indicated on Construction Drawings.

D. Install and connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

C. Duct Connections: Duct installation requirements are specified in Section 23 31 13 "Metal Ducts." Drawings indicate the general arrangement of ducts. Connect supply and return ducts to split-system air-conditioning units with flexible duct connectors. Flexible duct connectors are specified in Section 23 33 00 "Air Duct Accessories."

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

D. Prepare test and inspection reports.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 23 81 26

SECTION 26 05 00

COMMON REQUIREMENTS FOR ELECTRICAL SYSTEMS AND EQUIPMENT

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Design supports for multiple raceways capable of supporting combined weight of supported systems and contents plus the capacity to add 25% weight in the future.

B. Submittals:

1. Product Data: For sleeve seals.
2. Shop Drawings: For hangers and supports. Show fabrication and installation details.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 RACEWAYS

A. Raceways:

1. EMT: ANSI C80.3, zinc-coated steel, with setscrew or compression fittings.
2. ENT: NEMA TC 13, complying with UL 1653.
3. FMC: Zinc-coated steel.
4. IMC: ANSI C80.6, zinc-coated steel, with threaded fittings.
5. LFMC: Zinc-coated, flexible steel with sunlight-resistant and mineral-oil-resistant plastic jacket.
6. RNC: NEMA TC 2, Type EPC-40-PVC, with NEMA TC3 fittings.
7. Raceway Fittings: Specifically designed for raceway type used in Project.

B. Wireways: Sheet metal sized and shaped, with screw covers.

C. Surface Raceways:

1. Metal: Galvanized steel with snap-on covers. Manufacturer's standard enamel finish in color selected by Architect.

2.2 CONDUCTORS AND CABLES

A. Conductors:

1. Conductors, No. 10 AWG and smaller: Solid or stranded copper.
2. Conductors, Larger than No. 10 AWG: Stranded copper.
3. Insulation: Thermoplastic, rated at 75 deg C minimum.

4. Wire Connectors and Splices: Units of size, ampacity rating, material, type, and class suitable for service indicated.
5. Class 1 wiring to be No. 12 AWG minimum.
6. All low-voltage and communication cabling to be plenum rated.

2.3 GROUNDING MATERIALS

A. Conductors: Solid for No. 8 AWG and smaller, and stranded for No. 6 AWG and larger unless otherwise indicated.

1. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
2. Bare, Solid-Copper Conductors: Comply with ASTM B 3.
3. Bare, Stranded-Copper Conductors: Comply with ASTM B 8.

B. Ground Rods: Copper-clad steel, sectional type; 5/8 by 96 inches in diameter.

C. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts with clamp-type pipe connectors sized for pipe.

D. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.4 ELECTRICAL IDENTIFICATION MATERIALS

A. Raceway Identification Materials: [Snap-around, color-coding bands; flexible, preprinted, color-coded acrylic] [Self-adhesive, color-coding vinyl tape; flexible, preprinted, self-adhesive vinyl].

B. Conductor Identification Materials: Color-Coding Conductor Tape: Self-adhesive vinyl tape 1 to 2 inches wide.

C. Underground-Line Warning Tape: Permanent, bright-colored, continuous-printed, polyethylene tape with continuous metallic strip or core.

D. Tape Markers for Wire: Vinyl or vinyl-cloth, self-adhesive, wraparound type with circuit identification legend machine printed by thermal transfer or equivalent process.

E. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

F. Metal-Backed, Butyrate Warning Signs: Weather-resistant, non-fading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application.

G. Equipment Identification Labels: Engraved, laminated acrylic or melamine label; punched or drilled for screw mounting. White letters on a dark-gray background; red letters for emergency systems.

H. Fasteners: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

2.5 SUPPORT AND ANCHORAGE COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly, and provide finish suitable for the environment in which installed.

1. Channel Dimensions: Selected for structural loading.

B. Raceway and Cable Supports: As described in NECA 1.

C. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and fittings.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded malleable-iron body and insulating wedging.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components:

1. Powder-Actuated Fasteners: Threaded-steel stud.
2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated or stainless steel, for use in hardened portland cement concrete.
3. Concrete Inserts: Steel or malleable-iron, slotted-support-system units similar to MSS Type 18; complying with MFMA-3 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, high strength; complying with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.6 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized-steel sheet.

D. Sleeve Seals: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
2. Pressure Plates: Carbon steel. Include two for each sealing element.
3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.7 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 GENERAL ELECTRICAL EQUIPMENT INSTALLATION REQUIREMENTS

A. Install electrical equipment to allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.

B. Install electrical equipment to provide for ease of disconnecting the equipment with minimum interference to other installations.

C. Install electrical equipment to allow right of way for piping and conduit installed at required slope.

D. Install electrical equipment to ensure that connecting raceways, cables, wireways, cable trays, and busways are clear of obstructions and of the working and access space of other equipment.

E. Install required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

F. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Comply with requirements in Division 08 Section "Access Doors and Frames."

G. Install sleeve and sleeve seals of type and number required for sealing electrical service penetrations of exterior walls.

H. Comply with NECA 1.

3.2 RACEWAY AND CABLE INSTALLATION

A. Outdoor Raceways Applications:

1. Exposed or Concealed: IMC.
2. Underground, Single Run: RNC.
3. Connection to Vibrating Equipment: LFMC.
4. Boxes and Enclosures: Metallic, NEMA 250, Type 3R or Type 4.

B. Indoor Raceways Applications:

1. Exposed or Concealed: EMT.
2. Connection to Vibrating Equipment: FMC; in wet or damp locations, use LFMC.
3. Damp or Wet Locations: IMC.
4. Boxes and Enclosures: Metallic, NEMA 250, Type 1, unless otherwise indicated.
5. Exposed in occupied/finished areas below 9 feet AFF: Metal surface-mounted raceway.

C. Install raceways embedded in slabs in middle third of slab thickness where practical, and leave at least 1-inch thick 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. Install conduit larger than 1-inch trade size, parallel to or at right angles to main reinforcement. Where conduit is at right angles to reinforcement, place conduit close to slab support.

4. Transition from nonmetallic tubing to Schedule 80 nonmetallic conduit, rigid steel conduit, or IMC before rising above floor.

D. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.

E. Install pull wires in empty raceways.

F. Install separate neutral and grounding conductors, continuous to panel, for all 120-volt circuits.

G. Connect motors and equipment subject to vibration, noise transmission, or movement with a 72-inch maximum length of flexible conduit.

H. Install raceways and cables conceal within finished walls, ceilings, and floors unless otherwise indicated.

I. Install raceways and cables at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Locate horizontal raceway runs above water and steam piping.

3.3 WIRING METHODS

A. Service Entrance: Type THHN-THWN or XHHW, single conductors in raceway.

B. Exposed Feeders, Branch Circuits, and Class 1 Control Circuits, Including in Crawlspaces: Type THHN-THWN, single conductors in raceway.

C. Feeders and Branch Circuits Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN-THWN, single conductors in raceway.

D. Feeders and Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and underground: Type THHN-THWN, single conductors in raceway.

E. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, and strain relief device at terminations to suit application.

F. Class 2 Control Circuits: Type THHN-THWN, in raceway. Power-limited cable, in raceway, existing cable tray, or on J-hooks when concealed above lay-in ceiling systems.

G. Fire Alarm Circuits: All wiring to be installed in raceway.

3.4 GROUNDING

A. Underground Grounding Conductors: Install bare copper conductor as indicated. Bury at least 24 inches below grade.

B. Pipe and Equipment Grounding Conductor Terminations: Bolted.

C. Underground Connections: Welded.

D. Connections to Structural Steel: Welded.

E. Install grounding conductors routed along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

F. Install ground rods driven into ground until tops are 2 inches below finished floor or final grade unless otherwise indicated.

G. Make connections without exposing steel or damaging coating if any.

H. Install bonding straps and jumpers in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.

I. Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.

J. Bond to equipment mounted on vibration isolation hangers and supports so vibration is not transmitted to rigidly mounted equipment.

K. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

L. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells.

1. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
2. Perform tests by fall-of-potential method according to IEEE 81.
3. Report measured ground resistances that exceed the following values:

   a. Power and Lighting Equipment or System with Capacity 500 kVA and Less: 10 ohms.
   b. Power and Lighting Equipment or System with Capacity 500 to 1000 kVA: 5 ohms.
   c. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).

4. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

3.5 IDENTIFICATION

A. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color-coded, self-adhesive color coding tape-in bands:

1. Fire-Alarm System: Red.
2. Security System: Blue and yellow.
3. Telecommunication System: Green and yellow.

B. Power-Circuit Conductor Identification: For No. 3 AWG conductors and larger, at each location where observable, identify phase using color-coding conductor tape.

C. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring.

D. Warning Labels for Enclosures for Power and Lighting: Comply with 29 CFR 1910.145; identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.

E. Equipment Identification Labels:

1. Labeling Instructions:

a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine label. Provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.
b. Outdoor Equipment: Engraved, laminated acrylic or melamine label, drilled for screw attachment.
c. Elevated Components: Increase sizes of labels and legend to those appropriate for viewing from the floor.

2. Equipment to Be Labeled:

a. Panelboards, electrical cabinets, and enclosures.
b. Electrical switchgear and switchboards.
c. Transformers.
d. Motor-control centers.
e. Disconnect switches.
f. Enclosed circuit breakers.
g. Motor starters.
h. Push-button stations.
i. Power transfer equipment.
j. Contactors.
k. Terminals, racks, and patch panels for voice and data communication and for signal and control functions.

F. Verify identity of each item before installing identification products.

G. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

H. Attach non-adhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.

I. Install system identification color banding for raceways and cables at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

J. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Ungrounded service and feeder conductors.

1. Colors for 208/120-V Circuits:

a. Phase A: Black.
b. Phase B: Red.
c. Phase C: Blue.

2. Colors for 480/277-V Circuits:

a. Phase A: Brown.
b. Phase B: Orange.
c. Phase C: Yellow.

3. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points.

K. Underground-Line Warning Tape: Continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade.

3.6 INSTALLATION OF HANGERS AND SUPPORTS

A. Fasten hangers and supports securely in place, with provisions for thermal and structural movement. Install with concealed fasteners unless otherwise indicated.

B. Separate dissimilar metals and metal products from contact with wood or cementitious materials, by painting each metal surface in area of contact with a bituminous coating or by other permanent separation.

C. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC and RMC may be supported by openings through structure members, as permitted in NFPA 70.

D. Multiple Raceways or Cables: Install on trapeze-type supports fabricated with steel slotted channel.

E. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

F. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods, unless otherwise indicated or required by Code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
6. To Light Steel: Sheet metal screws.
7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount on slotted-channel racks attached to substrate.

G. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.7 SLEEVE AND SLEEVE-SEALS INSTALLATION

A. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

B. Cut sleeves to length for mounting flush with both wall surfaces.

C. Extend sleeves installed in floors 2 inches above finished floor level.

D. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and cable unless sleeve seal is to be installed.

E. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

F. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and cable, using joint sealant appropriate for size, depth, and location of joint according to Division 07 Section "Joint Sealants."

G. Roof-Penetration Sleeves: Seal penetration of individual cables with flexible boot-type flashing units applied in coordination with roofing work.

H. Aboveground Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeves to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

I. Underground Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between cable and sleeve for installing mechanical sleeve seals.

3.8 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Comply with requirements in Division 07 Section "Penetration Firestopping."

END OF SECTION 26 05 00

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.

B. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN-2-THWN-2.

C. Multiconductor Cable: Comply with NEMA WC 70/ICEA S-95-658 for metal-clad cable, Type MC with ground wire.

2.2 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger, except VFC cable, which shall be extra flexible stranded.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Exposed Branch Circuits, Including in Crawlspaces: Type THHN-2-THWN-2, single conductors in raceway, or Metal-clad cable, Type MC where specifically allowed.

B. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-2-THWN-2, single conductors in raceway or Metal-clad cable, Type MC where specifically allowed.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 26 05 33 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables according to Section 26 05 29 "Hangers and Supports for Electrical Systems."

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches (300 mm) of slack.

3.5 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 26 05 53 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.

    a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
    b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
    c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

B. Test and Inspection Reports: Prepare a written report to record the following:

1. Procedures used.
2. Results that comply with requirements.
3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

C. Cables will be considered defective if they do not pass tests and inspections.

END OF SECTION 26 05 19

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes grounding and bonding systems and equipment.

1.2 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Burndy; Part of Hubbell Electrical Systems.
2. Dossert; AFL Telecommunications LLC.
3. ERICO International Corporation.
4. Fushi Copperweld Inc.
5. Galvan Industries, Inc.; Electrical Products Division, LLC.
6. Harger Lightning and Grounding.
7. ILSCO.
8. O-Z/Gedney; A Brand of the EGS Electrical Group.
9. Robbins Lightning, Inc.
10. Siemens Power Transmission & Distribution, Inc.

2.2 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

2.3 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.

2.4 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.

3.2 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Three-phase motor and appliance branch circuits.
3. Flexible raceway runs.
4. Armored and metal-clad cable runs.

3.3 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.

END OF SECTION 26 05 26

SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Hangers and supports for electrical equipment and systems.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.3 ACTION SUBMITTALS

A. Product Data: For steel slotted support systems.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1. Trapeze hangers. Include Product Data for components.
2. Steel slotted channel systems. Include Product Data for components.
3. Equipment supports.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. 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:

   a. Allied Tube & Conduit.
   b. Cooper B-Line, Inc.
   c. ERICO International Corporation.
   d. GS Metals Corp.
   e. Thomas & Betts Corporation.
   f. Unistrut; Atkore International.
   g. Wesanco, Inc.

2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
5. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1) Cooper B-Line, Inc.
2) Empire Tool and Manufacturing Co., Inc.
3) Hilti, Inc.
4) ITW Ramset/Red Head; Illinois Tool Works, Inc.
5) MKT Fastening, LLC.

2. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
3. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
5. Toggle Bolts: All-steel springhead type.
6. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as scheduled in NECA 1, where its Table 1 lists maximum spacings less than stated in NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with two-bolt conduit clamps or single-bolt conduit clamps using spring friction action for retention in support channel.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
2. To Existing Concrete: Expansion anchor fasteners.
3. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
4. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69 or Spring-tension clamps.
5. To Light Steel: Sheet metal screws.
6. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

B. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 26 05 29

SECTION 26 05 33

RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Metal wireways and auxiliary gutters.
3. Boxes, enclosures, and cabinets.

1.2 ACTION SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:

1. Structural members in paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

A. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. GRC: Comply with ANSI C80.1 and UL 6.

C. EMT: Comply with ANSI C80.3 and UL 797.

D. FMC: Comply with UL 1; zinc-coated steel or aluminum.

E. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

F. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
2. Fittings for EMT:

    a. Material: Steel or die cast.
    b. Type: compression.

3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.

G. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 or Type 3R unless otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

2.3 BOXES, ENCLOSURES, AND CABINETS

A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

D. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

E. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb (23 kg). Outlet boxes designed for attachment of luminaires weighing more than 50 lb (23 kg) shall be listed and marked for the maximum allowable weight.

F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

G. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized, cast iron with gasketed cover.

H. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

I. Device Box Dimensions: 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep) 4 inches by 2-1/8 inches by 2-1/8 inches deep (100 mm by 60 mm by 60 mm deep).

J. Gangable boxes are allowed.

K. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 or Type 3R with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

L. Cabinets:

1. NEMA 250, Type 1 or Type 3R galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC
2. Concealed Conduit, Aboveground: EMT.
3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
4. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply raceway products as specified below unless otherwise indicated.
1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: GRC.
4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: GRC.

C. Minimum Raceway Size: 1/2-inch (16-mm) trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after

installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.

3. EMT: Use setscrew or compression, steel fittings. Comply with NEMA FB 2.10.
4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

F. Install surface raceways only where indicated on Drawings.

G. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F (49 deg C).

3.2 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for hangers and supports.

D. Arrange stub-ups so curved portions of bends are not visible above finished slab.

E. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches (300 mm) of changes in direction.

F. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

G. Support conduit within 12 inches (300 mm) of enclosures to which attached.

H. Stub-ups to Above Recessed Ceilings:

1. Use EMT, IMC, or RMC for raceways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

I. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

J. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

K. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

L. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch (35-mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

M. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

N. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces.

O. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service raceway enters a building or structure.
3. Where otherwise required by NFPA 70.

P. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F (17 deg C) and that has straight-run length that exceeds 25 feet (7.6 m).

2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per degree F (0.06 mm per meter of length of straight run per degree C) of temperature change for PVC conduits.
3. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
4. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

Q. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches (1830 mm) of flexible conduit for recessed and semi-recessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

R. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

S. Locate boxes so that cover or plate will not span different building finishes.

T. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

U. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

3.3 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 26 05 33

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.

1.2 ACTION SUBMITTALS

A. Product Data: For each electrical identification product indicated.

1.3 QUALITY ASSURANCE

A. Comply with ANSI A13.1.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

PART 2 - PRODUCTS

2.1 POWER RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Colors for Raceways Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage.

C. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.2 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.3 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.

B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.4 EQUIPMENT IDENTIFICATION LABELS

A. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. Apply identification devices to surfaces that require finish after completing finish work.

C. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

D. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

E. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

3.2 IDENTIFICATION SCHEDULE

A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30A, and 120V to ground: Install labels at 30-foot (10-m) maximum intervals.

B. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded feeder and branch-circuit conductors.

a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.

b. Colors for 208/120-V Circuits:
1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.

c. Colors for 480/277-V Circuits:
1) Phase A: Brown.
2) Phase B: Orange.
3) Phase C: Yellow.

d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

C. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

D. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.
b. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
c. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

END OF SECTION 26 05 53

SECTION 26 09 23

LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

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.

PART 2 - PRODUCTS

2.1 DEVICES

A. Line-Voltage Surge Protection: An integral part of the lighting control devices for 120- and 277-V solid-state equipment. For devices without integral line-voltage surge protection, field-mounting surge protection shall comply with IEEE C62.41 and with UL 1449.

B. Indoor Occupancy Sensors:

1. Acceptable Manufacturers: Hubbell, Leviton, or Watt Stopper

2. Products:

   a. Wall-box: Hubbell AD2000
   b. Ceiling-mounted: Hubbell ADT 500C, ATP1500C, ATD2000C
   c. Power packs: Hubbell CU300A

3. Type: Passive infrared or Dual technology (passive infrared and ultrasonic).
4. Voltage: 120/277 V.
5. Time Delay: Adjustable up to 30 minutes. Field set to 5 minutes.
6. Field of View: 180 to 360 degrees.
7. Minimum Coverage Area: 2000 sq. ft.

2.2 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG, complying with Division 26 Section "Common Work Results for Electrical."

B. Classes 2 and 3 Control Cable: Multi-conductor cable with stranded copper conductors not smaller than No. 22 AWG, complying with Division 26 Section "Common Work Results for Electrical."

C. Class 1 Control Cable: Multi-conductor cable with stranded copper conductors not smaller than No. 18 AWG, complying with Division 26 Section "Common Work Results for Electrical."

D. UTP Cable: 100 ohm, 4-pair UTP, formed into 25-pair, binder groups covered with a blue thermoplastic jacket.

1. Comply with ICEA S-90-661 for mechanical properties.
2. Comply with TIA/EIA-568-B.1 for performance specifications.
3. Comply with TIA/EIA-568-B.2, Category 5e.

a. Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
b. Multipurpose, Riser Rated: Type MPP, complying with UL 1666.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install and aim sensors in locations to achieve at least 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

B. Install field-mounting transient voltage suppressors for lighting control devices in Category A locations that do not have integral line-voltage surge protection.

C. Label time switches and contactors with a unique designation.

D. Verify actuation of each sensor and adjust time delays.

END OF SECTION 26 09 23

SECTION 26 24 16

PANELBOARDS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

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.

C. Comply with NEMA PB 1.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Panelboards shall be manufactured by Square D. No equivalents.

B. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Division 26 Section "Common Work Results for Electrical."

C. Enclosures: Flush and surface-mounted cabinets; NEMA 250, Type 1 or 3R.

1. Front: Secured to box with concealed trim clamps.
2. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.

D. Incoming Mains Location: Top or bottom.

E. Phase, Neutral, and Ground Buses: Tin-plated hard-drawn copper, 98 percent conductivity.

F. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Tin-plated hard-drawn copper, 98 percent conductivity.
2. Main and Neutral Lugs: Compression type.
3. Ground Lugs and Bus Configured Terminators: Compression type.
4. Feed-Through Lugs: Compression type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.

G. Service Equipment Label: NRTL labeled for use as service equipment for panelboards with one or more main service disconnecting and overcurrent protective devices.

H. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

I. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include size and type of allowable upstream and branch devices, and listed and labeled for series-connected short-circuit rating by an NRTL.

J. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 DISTRIBUTION PANELBOARDS

A. Doors: Omit in fused-switch panelboards.

B. Mains: Circuit breaker or lugs only.

C. Branch Overcurrent Protective Devices: For circuit-breaker frame sizes 125 A and smaller: Bolt-on circuit breakers.

D. Branch Overcurrent Protective Devices: For circuit-breaker frame sizes larger than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Mains: Circuit breaker or lugs only.

B. Branch Overcurrent Protective Devices: Plug-in circuit breakers, replaceable without disturbing adjacent units.

C. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with series-connected rating to meet available fault currents.

1. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
2. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).

B. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Receive, inspect, handle, store and install panelboards and accessories according to NECA 407.

B. Comply with mounting and anchoring requirements specified in Division 26 Section "Common Work Results for Electrical."

C. Mount top of trim 84 inches above finished floor unless otherwise indicated.

D. Stub four empty 3/4-inch conduits from panelboard into accessible or designated ceiling space.

E. Arrange conductors into groups; bundle and wrap with wire ties.

F. Create a directory to indicate installed circuit loads and incorporating Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory.

END OF SECTION 26 24 16

SECTION 26 27 13

ELECTRICITY METERING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data and Shop Drawings.

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.

C. Coordinate with utility companies for services and components they furnish.

PART 2 - PRODUCTS

2.1 EQUIPMENT FOR ELECTRICITY METERING BY UTILITY COMPANY

A. Meters will be furnished by utility company.

B. Current-Transformer Cabinets: Comply with requirements of electrical power utility company.

C. Meter Sockets: Comply with requirements of electrical power utility company.

D. Housing: NEMA 250, Type 3R enclosure.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with equipment installation requirements in NECA 1.

B. Install equipment for utility company metering. Install raceways and equipment according to utility company's written requirements. Provide empty conduits for metering leads and extend grounding connections as required by utility company.

END OF SECTION 26 27 13

SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

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.

C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 DEVICES

A. Wiring devices and plates shall be manufactured by Hubbell (preferred) or Leviton.

B. Convenience Receptacles: NEMA WD 1, NEMA WD 6, Configuration 5-20R, and UL 498.

1. Products:
   a. Hubbell 5362 OR Leviton CR20, spec. grade 20 amp, ivory.

C. Duplex GFCI Convenience Receptacles: 125 V, 20 A, straight blade, feed-through type. NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.

1. Products:
   a. Hubbell GF20, spec. grade 20 amp, ivory.

D. Snap Switches: NEMA WD 1 and UL 20. Single-pole, double-throw, momentary contact, center-off switches, 120/277 V, 20 A; for use with mechanically held lighting contactors.

1. Products:
   a. Hubbell HBL1221 or HBL1223 or HBL1224, spec. grade 20 amp, ivory or almond, no substitutes.

E. Wall Plates: Satin-finish stainless steel type 302/304, fastened with metal screws having heads matching plate color.

F. Wall Plates, Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet locations.

G. Finishes:

1. Wiring Devices Connected to Normal Power System: Ivory or Almond unless otherwise indicated or required by NFPA 70 or device listing.
2. Wiring Devices Connected to Emergency Power System: Red.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.

B. Install devices and assemblies plumb, level, and square with building lines.

C. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

D. Mount devices flush, with long dimension vertical, and grounding terminal of receptacles on top unless otherwise indicated. Group adjacent devices under single, multi-gang wall plates.

END OF SECTION 26 27 26

SECTION 26 28 13

FUSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Cartridge fuses rated 600-V ac and less for use in control circuits and enclosed switches.

1.2 ACTION SUBMITTALS

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

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NEMA FU 1 for cartridge fuses.

C. Comply with NFPA 70.

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. Cooper Bussmann, Inc.
2. Edison Fuse, Inc.
3. Ferraz Shawmut, Inc.
4. Littelfuse, Inc.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

PART 3 - EXECUTION

3.1 FUSE APPLICATIONS

A. Service Entrance: Class L, fast acting.

B. Feeders: Class L, fast acting.

C. Motor Branch Circuits: Class RK1, time delay.

D. Other Branch Circuits: Class RK1, time delay.

E. Control Circuits: Class CC, time delay.

3.2 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.3 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block and holder.

END OF SECTION 26 28 13

SECTION 26 28 16

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. Molded-case circuit breakers (MCCBs).
4. Enclosures.

1.2 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

D. DPDT: Double pole, double throw.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated.

B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For enclosed switches and circuit breakers, accessories, and components, from manufacturer.

B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

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. 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. Type GD, General Duty, Single Throw, 240-V ac, 800 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with cartridge fuse interiors to accommodate specified fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

C. Type HD, Heavy Duty, Single Throw, 240-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Type HD, Heavy Duty, Double Throw, 240-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

E. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
4. Lugs: Suitable for number, size, and conductor material.
5. Service-Rated Switches: Labeled for use as service equipment.

2.2 NONFUSIBLE SWITCHES

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. 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. Type GD, General Duty, Single Throw, 600 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

C. Type HD, Heavy Duty, Single Throw, 240-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Type HD, Heavy Duty, Double Throw, 240-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

E. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Lugs: Suitable for number, size, and conductor material.

2.3 MOLDED-CASE CIRCUIT BREAKERS

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. 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. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.

C. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

D. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:

1. Instantaneous trip.
2. Long- and short-time pickup levels.
3. Long- and short-time time adjustments.
4. Ground-fault pickup level, time delay, and I^2t response.

E. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.

F. Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: Suitable for number, size, trip ratings, and conductor material.
3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
5. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
6. Auxiliary Contacts: As specified.

2.4 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 3R.
3. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
4. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

C. Install fuses in fusible devices.

D. Comply with NECA 1.

3.2 IDENTIFICATION

A. Comply with requirements in Section 26 05 53 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION 26 28 16

SECTION 26 51 00

INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior lighting fixtures, lamps, and ballasts.
2. Emergency lighting units.
3. Exit signs.
4. Lighting fixture supports.
5. Retrofit kits for fluorescent lighting fixtures.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, and finishes.

B. Shop Drawings: Show details of nonstandard or custom lighting fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, from manufacturer.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, product(s) indicated on Drawings and as follows:

1. Eaton.

2. Failsafe.
3. Halo.
4. H.E. Williams.
5. Lithonia.
6. Lumark.
7. Metalux.
8. Mule.
9. Sure-Lites.

2.2 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

B. Metal Parts: Free of burrs and sharp corners and edges.

C. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.

D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

E. Diffusers and Globes:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

   a. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.
   b. UV stabilized.

2. Glass: Annealed crystal glass unless otherwise indicated.

2.3 EXIT SIGNS

A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Performance of System: Emergency illumination shall be provided for a minimum of 1-1⁄ 2 hours in the event of failure of normal lighting.

C. Internally Lighted Signs:

1. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.
2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.

a. Battery: Sealed, maintenance-free, nickel-cadmium type.
b. Charger: Fully automatic, solid-state type with sealed transfer relay.
c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

2.4 EMERGENCY LIGHTING UNITS

A. General Requirements for Emergency Lighting Units: Self-contained units complying with UL 924.

1. Battery: Sealed, maintenance-free, lead-acid type.
2. Charger: Fully automatic, solid-state type with sealed transfer relay.
3. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
6. Wire Guard: Heavy-chrome-plated wire guard protects lamp heads or fixtures.
7. Integral Time-Delay Relay: Holds unit on for fixed interval of 15 minutes when power is restored after an outage.

B. Performance of System: Emergency illumination shall be provided for a minimum of 1-1⁄ 2 hours in the event of failure of normal lighting.

2.5 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Section 26 05 29 "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, 1/2-inch (13-mm) steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm).

E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage (2.68 mm).

F. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.

G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

2.6 RETROFIT KITS FOR FLUORESCENT LIGHTING FIXTURES

A. Ballast and Lamp Change Kit: UL 1598, Type II. Suitable for changing existing ballast, lamps, and sockets.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.

B. Comply with NFPA 70 for minimum fixture supports.

C. Suspended Lighting Fixture Support:

1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.

D. Air-Handling Lighting Fixtures: Install with dampers closed and ready for adjustment.

E. Adjust aimable lighting fixtures to provide required light intensities.

F. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

3.2 FIELD QUALITY CONTROL

A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END OF SECTION 26 51 00

SECTION 26 56 00

EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior luminaires with lamps and ballasts.
2. Luminaire-mounted photoelectric relays.

1.2 ACTION SUBMITTALS

A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, and finishes.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with IEEE C2, "National Electrical Safety Code."

C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, product(s) indicated on Drawings and as follows:

1. Eaton.
2. Failsafe.
3. Halo.
4. H.E. Williams.
5. Lithonia.
6. Lumark.
7. Metalux.
8. Mule.
9. Sure-Lites.

2.2 GENERAL REQUIREMENTS FOR LUMINAIRES

A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.

1. LER Tests Incandescent Fixtures: Where LER is specified, test according to NEMA LE 5A.
2. LER Tests HID Fixtures: Where LER is specified, test according to NEMA LE 5B.

B. Lateral Light Distribution Patterns: Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.

C. Metal Parts: Free of burrs and sharp corners and edges.

D. Sheet Metal Components: Corrosion-resistant aluminum unless otherwise indicated. Form and support to prevent warping and sagging.

E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.

F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.

G. Exposed Hardware Material: Stainless steel.

H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

I. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.

J. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.

K. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

L. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

M. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. 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. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
2. Exterior Surfaces: 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 selected from manufacturer's standard catalog of colors.

N. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
2. 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.
3. Class I, Clear Anodic Finish: AA-M32C22A41 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
4. 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 611.

    a. Color: As selected from manufacturer's standard catalog of colors.

O. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp and ballast characteristics:

    a. "USES ONLY" and include specific lamp type.
    b. Lamp tube configuration (twin, quad, triple), base type, and nominal wattage for compact fluorescent luminaires.
    c. Lamp type, wattage, bulb type (ED17, BD56, etc.) and coating (clear or coated) for HID luminaires.
    d. Start type (preheat, rapid start, instant start) compact fluorescent luminaires.
    e. ANSI ballast type (M98, M57, etc.) for HID luminaires.
    f. CCT and CRI for all luminaires.

PART 3 - EXECUTION

3.1 LUMINAIRE INSTALLATION

A. Install lamps in each luminaire.

B. Fasten luminaire to indicated structural supports.

1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

C. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.

3.2 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Section 26 05 33 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- (0.254-mm-) thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

END OF SECTION 26 56 00

SECTION 27 05 00

COMMON REQUIREMENTS FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 SLEEVES FOR PATHWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized-steel sheet.

D. Sleeve Seals: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
2. Pressure Plates: Carbon steel. Include two for each sealing element.
3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.2 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 GENERAL COMMUNICATION EQUIPMENT INSTALLATION REQUIREMENTS

A. Install communication equipment to allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.

B. Install communication equipment to provide for ease of disconnecting the equipment with minimum interference to other installations.

C. Install communication equipment to allow right of way for piping and conduit installed at required slope.

D. Install communication equipment to ensure that connecting pathways and cables are clear of obstructions and of the working and access space of other equipment.

E. Install required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

F. Coordinate location of access panels and doors for communications items that are behind finished surfaces or otherwise concealed. Comply with requirements in Division 08 Section "Access Doors and Frames."

G. Install sleeve and sleeve seals of type and number required for sealing communication service penetrations of exterior walls.

3.2 SLEEVE AND SLEEVE-SEALS INSTALLATION

A. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

B. Cut sleeves to length for mounting flush with both wall surfaces.

C. Extend sleeves installed in floors 2 inches above finished floor level.

D. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and cable unless sleeve seal is to be installed.

E. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

F. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and cable, using joint sealant appropriate for size, depth, and location of joint according to Division 07 Section "Joint Sealants."

G. Roof-Penetration Sleeves: Seal penetration of individual cables with flexible boot-type flashing units applied in coordination with roofing work.

H. Aboveground Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeves to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

I. Underground Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between cable and sleeve for installing mechanical sleeve seals.

3.3 FIRESTOPPING

A. Apply firestopping to communications penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Comply with requirements in Division 07 Section "Penetration Firestopping."

END OF SECTION 27 05 00

SECTION 27 10 00
COMMUNICATIONS SYSTEMS STRUCTURED CABLING

GENERAL

1.1 SECTION INCLUDES

A. Communication and data processing structured cabling systems, enclosures and accessories.

1.2 SUMMARY OF WORK

A. Provide all voice and data cable runs as depicted on the plans.

B. All new voice cables will be terminated onto 24 port unloaded patch panel. All new data cables will be terminated onto a separate 24 port unloaded patch panel.

C. Contractor will provide 6U vertical lockable cabinet, Black Box RMT353A-R2 or similar.

D. Points of Contact (POCs) for this project:

Onsite: Jeremy Newton
(573) 690-1416

Offsite J6/DOIM: Mitch Simpson
(573) 638-9500 ext 37603

E. The contractor will coordinate site visits and work schedules in advance with both the J6/DOIM and site POCs.

1.3 REFERENCES

A. National Fire Protection Association, Inc., NFPA 70: National Electric Code (NEC), 2005 or as adopted by authority having jurisdiction..
1. NEC Article 250: Grounding and Bonding.
2. NEC Article 300: Wiring Methods.
3. NEC Article 352: Rigid Non-Metallic Conduit Type RNC.
4. NEC Article 388: Surface Non-Metallic Raceways.
5. NEC Article 800: Communications Circuits.
6. NEC Article 725: Remote Control, Signaling, and Power-Limited Circuits.
7. NEC Article 770: Optical Fiber Cables and Raceway.

B. Underwriter's Laboratory, Inc. (UL).
1. UL-5A: Standard for Non-Metallic Raceways and Fittings.
2. UL-5C: Standard for Surface Raceways and Fittings for Use with Data, Signal, and Control Circuits.
3. UL-50: Standard for Enclosures for Electrical Equipment.
4. UL-94-V0: Tests for Flammability of Plastic Materials.
5. UL1863: Standard for Safety- Communications Circuit Accessories, 4th Ed, 2004.

C. National Electrical Manufacturer's Association (NEMA).
1. ANSI/NEMA WD-6-2002: Wiring Devices - Dimensional Requirements.
2. NEMA 250-2003: Enclosures for Electrical Equipment.

D. ANSI/EIA-310-D, Cabinets, Racks, Panels, and Associated Equipment, 1992.

E. ANSI-J-STD-607A, Commercial Building Grounding and Bonding Requirements for Telecommunications, 2002.

F. ANSI/TIA/EIA-569-B, Commercial Building Standard for Telecommunications Pathways and Spaces, 2003.

G. ANSI/TIA/EIA-568-B.1, Commercial Building Telecommunications Cabling Standard, Part 1: General Requirements, 2001.

H. ANSI/TIA/EIA-568-B.2, Commercial Building Telecommunications Cabling Standard (and all published addenda), Part 2: Balanced Twisted Pair Cabling Components, 2001.

I. ANSI/TIA/EIA-568-B.3, Optical Fiber Cabling Components Standard, 2000.

J. ANSI/TIA/EIA-606-A, Administration Standard for Commercial Telecommunications Infrastructure, 2002.

K. ANSI/TIA/EIA-942, Telecommunications Infrastructure Standard for Data Centers, 2005.

L. Federal Communications Commission (FCC), Code of Federal Regulations, Part 68: Connection of Terminal Equipment to the Telephone Network, 1998.

M. U.S. Public Law 336. 101st Congress, ADA: Americans with Disabilities Act of 1992.

N. ISO/IEC 11801, Information Technology - Generic Cabling for Customer Premises, 2002.

O. ISO/IEC 18010, Information Technology - Pathways and Spaces for Customer Premises Cabling, 2005.

P. ISO/IEC 14763-1, Information Technology - Implementation and Operation of Customer Premises Cabling - Part 1: Administration, 2004.

Q. BS EN 50173-1, Information Technology - Generic Cabling Systems - Part 1: General Requirements, 2002.

R. BS EN 50174-1, Information Technology - Cabling Installation - Part 1: Specification and Quality Assurance, 2001.

S. Telcordia GR-63-CORE, NEBS Requirements: Physical Protection, 2002.

T. Telcordia GR-487-CORE, Electronic Equipment Cabinets, 2000.

U. Telecommunications Distribution Methods Manual, 10th Ed., Building Industry Consulting Services International (BICSI), 2003.

V. Information Transport Systems Installation Manual, 4th Ed., Building Industry Consulting Services International (BICSI), 2004.

W. IEEE 802.3af, Data Terminal Equipment (DTE) Power Over Media Dependent Interface (MDI), 2003.

X. IEEE 802.3ab, Specification for 1000 Mb/s (Gigabit Ethernet) Operation over Category 5 or higher 4-Pair Balanced Twisted Pair Cabling, 1999.

Y. ANSI/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, 2002.

Z. IEEE 802.3an (current draft), Specification for 10 Gb/s (10 Gigabit Ethernet) Operation over Category 6 or higher 4-Pair Balanced Twisted Pair Cabling.

AA. TIA/TSB-155 (current draft), Telecommunications System Bulletin: Characterizing Existing

Category 6 cabling for 10 Gb/s Ethernet Operation over 55 Meters Channel Length.

1.4 SUBMITTALS

A. Submit under provisions of General Electrical Requirements Specifications Section.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. Shop Drawings: Provide diagrams, schematics of networked systems indicating system performance and identifying components with location.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum of 5 years' experience manufacturing products specified in this Section.

B. Installer Qualifications: Minimum of 5 years' experience installing products specified in this Section. Must be appropriately certified and have at minimum a BICSI level II installer on staff to be present during any installation or testing.

C. Product Requirements:
   1. Product shall be manufactured by an ISO 9001-2000 Certified facility.
   2. Product shall be free from defects in material or workmanship.
   3. Critical manufacturing processes of the product shall have documented in-process inspections and production testing according to ISO 9001-2000.
   4. Product shall be lot-traceable by date code.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.7 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.8 WARRANTY

A. Product is warranted free of defects in material or workmanship.

B. Product is warranted to perform the intended function within design limits.

C. Minimum 25 year warranty on cabling and connectivity.

D. Installed components shall be granted a full link or channel warranty by Hubbell Premise Wiring under the conditions stated below.
   1. Construction is performed by an installer that is certified by the Hubbell Mission Critical training program.
   2. Contractors performing the certified installation are properly registered in the Hubbell

Mission Critical warranty program.

3. The link or channel components are supplied entirely by Hubbell (including patch cords for channel).
4. Cable used in the installation is qualified and recognized by Hubbell.
5. Links or channels in the installation are properly documented and tested with a "PASS" result.
6. Required test results and project documentation is submitted to Hubbell by the registered contractor.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Manufacturer: Hubbell Premise Wiring.

B. Alternative Manufacturers: Leviton, Panduit.

C. Requests for substitutions will be considered in accordance with provisions General Electrical Requirements Specifications Section 260500.

2.2 PATCH PANELS

A. Hubbell model UDX24E (unloaded).

2.3 JACKS

A. Jacks: Jacks shall be made by Hubbell Premise Wiring and be UL LISTED 1863 and CSA certified. Jacks shall exceed IEEE 802.3af DTE Power specification to 4 times the rated current limits with no degradation of performance or materials.
   1. UTP Jack
      a. Jack Wiring: B Wired
      b. Data Jacks (Blue): HXJ6B
      c. Phone Jacks (White): HXJ6W

2.4 FACEPLATES AND CONNECTORS

1. Faceplates: Faceplates shall be white plastic and by same manufacturer as jacks.
2. All Data/Phone locations must use a 2 gang box with mud ring.
3. Product: Rear-Loading as manufactured by Hubbell-Premise, Inc.
   a. 1 Port Faceplate: IFP11W
   b. 2 Port Faceplate: IFP12W

2.5 COPPER HORIZONTAL CABLING

A. Category 6 Performance and Design Requirements:
   1. Cable shall exceed Category 6 transmission requirements specified in ANSI/TIA/EIA-568-B.2-1, and shall be tested to 500 MHz.
   2. Cable shall exceed IEEE 802.3af DTE Power specification to 4 times the rated current limits with no degradation of performance or materials.
   3. Cable shall be error free Gigabit Ethernet performance to IEEE 802.3ab.
   4. Cable shall exceed the requirements of TIA/TSB-155: 10 Gb/s Ethernet Operation over 55 Meters Channel Length.
   5. Cable shall meet or exceed the 4-connector channel performance requirements of Category 6, per the ANSI/TIA/EIA-568-B.2-1 standard.

6. Product: Construction shall be four twisted pairs of 23 AWG insulated solid conductors, with a ripcord, surrounded by a tight outer jacket. UTP Standard Riser, Category 6 - NextSpeed Riser as manufactured by Hubbell-Premise, 1nc.
7. Plenum Cable: Cable Listed for use in air-handling spaces. Provide plenum cable if cable is installed in air-handling spaces.
8. Cables shall be color coded:
   a. Data: Blue
   b. Phone: White

B. Approved manufacturers:
   1. Berk-Tek, Mohawk, Superior Essex.

2.6 PATCH CORDS, STATION CORDS AND CROSS CONNECT WIRES

A. Provided and installed by owner.

2.7 FIBER-OPTIC CABLES, CONNECTORS AND TERMINAL EQUIPMENT

A. Cables: Factory fabricated, jacketed, low loss, glass type, fiber optic, tight-buffered, multimode, graded index, operating at 850 and 1300 nm.
   1) Dimensions: 50-micrometer core diameter; 125-micrometer cladding diameter.
   2) Maximum Attenuation: 3.50 dB/km at 850 nm; 1.25 dB/km at 1300 nm.
   3) Minimum Modal Bandwidth: 500 MHz/km at 850 nm; 500 MHz/km at 1300 nm.
   4) Operating Temperature Range: -20 deg C to +70 deg C.
   5) Backbone, Strands per Cable: 4.
   6) Non-Plenum cable: Equal to Mohawk/CDT #M9C038, Plenum-rated cable (where required): Equal to Mohawk/CDT #M9C044
   7) Outdoor in buried conduit: Equal to Mohawk/CDT #M9C151 outdoor central loose tube.
   8) Fiber Optic cable meets EIA-455-41 crush resistance, EIA-455-25 impact resistance, and EIA-455-104 flexure specifications and shall not have greater than eight (8) inch bend radius.

B. Plenum Cable: Cable Listed for use in air-handling spaces. Provide plenum cable if cable is installed in air-handling spaces.

C. Cable Connectors: Quick-connect, simplex- and duplex-type SC couplers with self-centering, axial alignment mechanisms. Insertion loss not more than 0.7 dB. Equal to 2CLICK SC made by Wiring Hubbell Premise.

D. Patch Panel: Provided and installed by owner.

E. Patch Cords: Provided and installed by owner.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates and supporting structures have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. The contractor will perform a site survey with the on or offsite POC to validate the summary of work as stated in this document.

3.2 GENERAL INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. The contractor must perform all services in compliance with provided NGMO Standard Operating Procedure.

1. The contractor will provide As-Built documents in both hard and soft copy form upon completion of project. Hard copy and Soft copy documents will consist of individual files, by building, with cable count, cable pairs, strand count, jack number and locations, GPS coordinates of all hand holes, product specification documents and warranty information of all products installed. All new cabling will be labeled with a permanent label on the cable at both ends as well as the faceplate of the jack according to Section 4. LABELING in the NGMO Standard Operating Procedures document (see attached). All OSP cables will be tagged/labeled with a waterproof tag using permanent indelible ink (can be affixed with zip ties) in each HH they pass thru with the building it is coming from and the building it is going to along with the strand/pair count of that particular cable.
2. The contractor will be responsible for all utility locates.
3. New cable runs are to be certified and test results are to be provided to the DOIM/ J6 POC.

C. All WAP runs will have a label affixed to the ceiling tile grid work where the drop is located.

D. All cabling is to be suspended above drop ceiling with J-hooks where applicable. All runs must be kept straight with a neat appearance. No diagonal runs.

E. Zip ties will not be allowed. All cables will be attached and bundled using Velcro straps.

F. Metal conduit will be used for all surface mount locations. If drywall is available, the runs will be flush mounted inside the walls.

G. Upon contract completion, the contractor will schedule a site survey with the J6/DOIM POC. The J6/DOIM appointed representative will validate the contractor's work and compliance with this statement of work prior to payment authorization.

3.3 QUALITY CONTROL - RACEWAY TESTING

A. Verify layout of system to contract drawings.

B. Raceway system shall be free of open gaps and exposed uneven cuts.

C. All outlets, boxes, and enclosures shall be fastened securely to walls or permanent structures.

D. Verify power wires and data cables are separated by a physical barrier. CAUTION: Power wires and data cables shall not be combined in any channel.

3.4 QUALITY CONTROL - COMMUNICATION CABINET TESTING

A. Verify the cabinet wall location according to contract drawings.

B. Verify grounding and bonding to applicable standards and codes.

C. Verify cabinet wall-mounting screws in concrete or cinder block anchors are bottomed fully with no gaps under the heads.

D. Copper and fiber link testing is performed after cable termination.

3.5 QUALITY CONTROL - PATCH PANEL TESTING

A. Verify the cabinet wall location according to contract drawings.

B. Panels shall be tested as part of the installed horizontal or backbone cabling system.

C. Each link or channel in the horizontal or backbone cabling system shall be identified and tested individually, using an industry standard level III tester with proper settings, including the correct cable NVP value.

D. Each backbone or horizontal link/channel shall be tested to Category 6 parameters listed in the table below. (Note: a level III tester will produce all results below automatically)

E. A "PASS" indication shall be obtained for each channel or link, using a level III tester.

F. Completed test reports shall be submitted per contract requirements of Division 01: "Field Test Reporting".

G. Refer to warranty provisions in Part 1 for the Hubbell link or channel full coverage warranty.

3.6 QUALITY CONTROL - COPPER HORIZONTAL CABLING TESTING

A. Preparation:
1. Horizontal pathways (conduit, cable tray, raceway, etc.) shall be fully deployed from the TR or TE to each wall plate location according to applicable codes and standards.
2. Metallic horizontal cable pathways shall be bonded to an approved ground according to ANSI-J-STD-607.

B. Installation:
1. Pull cable into conduits, or place into raceway or cable tray as specified. Do not exceed 25 Lb pull force per cable. Use appropriate lubricants as required to reduce pulling friction.
2. All exposed wiring shall be installed in surface raceway.
3. All wiring above ceilings or below access floors shall be installed in cable tray or open-top cable hangers.
4. Cable slack and service loops shall be stored properly above the ceiling or under the access floor. A "figure-eight" service loop is recommended for Category 6 cabling to reduce EMI coupling.
5. Pathway fill ratio in conduit, tray, raceway, etc. shall not exceed 40% of pathway cross-sectional area.
6. Installed cable bend radius shall be greater than 4X cable diameter. Avoid kinking or twisting the cable during installation.
7. Do not over-tighten cable ties, and do not use staples or clamps to anchor cables. Velcro straps are recommended.
8. Recommended spacing of cable supports above the ceiling shall be 48 inches (1219 mm).
9. Maintain the following clearances from EMI sources:
   a. Power cable: 6 inches (152 mm).
   b. Florescent lights: 12 inches (305 mm).
   c. Transformers and electrical service enclosures: 36 inches (914 mm).
10. Communications cabling that must cross power cables or conduit shall cross at a 90-degree angle, and shall not make physical contact.
11. Length of each horizontal cable run from the TR to the wall outlet shall not exceed 90 meters.

12. Leave sufficient slack for 90 degree sweeps at all vertical drops.
13. Do not install cable in wet areas, or in proximity to hot water pipes or boilers.
14. Cable ends for termination shall be clean and free from crush marks, cuts, or kinks left from pulling operations.
15. Installed cable jackets shall have no abrasions with exposed conductor insulation or bare copper shiners". The installer is responsible to replace damaged cables.
16. Horizontal cables extending from mounted jacks or panels shall maintain a minimum bend radius of at least 4 times the cable diameter.
17. Firestop all cable penetrations through fire-rated barriers per local codes.
18. For termination of panels in the TR, refer to Division 27: "Communications Termination Blocks and Patch Panels".
19. For termination of jacks in the wall outlet, refer to Division 27: "Communications Faceplates and Connectors".
20. All cabling terminating in the telecommunications room (MDF/IDF) must have 10' of slack and be installed in an extended loop[meeting all BICSI requirements and best practices.

C. Field Quality Control:
1. Cables are tested in the fully terminated condition, as part of the installed horizontal cabling system. Jacks in the wall outlet, and panels in the TR are to be terminated complete, with faceplates assembled complete and properly mounted.
2. Each link or channel in the horizontal cabling system shall be identified and tested individually, using an industry standard level III tester with correct settings.
3. Test cables in the horizontal channel or link for the parameters listed below.
4. A "PASS" indication shall be obtained for each channel or link, using a level III tester. The installer is responsible to correct any test failures.
5. Completed test reports shall be submitted per contract requirements of Division 01: "Field Test Reporting".
6. Refer to "Warranty" in Part 1 for provisions of the Hubbell link or channel full coverage warranty.

3.7 OPTICAL FIBER CONNECTS

A. Preparation:
1. Prior to field termination, horizontal or backbone fiber cabling shall be fully deployed throughout the building according to applicable codes and standards.
2. Telecommunications outlet locations, patch panels in each TR, and patch panels in the ER shall be installed and terminated complete per manufacturer's instructions, and applicable codes and standards.
3. Where applicable, any consolidation point or MUTOA locations shall be permanently mounted and terminated complete.
4. Faceplates at each TO shall be assembled complete and properly mounted.

B. Installation:
1. Remove fiber patch cords from bags and apply channel or port identification labels per specification. Patch cord lengths should match the distance between connection points, with enough slack for cable management and bend radius control.
2. For panel cross-connections in the ER or TR, lay the patch cords into front cable organizer. Remove dust caps and plug the patch cords into the respective panel ports. Installed fiber patch cords should be neat, with no kinks, tangles, or tight bends.
3. To connect workstation equipment to the TO, route the patch cord behind furniture and plug into the network port. Patch cords should not interfere with the operator space or electrical cords. (Note: workstation cords are normally installed after

placement of office furniture).

4. Patch cord minimum installed bend radius shall be 1.1 inches (28 mm).
5. All cabling terminating at a communications outlet (jack) must have 3.28’ (1m) of slack.

C. Field Quality Control:

1. If required, fiber patch cords are field tested only as part of a completely installed horizontal or backbone cable channel. A fiber channel includes the installed permanent link with the patch cords connected on each end.
2. For testing an installed fiber cable channel, including the patch cords, each channel in the horizontal and backbone cabling system shall be identified and tested individually for dB insertion loss, using an industry standard optical loss test set (OLTS).
3. Each channel, including patch cords on each end, shall be within the dB insertion loss limit (or budget) assigned to each channel. NOTE: The channel insertion loss budget is based on the cable length and number of mated connectors.
4. If testing is required per TIA/EIA-TSB-140, Tier 2, an OTDR trace of each channel must be performed in addition to the dB insertion loss measurement. Local attenuation events within the fiber channel, as measured with the OTDR, shall be within prescribed limits.
5. Completed test reports shall be submitted per contract requirements of Division 01: "Field Test Reporting".
6. Refer to "Warranty" in PART 1 for provisions of the Hubbell channel full coverage warranty.

3.8 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 27 10 00

SECTION 28 05 00

COMMON REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 SLEEVES FOR PATHWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized-steel sheet.

D. Sleeve Seals: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
2. Pressure Plates: Carbon steel. Include two for each sealing element.
3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.2 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, non-metallic aggregate grout, non-corrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 GENERAL ELECTRONIC SAFETY AND SECURITY EQUIPMENT INSTALLATION REQUIREMENTS

A. Install electronic safety and security equipment to allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.

B. Install electronic safety and security equipment to provide for ease of disconnecting the equipment with minimum interference to other installations.

C. Install electronic safety and security equipment to allow right of way for piping and conduit installed at required slope.

D. Install electronic safety and security equipment to ensure that connecting pathways and cables are clear of obstructions and of the working and access space of other equipment.

E. Install required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

F. Coordinate location of access panels and doors for electronic safety and security items that are behind finished surfaces or otherwise concealed. Comply with requirements in Division 08 Section "Access Doors and Frames."

G. Install sleeve and sleeve seals of type and number required for sealing electronic safety and security service penetrations of exterior walls.

3.2 SLEEVE AND SLEEVE-SEALS INSTALLATION

A. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

B. Cut sleeves to length for mounting flush with both wall surfaces.

C. Extend sleeves installed in floors 2 inches above finished floor level.

D. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and cable unless sleeve seal is to be installed.

E. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

F. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and cable, using joint sealant appropriate for size, depth, and location of joint according to Division 07 Section "Joint Sealants."

G. Roof-Penetration Sleeves: Seal penetration of individual cables with flexible boot-type flashing units applied in coordination with roofing work.

H. Aboveground Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeves to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

I. Underground Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between cable and sleeve for installing mechanical sleeve seals.

3.3 FIRESTOPPING

A. Apply firestopping to electronic safety and security penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Comply with requirements in Division 07 Section "Penetration Firestopping."

END OF SECTION 28 05 00

SECTION 28 46 00

FIRE DETECTION AND ALARM

PART 1 - GENERAL

1.1 SUMMARY

A. This Section covers fire alarm systems, including initiating devices, notification appliances, controls, and supervisory devices.

B. Work covered by this section includes the furnishing of labor, equipment, and materials for installation of the fire alarm system as indicated on the drawings and specifications.

C. The Fire Detection and Alarm System shall consist of all necessary hardware equipment and programming to perform the following functions:
   1. Fire alarm system detection and notification operations.
   2. Control and monitoring of elevators, smoke control equipment, door hold-open devices, fire suppression systems, emergency power systems, and other equipment as indicated in the drawings and specifications.

1.2 ACCEPTABLE MANUFACTURERS

A. Manufacturers: The equipment and service described in this specification are those supplied and supported by SimplexGrinnell and represent the base bid for the equipment.

   1. Subject to compliance with the requirements of this specification, provide alternate products by one of the following:
      a. Notifier
      b. Siemens

B. Being listed as an acceptable Manufacturer in no way relieves obligation to provide all equipment and features in accordance with these specifications.

1.3 RELATED DOCUMENTS

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

B. The work covered by this section is to be coordinated with related work as specified elsewhere in the specifications. Requirements of the following sections apply:
   1. Division 260500: "Basic Electrical Materials and Methods."
   2. Division 261200: "Raceways and Boxes"
   3. Division 223000: "Fire Sprinkler System"

C. The system and all associated operations shall be in accordance with the following:
   1. Guidelines of the following Building Code: BOCA
   2. NFPA 72, National Fire Alarm Code
   3. NFPA 70, National Electrical Code
   4. NFPA 101, Life Safety Code
   5. NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems

6. Other applicable NFPA standards
7. Local Jurisdictional Adopted Codes and Standards
8. ADA Accessibility Guidelines

1.4 SYSTEM DESCRIPTION

A. General: Provide a complete, non-coded addressable, microprocessor-based fire alarm system with initiating devices, notification appliances, and monitoring and control devices as indicated on the drawings and as specified herein.

B. Wiring/Signal Transmission:
1. Transmission shall be addressable signal transmission, dedicated to fire alarm service only.
2. System connections for initiating (signaling) circuits and notification appliance circuits shall be Class B.
3. Circuit Supervision: Circuit faults shall be indicated by a trouble signal at the FACP. Provide a distinctive indicating audible tone and alphanumeric annunciation.

1.5 SUBMITTALS

A. General: Submit the following according to Conditions of Contract and Division 1 Specification Sections.
1. Product data sheets for system components highlighted to indicate the specific products, features, or functions required to meet this specification. Alternate or as-equal products submitted under this contract must provide a detailed line-by-line comparison of how the submitted product meets, exceeds, or does not comply with this specification.
2. Wiring diagrams from manufacturer.
3. Shop drawings showing system details including location of FACP, all devices, circuiting and details of graphic annunciator.
4. System Power and battery charts with performance graphs and voltage drop calculations to assure that the system will operate per the prescribed backup time periods and under all voltage conditions per all applicable standards.
5. System operation description including method of operation and supervision of each type of circuit and sequence of operations for all manually and automatically initiated system inputs and outputs. A list of all input and output points in the system shall be provided with a label indicating location or use of SLC, NAC, RAC, Sensor, and auxiliary control circuits.
6. Operating instructions for FACP.
7. Operation and maintenance data for inclusion in Operating and Maintenance Manual. Include data for each type product, including all features and operating sequences, both automatic and manual. Provide the names, addresses, and telephone numbers of service organizations.
8. Product certification signed by the manufacturer of the fire alarm system components certifying that their products comply with indicated requirements.
9. Record of field tests of system.

B. Submission to Authority Having Jurisdiction: In addition to routine submission of the above material, make an identical submission to the authority having jurisdiction. Include copies of shop drawings as required to depict component locations to facilitate review. Upon receipt of comments from the Authority, make resubmissions if required to make clarifications or revisions to obtain approval.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A factory authorized installer is to perform the work of this section.

B. Each and all items of the Fire Alarm System shall be listed as a product of a single fire alarm system manufacturer under the appropriate category by Underwriters Laboratories, Inc. (UL), and shall bear the "UL" label.

1.7 MAINTENANCE SERVICE

A. Maintenance Service Contract: Provide maintenance of fire alarm systems and equipment for a period of 12 months, using factory-authorized service representatives.

B. Basic Services: Systematic, routine maintenance visits on a basis at times scheduled with the Owner. In addition, respond to service calls within 24 hours of notification of system trouble. Adjust and replace defective parts and components with original manufacturer's replacement parts, components, and supplies.

C. Additional Services: Perform services within the above 12-month period not classified as routine maintenance or as warranty work when authorized in writing. Compensation for additional services must be agreed upon in writing prior to performing services.

D. Renewal of Maintenance Service Contract: No later than 60 days prior to the expiration of the maintenance services contract, deliver to the Owner a proposal to provide contract maintenance and repair services for an additional one-year term. Owner will be under no obligation to accept maintenance service contract renewal proposal.

1.8 EXTRA MATERIALS

A. General: Furnish extra materials, packaged with protective covering for storage, and identified with labels clearly describing contents as follows:

B. Strobe Units: Furnish quantity equal to 10 percent of the number of units installed, but not less than one.

C. Smoke Sensors, Fire Detectors, and Flame Detectors: Furnish quantity equal to 10 percent of the number of units of each type installed but not less than one of each type.

D. Sensor Bases: Furnish quantity equal to 2 percent of the number of units of each type installed but not less than one of each type.

PART 2 - PRODUCTS

2.1 FIRE ALARM CONTROL PANEL

A. General: Comply with UL 864, "Control Units and Accessories for Fire Alarm Systems".

B. The following FACP hardware shall be provided:

1. Power Limited base panel with red cabinet and door, 120 VAC input power.
2. 100 point capacity where (1) point equals (1) monitor (input) or (1) control (output).
   a.

3. From all battery charging circuits in the system provide battery voltage and ammeter readouts on the FACP LCD Display.
4. One Auxiliary electronically resettable fused 2A @24VDC Output, with programmable disconnect operation for 4-wire detector reset.
5. One Auxiliary Relay, SPDT 2A @32VDC, programmable as a trouble relay, either as normally energized or de-energized, or as an auxiliary control.
6. Class B or Class A Addressable Notification Appliance Signaling Line Circuits (SLCs).
   a. Each Addressable Notification Appliance SLC shall be rated at 3A and capable of supporting up to 30 Notification Appliances per channel.
   b. Wiring shall be 18 AWG to 12 AWG unshielded twisted pair wire. Systems that require shielded wire for Notification Appliances shall not be accepted.
   c. A constant voltage under both primary and secondary power conditions shall be maintained at the notification appliance field wiring terminal connections in the FACP to ensure the voltage drop on the circuit is consistent under both primary and secondary power conditions.
   d. For systems that do not provide a constant voltage source at the FACP notification appliance field wiring terminal connections, the fire alarm contractor shall:
      1) Provide separate point-to-point voltage drop calculations for all notification appliances under worst case secondary power specifications, and
      2) Perform a complete functional test of all notification appliances under worst case secondary power conditions.
7. Where required provide Intelligent Remote Battery Charger for charging up to 33 Ah batteries.
8. Power Supplies with Class B or Class A integral Intelligent Addressable Notification Appliance Signaling Line Circuits (SLCs) for system expansion.
   a. Each Addressable Notification Appliance SLC shall be rated at 3A and capable of supporting up to 30 Notification Appliances per channel.
   b. Wiring shall be 18 AWG to 12 AWG unshielded twisted pair wire. Systems that require shielded wire for Notification Appliances shall not be accepted.
   c. A constant voltage under both primary and secondary power conditions shall be maintained at the notification appliance field wiring terminal connections in the FACP to ensure the voltage drop on the circuit is consistent under both primary and secondary power conditions.
   d. For systems that do not provide a constant voltage source at the FACP notification appliance field wiring terminal connections, the fire alarm contractor shall:
      1) Provide separate point-to-point voltage drop calculations for all notification appliances under worst case secondary power specifications, and
      2) Perform a complete functional test of all notification appliances under worst case secondary power conditions.

9. The FACP shall support up to (2) RS-232-C ports and one service port. All (2) RS-232 Ports shall be capable of two-way communications.
10. Remote Unit Interface: supervised serial communication channel for control and monitoring of remotely located annunciators and I/O panels.
11. Programmable DACT for either Common Event Reporting or per Point Reporting.
12. Fire Panel Internet Interface to provide supplemental notification and remote user access to the FACP using Ethernet and TCP/IP communications protocol compatible with IEEE Standard 802.3.

C. Cabinet: Lockable steel enclosure. Arrange unit so all operations required for testing or for normal care and maintenance of the system are performed from the front of the enclosure. If

more than a single unit is required to form a complete control unit, provide exactly matching modular unit enclosures.

D. Alphanumeric Display and System Controls: Panel shall include an 80 character, expanded content multi-line LCD display to indicate alarm, supervisory, and component status messages and shall include a keypad for use in entering and executing control commands.

2.2 SMOKE SENSORS

A. General: Comply with UL 268, "Smoke Detectors for Fire Protective Signaling Systems." Include the following features:
   1. Factory Nameplate: Serial number and type identification.
   2. Operating Voltage: 24 VDC, nominal.
   3. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore normal operation.

B. Type: Smoke sensors shall be of the photoelectric or combination photoelectric / heat type. Where acceptable per manufacturer specifications, ionization type sensors may be used.

C. Bases: Relay output, sounder and isolator bases shall be supported alternatives to the standard base.

D. Duct Smoke Sensor: Photoelectric type, with sampling tube of design and dimensions as recommended by the manufacturer for the specific duct size and installation conditions where applied. Sensor includes relay as required for fan shutdown.
   1. Environmental compensation, programmable sensitivity settings, status testing, and monitoring of sensor dirt accumulation for the duct sensor shall be provided by the FACP.
   2. The Duct Housing shall provide a supervised relay driver circuit for driving up to 15 relays with a single "Form C" contact rated at 7A@ 28VDC or 10A@ 120VAC. This auxiliary relay output shall be fully programmable. Relay shall be mounted within 3 feet of HVAC control circuit.
   3. Duct Housing shall provide a relay control trouble indicator Yellow LED.
   4. Compact Duct Housing shall have a transparent cover to monitor for the presence of smoke. Cover shall secure to housing by means of four (4) captive fastening screws.
   5. Duct Housing shall provide two (2) Test Ports for measuring airflow and for testing. These ports will allow aerosol injection in order to test the activation of the duct smoke sensor.
   6. Duct Housing shall provide a magnetic test area and Red sensor status LED.
   7. For maintenance purposes, it shall be possible to clean the duct housing sampling tubes by accessing them through the duct housing front cover.
   8. Each duct sensor shall have a Remote Test Station with an alarm LED and test switch.
   9. A NEMA 4X weatherproof duct housing enclosure shall provide for the circulation of conditioned air around the internally mounted addressable duct sensor housing to maintain the sensor housing at its rated temperature range. The housing shall be UL Listed to Standard 268A.

2.3 STANDARD ALARM NOTIFICATION APPLIANCES

A. Horn: Piezoelectric type horn shall be listed to UL 464. The horn shall have a minimum sound pressure level of 85 dBA @ 24VDC. The horn shall mount directly to a standard single gang, double gang or 4" square electrical box, without the use of special adapter or trim rings.

B. Visible/Only: Strobe shall be listed to UL 1971. The V/O shall consist of a xenon flash tube and associated lens/reflector system. The V/O enclosure shall mount directly to standard single gang, double gang or 4" square electrical box, without the use of special adapters or trim rings. V/O appliances shall be provided with different minimum flash intensities of 15cd, 75cd and 110cd. Provide a label inside the strobe lens to indicate the listed candela rating of the specific Visible/Only appliance.

C. Speaker/Visible: Combination Speaker/Visible (S/V) Notification Appliances shall be listed to UL 1971 and UL 464. The strobe light shall consist of a xenon flash tube and associated lens/reflector system. Provide a label inside the strobe lens to indicate the listed candela rating of the specific strobe. The speaker shall have a minimum sound pressure level of 85 dBA @ 24VDC. The speaker/visible enclosure shall mount directly to standard single gang, double gang or 4" square electrical box, without the use of special adapters or trim rings. Speaker strobe shall have power taps (from ¼ watt to 2 watts).

D. Notification Appliance Circuit provides synchronization of strobes at a rate of 1Hz and operates horns with a March Time cadence operation. The circuit shall provide the capability to silence the audible signals, while the strobes continue to flash, over a single pair of wires. The capability to synchronize multiple notification appliance circuits shall be provided.

E. Accessories: The contractor shall furnish the necessary accessories.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install system components and all associated devices in accordance with applicable NFPA Standards and manufacturer's recommendations.

B. Installation personnel shall be supervised by persons who are qualified and experienced in the installation, inspection, and testing of fire alarm systems. Examples of qualified personnel shall include, but not be limited to, the following:
   1. Factory trained and certified personnel.
   2. National Institute of Certification in Engineering Technologies (NICET) fire alarm level II certified personnel.
   3. Personnel licensed or certified by state or local authority.

3.2 EQUIPMENT INSTALLATION

A. Furnish and install a complete Fire Alarm System as described herein and as shown on the plans. Include sufficient control unit(s), annunciator(s), manual stations, automatic fire detectors, smoke detectors, audible and visible notification appliances, wiring, terminations, electrical boxes, and all other necessary material for a complete operating system.

B. Existing Fire Alarm Equipment shall be maintained fully operational until the new equipment has been tested and accepted.

C. Equipment Removal: After acceptance of the new fire alarm system, disconnect and remove the existing fire alarm equipment and restore damaged surfaces. Package operational fire alarm and

detection equipment that has been removed and deliver to the Owner. Remove from the site and legally dispose of the remainder of the existing material.

D. Water-Flow and Valve Supervisory Switches: Connect for each sprinkler valve required to be supervised.

E. Device Location-Indicating Lights: Locate in the public space immediately adjacent to the device they monitor.

3.3 WIRING INSTALLATION

A. System Wiring: Wire and cable shall be a type listed for its intended use by an approval agency acceptable to the Authority Having Jurisdiction (AH and shall be installed in accordance with the appropriate articles from the current approved edition of NFPA 70: National Electric Code (NEC).

B. Contractor shall obtain from the Fire Alarm System Manufacturer written instruction regarding the appropriate wire/cable to be used for this installation. No deviation from the written instruction shall be made by the Contractor without the prior written approval of the Fire Alarm System Manufacturer.

C. Color Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color code for alarm initiating device circuits wiring and a different color code for supervisory circuits. Color-code notification appliance circuits differently from alarm-initiating circuits. Paint fire alarm system junction boxes and covers red.

D. Fire alarm system wiring shall be installed entirely in EMT conduit. Install in surface metal raceway where devices are to be installed on existing construction.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Provide services of a factory-authorized service representative to supervise the field assembly and connection of components and the pretesting, testing, and adjustment of the system.

B. Service personnel shall be qualified and experienced in the inspection, testing, and maintenance of fire alarm systems. Examples of qualified personnel shall be permitted to include, but shall not be limited to, individuals with the following qualifications:
   1. Factory trained and certified.
   2. National Institute for Certification in Engineering Technologies (NICET) fire alarm certified.
   3. International Municipal Signal Association (IMSA) fire alarm certified.
   4. Certified by a state or local authority.
   5. Trained and qualified personnel employed by an organization listed by a national testing laboratory for the servicing of fire alarm systems.

C. Pretesting: Determine, through pretesting, the conformance of the system to the requirements of the Drawings and Specifications. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new and retest until satisfactory performance and conditions are achieved.

D. Final Test Notice: Provide a 10-day minimum notice in writing when the system is ready for final acceptance testing.

E. Minimum System Tests: Test the system according to the procedures outlined in NFPA 72.

F. Retesting: Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by the system test that the total system meets the Specifications and complies with applicable standards.

G. Report of Tests and Inspections: Provide a written record of inspections, tests, and detailed test results in the form of a test log.

H. Final Test, Certificate of Completion, and Certificate of Occupancy:
   1. Test the system as required by the Authority Having Jurisdiction in order to obtain a certificate of occupancy.

3.5 CLEANING AND ADJUSTING

A. Cleaning: Remove paint splatters and other spots, dirt, and debris. Clean unit internally using methods and materials recommended by manufacturer.

B. Occupancy Adjustments: When requested within one year of date of Substantial Completion, provide on-site assistance in adjusting sound levels and adjusting controls and sensitivities to suit actual occupied conditions. Provide up to three visits to the site for this purpose.

3.6 TRAINING

A. Provide the services of a factory-authorized service representative to demonstrate the system and train Owner's maintenance personnel as specified below.
   1. Train Owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventive maintaining of the system. Provide a minimum of 8 hours' training.
   2. Schedule training with the Owner at least seven days in advance.

END OF SECTION 28 46 00

SECTION 31 00 00

EARTHWORK

PART 1 – GENERAL

1.01 SUMMARY

A. Perform excavation, stripping, stockpiling, filling, compacting, hauling, and grading operations both inside and outside building limits as required for below-grade improvements and to achieve grades and elevations indicated. Provide trenching and backfilling for mechanical and electrical work and utilities.

B. Provide subbase materials, drainage fill, and common fill materials for slabs, pavements, and improvements.

C. Provide suitable fill from off-site if on-site quantities are insufficient or unacceptable, and legally dispose of excess fill off-site.

D. Provide rock excavation without blasting, unless specifically authorized, in unit prices on Bid Proposal and as defined herein.

1.02 PROJECT CONDITIONS

A. A topographical survey has been prepared for this site, refer to drawings.

B. A geotechnical analysis has been prepared for this site, refer to Appendix A.

C. Data on indicated subsurface conditions are not intended as representations or warranties of accuracy or continuity between soil borings. It is expressly understood that the Owner will not be responsible for interpretations or conclusions drawn therefrom by Contractor. Data is made available for the convenience of Contractor. Additional test borings and other exploratory operations may be made by Contractor at no cost to Owner.

D. Locate existing underground utilities in the area of work. Provide adequate means of protection during earthwork operations. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of operating authority.

1.03 TESTING AND INSPECTION

A. Comply with Section 01 45 33 – Special Inspections and Procedures.

B. Testing Laboratory and Reporting: Owner shall provide the services of a qualified independent geotechnical testing laboratory to perform soil testing and inspection service during earthwork operations.

C. Test and analysis of fill material will be performed in accordance with ASTM D698 or ASTM D1557 “Standard” Proctor Density as recommended by testing laboratory

D. Frequency of test: One in-place compaction test should be performed for each 2,500 square feet of fill placed, per lift, with a minimum of three tests per lift, unless otherwise recommended by testing laboratory.

E. Sub-grade shall be approved by testing lab before backfilling begins.

F. Non-conforming work shall be corrected as directed by testing laboratory.

G. Testing laboratory shall submit approved final field density test reports within 7 days of obtaining data. Reports shall identify project, date of testing, test locations, materials, and Contractor’s equipment and methods used.

1.04 SUBMITTALS

A. Comply with Section 01 33 00.

B. Product Data: Submit for approval list of materials and gradations proposed for use.

1.05 QUALITY ASSURANCE

A. Compaction (Unless otherwise indicated in Geotechnical Analysis or as recommended by Testing Laboratory):
   1. Under structures, building slabs, steps, pavements, and walkways, 95% minimum density per ASTM D1557, at moisture content range of 1% below to 3% above optimum moisture content.
   2. Under lawns or unpaved areas, 90% minimum density, ASTM D698, at moisture content range of 3% below to 3% above optimum moisture content.

B. Grading Tolerances Outside Building Lines:
   1. Lawns, unpaved areas, and walks, plus or minus 1-inch.
   2. Pavements, plus or minus ½-inch.

C. Grading Tolerance for Fill Under Building Slabs: Plus, or minus ½-inch measured with 10-foot straightedge.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Topsoil: Material defined as friable clay loam surface soil found in a depth of not less than 4". Satisfactory topsoil is reasonably free of subsoil, clay lumps, stones, objects over 2" in diameter, reproductive parts of noxious weeds, roots, brush, litter, and other objectionable material.

B. Subbase material: Material acceptable for intended use as subbase for paving specified unless noted on the drawings.
   1. Naturally or artificially graded mixture of natural or crushed gravel.

2. Crushed limestone graded from 1” to dust.
3. Crushed slag.
4. Natural or crushed sand, free of silt, clay, loam, friable or soluble materials, and organic matter.
5. Cohesive subgrade: Subgrade soils may be stabilized with hydrated lime, cement, or flyash, or chemical treatment in accordance with AASHTO standards. The quantity of additive required should be determined after the site is stripped of the loose topsoil and the subgrade soils exposed. Actual percentage required shall be determined by independent laboratory tests provided by Contractor and approved by Geotechnical Engineer.
6. Substitute materials may be utilized with prior approval from Geotechnical Engineer.

C. Drainage fill: Washed gravel or crushed stone, ¼” to ¾” size; ASTM C33, Size 67.

D. Common fill: Mineral soil substantially free from organic and unsuitable materials, and free from rock or gravel larger than 2” in diameter, 80% passing No. 40 sieve and not more than 50% passing No. 200 sieve.

E. Structural fill:
1. Inactive silty or sandy clay, with a plasticity index less than 20 and a liquid limit less than 45, free of rocks greater than 6” in diameter.
2. Gravel or sandy gravel free of organic and unsuitable materials and within the following gradation limits: 4” sieve, 100 percent finer by weight; 1” sieve, 60 to 100 percent; No. 4 sieve, 25 to 85 percent; No. 20 sieve, 10 to 60 percent; No. 50 sieve, 4 to 35 percent; No. 200 sieve, 0 to 5 percent.
3. Substitute materials may be utilized with prior approval from Geotechnical Engineer.

PART 3 – EXECUTION

3.01 EXCAVATION

A. Excavation classification: Excavation classifications shall be defined herein and includes removal and disposal of any material encountered to obtain required subgrade elevations, including pavement, obstructions visible on ground surface, underground structures and utilities indicated to be removed, boulders, solid rock, rock in ledges, and rock-hard cementitious aggregate deposits.

B. Unauthorized excavations (removal of materials beyond indicated subgrade elevations and dimensions) shall be corrected as follows:
1. At structure:
   a. Extend the indicated bottom elevation of footing to the lower elevation.
   b. Provide concrete or lean concrete mix approved by Architect or Engineer.
   c. Compacted structural fill.
2. Elsewhere: Backfill and compact as directed.

C. Topsoil stripping and stockpiling:
1. Strip topsoil to whichever depths encountered in a manner to prevent intermingling with the underlying subsoil or other objectionable material. Remove heavy growths of grass from areas before stripping. Where trees are indicated to be

remain, stop topsoil stripping a sufficient distance to prevent damage to main root system.

2. Stockpile topsoil in storage piles in areas not to impede construction activities or encumber adjacent property. Construct storage piles to freely drain surface water. Cover storage piles if required to prevent windblown dust.

D. Excavation for structure: Excavate for structure to elevations and dimensions shown, extending excavation a sufficient distance to permit placing and removal of concrete formwork, installation of services, other work, and for inspection. Excavate by hand to final grade just before concrete reinforcement is placed. Trim bottom to required lines and grades to provide solid base to receive concrete.

1. Arrange for observation of completed excavation by geotechnical engineer prior to fill placement or footing construction.

E. Excavation for pavements: Cut surface under pavements to comply with cross-section, elevations and grades as indicated

F. Excavation for trenches: Dig trenches to the uniform width required for the particular item to be installed, sufficiently wide to provide ample working room, and to the depth indicated or required. Trench width for piping shall be cut to provide 6” –12” of clear space between the pipe O.D. and trench wall. Carry the depth of trenches for piping to establish the indicated flow lines and invert elevations with a minimum of 4” of granular bedding below the pipe. Beyond the building perimeter, keep bottoms of trenches sufficiently below finish grade to avoid freeze-ups. Where rock is encountered, carry the excavation 6” below the required elevation and backfill with a 6” layer of crushed stone or gravel prior to installing pipe. Grade bottoms of trenches as indicated, notching pipe bells to provide solid bearing for the entire body of pipe. Backfill trenches with concrete where trench excavations pass within 18” of column or wall footings and which are carried below bottom of such footings, or which pass under wall footings. Place backfill to level of bottom of adjacent footing. Do not backfill trenches until tests and inspections have been made and backfilling authorized by Geotechnical Engineer. Use care in backfilling to avoid damage or displacement of pipe system.

G. Excavation of rock: If rock, as defined below, which requires for its removal the continuous use of pneumatic tools or drilling and blasting, is encountered, Contractor shall cease all excavation and trenching work in associated area and notify Owner in accordance with General Conditions. Provide rock excavation unit price basis as set forth in Contractor’s Bid Proposal defined as follows:

1. Solid rock excavation is defined as rock in solid bed or masses in its original or stratified position including boulders and detached masses of rock, portions of which projecting into the lines of excavation and necessary to be removed exceed in any one bed, mass or boulder one (1) cubic yard, and which is not, in the opinion of the Geotechnical Engineer, practicable to except after drilling and blasting.
2. Trench rock excavation is defined as excavation of a continuous nature, narrow in width such as excavation for foundation walls, foundation wall footings, plumbing, heating and sewer lines, drain tile and excavation of a similar nature.
3. Pit rock excavation is defined as excavation of an isolated nature, such as piers, footing for piers, shafts, tanks and other excavation of a similar nature.

4. Solid rock occurring in any excavation shall be uncovered by Contractor and measured by the Geotechnical Engineer before its removal by the Contractor. Any rock removed before Geotechnical Engineer's inspection and measurement shall be treated as earth excavation and the Contractor shall not be entitled to additional compensation for its removal.
5. Unless rocks comply with the requirements above, closely packed strata or flint or other rock separated by clay or earth seams shall be classed as earth excavations and the Contractor shall not be entitled to additional compensation for its removal; provided, however, that bedded deposits, unstratified masses, and other rock deposits so firmly cemented as to present the characteristics of solid rock shall be deemed to be solid rock within the provision above when Geotechnical Engineer so certifies.
6. Blasting: No blasting of rock will be allowed unless specifically authorized.
   a. Contractor shall comply with all local, state, and federal laws, ordinances, applicable safety code requirements and regulations relative to handling, storage, and use of explosives and the protection of life and property.
   b. The Contractor shall be responsible for all damages caused by his blasting operations. Suitable methods shall be employed to confine all materials lifted by blasting within limits of the excavation or trench.
   c. No blasting of rock will be allowed in foundation wall lines or general areas that are within twenty (20) feet of adjacent structures unless specifically authorized.
   d. All rock which cannot be handled and compacted as earth shall be kept separate from other excavated materials and shall not be mixed with backfill or embankment materials except as specified or directed.

3.02 SHORING AND BRACING

A. Sheeting, bracing and shoring shall be the responsibility of the Contractor and be designed by a professional engineer licensed in the jurisdiction of the project and built to withstand all loads that might be caused by earth movement or pressure, and shall be rigid, maintaining shape and position under all circumstances. Design and construction shall be in compliance with codes and ordinances of governing authorities having jurisdiction.

B. Except where banks are cut back on a stable slope, excavation for structures and trenches shall be properly and substantially sheeted, braced, and shored, as necessary, to prevent caving or sliding; to provide protection for workmen and the work; and to provide protection for existing structures and facilities.

3.03 BACKFILL AND FILL

A. Place and compact acceptable soil material in layers to required elevations. Do not place materials on surfaces that are muddy, frozen, contain ice, or frost. Backfill excavations as promptly as work permits.

B. Place acceptable materials in layers not more than 8" loose depth for materials compacted by heavy equipment and not more than 4" loose depth for materials compacted by hand equipment to subgrades indicated as follows:
   1. Structural Fill: Use under foundations, slabs on grade in layers as indicated.

2. Drainage Fill: Use under designated building slabs, at foundation drainage and elsewhere as indicated.
3. Common Fill: Use under unpaved areas. Note, where post-tension type foundation systems are indicated or when recommended in Geotechnical Analysis for other foundation system types, provide 12” of high plastic index type clay soil “plug” surrounding unpaved building perimeter for a minimum of five (5) feet extension from building properly compacted to minimize infiltration of surface water for gaining access to subgrade beneath structure.
4. Subbase Material: Use under pavement, walks, steps, piping and conduit.
5. Pipe Embedment: Pipe embedment shall extend from the pipe bedding to 12” above the top of pipe for plastic pipe and to the centerline of the pipe for reinforced concrete pipe. Pipe embedment shall consist of gravel or sand compacted to 90% density.

3.04 PAVEMENT SUBBASE COURSE

A. Place specified subbase material in layers of indicated thickness, over subgrade surface to support pavements. Place in a single layer not to exceed 6” in thickness and in equal layers of 6” or less for thickness greater than 6”.

3.05 BUILDING SLAB DRAINAGE COURSE

A. Place drainage fill material on prepared subgrade in a single layer not to exceed 6” in thickness and in equal layers of 6” or less for thickness greater than 6”.

3.06 GRADING

A. Subgrade elevation to be 4” below finish indicated for placement of topsoil specified in Section 32 90 00. Grade areas indicated with uniform levels or slopes between finish elevations. Shape surface of areas to 0.10 ft. above or below required subgrade elevation, compacted as required. Where in-situ soil is used as subgrade, soil shall be scarified, moisture conditioned and recompacted to a depth of 6-inches unless otherwise noted.

3.07 MAINTENANCE AND DISPOSAL

A. Dewatering: Prevent surface water and subsurface or groundwater from flowing into excavations and from flooding project site and surrounding area. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrade and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other de-watering systems components necessary to convey water away from excavations. Convey water removed from excavations and rainwater to collection or runoff areas. Establish and maintain temporary drainage ditches and other diversions outside excavation limits for each structure. Do not use trench excavations as temporary drainage ditches.

B. Material storage: Stockpile excavated materials in such a manner not to impede construction activities, encumber adjacent property, or within drip line of trees to remain. Place, grade, and shape stockpiles for proper drainage. Locate and retain soil materials away from edge of excavations.

C. Protect existing structures, planting, utilities, and conditions designated to remain.

D. Protect newly graded areas from traffic and erosion. Recompact and regrade settled, disturbed and damaged areas as necessary to restore quality, appearance, and condition of work

E. Control erosion to prevent runoff into sewers or damage sloped or runoff areas.

F. Control dust to prevent hazards to adjacent properties and vehicles. Immediately repair or remedy damage caused by dust, including air filters in equipment and vehicles. Clean soiled surfaces.

G. Dispose of waste and unsuitable materials off-site in a legal manner.

END OF SECTION

SECTION 31 10 00

SITE CLEARING

PART 1 - GENERAL

1.01 SUMMARY

A. Provide site clearing and preparation including:
   1. Protection of existing trees, vegetation, landscaping, and site improvements not scheduled for clearing which might be damaged by construction activities.
   2. Trimming of existing trees and vegetation as recommended by arborist for protection during construction activities.
   3. Clearing and grubbing of stumps and vegetation, and removal and disposal of debris, rubbish, designated trees, and site improvements.
   4. Topsoil stripping and stockpiling.
   5. Temporary protection of adjacent property, structures, benchmarks, and monuments.
   6. Temporary relocation of fencing, and site improvements scheduled for reuse.
   7. Protection from natural resource damage.
   8. Removal and legal disposal of cleared materials.

1.02 SUBMITTALS

A. Comply with Section 01 33 00.

B. Upon request, submit documentation of proper clearing, protection, and legal disposal of site materials.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Use experienced workers.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Tree protection, erosion control, siltation control, and dust control materials suitable for site conditions.

PART 3 - EXECUTION

3.01 EROSION, SEDIMENTATION AND DUST CONTROL

A. Erosion and sedimentation control: Comply with Section 01 57 00.

B. Dust Control: The Contractor shall exercise precautionary measures to minimize emissions which will include, but shall not be limited to, periodical sprinkling or wetting of the site. The Contractor has the option of using a dust palliative.

3.02 CLEARING

A. Prevent damage to existing improvements indicated to remain, including improvements on and off site. Protect existing trees and vegetation indicated to remain. Do not stockpile materials and restrict traffic within drip line of existing trees to remain. Provide and maintain temporary guards to encircle trees or groups of trees to remain; obtain approval before beginning work.

B. Existing Trees and planting:
   1. Water vegetation as required to maintain health. Cover temporarily exposed roots with wet burlap and backfill as soon as possible. Coat cut plant surfaces with approved emulsified asphalt plant coating.
   2. Repair or replace vegetation which has been damaged or pay damages.
   3. Completely remove all improvements including stumps and debris except for those indicated to remain. Remove below grade improvements at least 12" below finish grade and to the extent necessary so as not to interfere with new construction. Remove abandoned mechanical and electrical work as required.
   4. Trees, 1 ½" or more in diameter, designated to remain within the cleared areas shall be trimmed of branches to approximate 7 feet height above finish grade. Remove all dead branches 1 ½" or more in diameter. Limbs and branches to be trimmed shall be neatly cut close to the main trunk. Cuts more than 1 ½" in diameter shall be painted with approved tree-wound paint.

C. Topsoil:
   1. Topsoil is defined as friable clay loam surface soil found in a depth of not less than 4". Satisfactory topsoil is reasonably free of subsoil, clay lumps, stones, and other objects over 2" in diameter, and without weeds, roots, and other objectionable material.
   2. Strip topsoil to whichever depths encountered in a manner to prevent intermingling with the underlying subsoil or other objectionable material. Remove heavy growths of grass from areas before stripping. Where trees are indicated to be remain, stop topsoil stripping a sufficient distance to prevent damage to main root system.
   3. Stockpile topsoil in storage piles in areas not to impede construction activities or encumber adjacent property. Construct storage piles to freely drain surface water. Cover storage piles if required to prevent windblown dust.

D. Disposal of waste materials:
   1. Burning on Owner’s property is not permitted.
   2. Remove waste materials and unsuitable and excess topsoil from Owner’s property and dispose of off site in legal manner.

END OF SECTION

SECTION 32 13 13

PORTLAND CEMENT CONCRETE PAVING

PART 1 - GENERAL

1.01 SUMMARY

A. Provide cast-in-place concrete paving over prepared sub-base where indicated on drawings:
   1. Parking areas.
   2. Driveways.
   3. Walkways.

1.02 SUBMITTALS

A. Comply with Section 01 33 00.

B. Product Data: Submit for approval product data, mix design, test reports in accordance with Section 03 30 00.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

B. Comply with requirements of Section 03 30 0 for concrete mix design, sampling, testing, quality control, and as specified below.

C. Construction Tolerance: 1/8" in 10' for grade and alignment of top of forms; 1/4" in 10' for vertical face on longitudinal axis.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Provide concrete materials, forms, reinforcing, and isolation joint fillers as specified in Section 03 30 00.

2.02 CONCRETE MIX, DESIGN TESTING:

A. Comply with requirements of Section 03 30 00 for concrete mix design, sampling, testing, and quality control as specified below.

B. Design the mix to produce normal-weight concrete consisting of portland cement, aggregate, air-entraining admixture and water to produce the following properties:
   1. Compressive Strength: 4000 psi, at 28 days.
   2. Slump Limits: 4 inches maximum, (plus or minus 1 inch), unless otherwise specified.
   3. Air Content: 5 to 7 percent.
   4. Flexural Strength: ASTM C78, 550 psi minimum at 28 days.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Comply with requirements of Section 03 30 00 for mixing, testing, placement, reinforcement placement, joints, tolerances, curing, repairs, protection and placing concrete.

B. Proof roll sub-base and check for unstable areas. Report unsatisfactory conditions in writing. Beginning paving work means acceptance of sub-base.

C. Joints: Construct control, isolation and construction joints true to line with face perpendicular to surface of pavement, unless otherwise indicated.
   a. Construction joints: At locations of separate pours or thickness separations.
   b. Isolation joints:
      a. Walkways: Fifty (50) feet on center unless otherwise indicated.
      b. Parking areas, driveways: Sixty (60) feet on center maximum.
   c. Control joints:
      a. Walkways: Five (5) feet on center unless otherwise indicated.
      b. Parking areas, driveways: Fifteen (15) feet on center maximum.
   d. Seal isolation and construction joints.
   e. Contractor’s option to pour concrete curb and cutter integral (monolithic) with concrete paving in lieu of providing key-ways or dowels.

E. Work edges of slabs, gutters, back top edge of curb, and formed joints with an edging tool, and round to 1/4" radius, unless otherwise indicated. Eliminate any tool marks on concrete surface.

F. Protect Concrete paving until weight of a person will not leave an impression. Exclude traffic from pavement for at least 14 days after placement. Remove and replace concrete paving which shows impressions or other defects. Skim coating defects is not acceptable.

G. Dispose to over-mixed concrete off-site in a legal manner.

END OF SECTION

SECTION 32 30 00

SITE IMPROVEMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Provide the following site improvements where indicated on drawings.
   1. Bollards.
   2. Site signage (Handicapped accessible parking).
   3. Precast concrete parking bumper blocks.

1.02 SUBMITTALS

A. Comply with Section 01 33 00.

B. Product Data: Submit for manufacturer’s technical data for site signage..

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

B. Regulations: ANSI, ADA, and local governing code.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Provide units specifically designed for exterior exposure and intended use:
   1. Bollards: Concrete-filled steel bollards.
      a. Concrete construction shall comply with Section 03 30 00.
      b. Steel construction shall comply with Section 05 50 00.
      c. Painting shall comply with Section 09 90 00.
   2. Site Signage: Handicapped accessible parking.
      a. Steel construction and fasteners shall comply with Section 05 50 00.
      b. Painting shall comply with Section 09 90 00.
      c. Signs: Type and model as shown on plans.
         1). Manufacturer: Best, Grimco, Seton or approved equal.
         2). Comply with ANSI, ADA, and local governing code.
            (a). Lettering, symbols, color, quantity, and mounting heights.
   3. Precast Concrete Parking Bumper Blocks:
      a. Concrete construction shall comply with Section 03 30 00.
         1). Concrete: 4000 psi, Type A.
         2). Reinforcement: (2) #4's continuous minimum.
      b. Steel construction shall comply with Section 05 50 00.
         1). Anchor with (2) #’4 dowels per block.

c. Size: Length 6'-0", height 5", width: 9", with edges rounded with faces chamfered.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.

B. Restore damaged finishes and test for proper function. Clean and protect work from damage.

END OF SECTION

SECTION 32 90 00

LANDSCAPING

PART 1 - GENERAL

1.01 SUMMARY

A. Provide landscape work where indicated on drawings:
   1. Finish grading and lawns.
   2. Topsoil and soil amendments.
   3. Initial maintenance of landscape materials.
   4. Erosion control matting.

1.02 SUBMITTALS

A. Comply with Section 01 33 00.

B. Product Data: Submit manufacturer’s technical data for seed and soil amendment materials.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

B. Testing: Laboratory testing for suitable soil amendments and fertilizer for plants provided.

C. Planting Season: Plant or install materials during normal planting seasons for each type of landscape material utilized. Correlate planting with specific maintenance periods to provide maintenance from date of substantial completion.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Lawns: (Hydroseed), fresh, clean, new crop seed mixture by approved method composed of Falcon Tall Fescue (75%) and Rebel Rye (25%) or Crossfire (25%) and degradeable green dyed wood cellulose fiber or 100% recycled long fiber pulp. Mixture shall be free from weeds or other foreign matter toxic to seed germination. Seed purity shall be 95% with a minimum 80% germination.

B. Topsoil: 4” deep minimum from site stockpile or additional fertile, friable topsoil from local source. Material shall be reasonably free of subsoil, clay, lumps, brush, reproductive parts of noxious weeds, and other litter, and free of roots, stumps, sticks, and stones larger than 2" in any dimensions.

C. Soil Amendments:
   1. Fertilizer, ten pounds of 13-13-13, non-burning fertilizer per 1000 square foot composed of not less than 50% organic slow acting guaranteed analysis fertilizer or approved equal.
   2. Rotted composted manure.

3. Planting Tablets: 21 gram Agriform (20-10-5) or approved equal.
4. Lime, peat moss, and other amendments as required for planting soil mixture.

D. Pre-Emergent Herbicide: Elanco XL, Ronstar, Surflan, or approved equal, complying with regulatory agency requirements.

E. Landscape Materials:
1. Riprap: 4" stone, placed in nominal 4" lean concrete bed where indicated on drawings.
2. Erosion control matting:
   a. Nylon woven geomatrix: SC150 by North American, Enkamat by Akzo or approved equal.
   b. Nonwoven polyester geotextile: by Akzo or approved equal.
   c. Polyvinyl chloride non-woven mat: by Greenstreak or approved equal.

PART 3 - EXECUTION

3.01 LAWN PLANTING:

A. Prepare topsoil by mixing fertilizer with loam. Apply fertilizer at a rate of 10 pounds of actual nitrogen per 1000 sq. ft.. For lawn areas to receive either seeded or sod provided 4” loosely compacted topsoil over compacted subgrade specified under Section 31 00 00. Top of finish grade with lawns to be 8” minimum below finish floor unless otherwise indicated. Install to keep masonry flashing, weeps and other wall penetration free of debris and functioning properly.

B. For seeded lawns, apply seed at rate of 5 pounds per 1000 square feet. Apply erosion control matting over areas where slopes exceed 1:4.

C. Water and maintain lawns until date of substantial completion.

3.02 CLEANUP, PROTECTION AND MAINTENANCE

A. Keep pavements clean and work area in an orderly condition. Remove excess, waste material, trash and debris.

B. Replace damaged materials and dead or unhealthy lawns prior to turnover to Owner. Maintain lawn areas by mowing, watering, fertilizing and applying weed killer in accordance with manufacturer’s recommendations until date of substantial completion.

C. Correct areas of soil settlement.

D. Instruct Owner on proper maintenance procedures.

E. Provide 48-hour written notice prior to turnover to Owner for watering and maintenance.

END OF SECTION

SECTION 33 00 00

SITE UTILITIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The following shall apply to this Section:
   1. Drawings.
   2. General Conditions.

1.02 WORK INCLUDES

A. The basic materials used in the various piping and fluid conveying systems 5'-0" outside the building to the serving utilities point of connection (POC). Unless stated otherwise the following is required:
   1. Water System
   2. Fire Hydrants and Valves (if used)
   3. Sanitary Sewer System
B. Gas service, meter and regulator (if used) will be provided by the gas utility company.
C. Unless noted on the drawings otherwise, work shall include:
   1. The procurement of and payment for all fees, permits and licenses required for the performance of the work.
   2. All fees and direct expenses involved in any inspections required for the project.
   3. All hoists, scaffolds, staging, runways, and equipment required for the performance of the work.
   4. All job measurements and shop layouts required for the proper installation of material and equipment included in the work.
   5. All lights, guards, and signs as required by safety regulations applicable to the work.
   6. The removal from the premises, as it accumulates, of all dirt and refuse resulting from the performance of the work.
D. The work shall include revisions, modifications, and rework of existing work as required for installation of new work, and as required for connections of new work to existing systems, and of existing work to new systems.

1.03 SUBMITTALS

A. Comply with Section 01 33 00.
B. Submit product data.

1.04 QUALITY ASSURANCE

A. Codes and Standards: Comply with current editions of following, as applicable:
   1. National Fuel Gas Code, NFPA 54.
   2. AWWA and ASTM standards.
   3. National Fire Protection Association NFPA 24.

1.05 PROTECTION OF EXISTING UTILITIES AND CONDITIONS

A. The existing utilities and conditions as encountered or as shown on the drawings shall be protected from damage during all construction including the excavation and backfilling of trenches, and, if damaged, shall be repaired by the Contractor at his expense.

1.06 PRODUCT DELIVERY STORAGE AND HANDLING

A. Follow manufacturer's directions in delivery, storage, protection and handling of all equipment and materials.
B. Deliver and store equipment and materials to the site in original containers, suitably sheltered from the elements
and mechanical injury, but readily accessible for inspection until installed.
C. Plastic pipe and materials shall be stored under cover and protected from sunlight and heat.

1.07 INTERFERENCES

A. The Contractor shall confer with other Contractors at the site to avoid interferences. In the event that interferences develop, the Engineer's decision will be final and no additional compensation will be allowed for the moving of misplaced piping, valves, etc.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Valve and Valve Boxes
   1. Meuller.
B. Hydrants and Valves
   1. Mueller.
   2. American Foundry.
   3. Clow.
   4. Waterous/Traverse City.

2.02 PIPING MATERIALS AND APPLICATIONS

A. <u>The following applications are for only from 5’-0” outside the building to the utility point of connection (POC).</u>
B. Underground domestic water service piping from the shut-off valve in the building to a point 5 feet outside the building.
   <u>(See drawings for which piping material (Copper or PVC) is required):</u>
   1. ¾” - 1 ¼”, Schedule 40 PVC pipe with solvent-welded joints.
   2. 1 ½” - 3”, SDR-21, PVC pipe (ASTM D2241) Class 200, Bell and Spigot with rubber gasketed joints and matching fittings. Provide concrete blocking at all tees and elbows.
   3. ¾” - 3”, Type "K" hard drawn copper tubing (SIL-FOS 2, FOS-FLO 7 or other silver brazing material). All copper piping shall be installed with wrought copper fittings.
   4. 4” and larger, SDR-18 PVC pipe (AWWA C-900) Class 150 Bell and Spigot with rubber gasketed joints, and matching fittings. Provide concrete blocking at all tees

and elbows.

C. Underground fire protection water piping:
   1. 3" and smaller polyvinyl chloride (PVC) pipe, class 200 bell and spigot with rubber sealing ring, (SDR-21, with matching fittings). Provide concrete blocking at all tees and elbows.
   2. 4" and larger polyvinyl chloride (PVC) pipe, class 150 bell and spigot with rubber sealing ring conforming to AWWA C900. Fittings shall be ductile-iron conforming to
      AWWA C111/A21.11 with non-toxic rubber gaskets. Provide concrete blocking at all tees and elbows.
   3. Ductile iron pipe, 150 psi working pressure, conforming to ANSI/AWWA C-151/A21.51 with mechanical joint fittings conforming to AWWA C-111/A21.11 with gasket material
      that is non-toxic, durable and impervious. Provide concrete blocking at all tees and elbows.

D. Sanitary Sewer Piping:
   1. Polyvinyl chloride (PVC) sewer pipe shall conform to ASTM D3034 (SDR-35). Fittings shall also conform to ASTM D3034 (SDR-35). Connections shall be molded tees and wyes. Joints shall be rubber gasketed.
   2. Cast iron or ductile iron pipe and fittings shall conform to USASI #A-21 class 50 with mechanical or push-on joints.

2.03 VALVES AND VALVE BOXES

A. Valves shall be AWWA iron body, bronze mounted, double disc, parallel seat, non-rising stem gate valves with a working pressure of 200 psi. Valves shall be furnished with end connections as required.
B. Valve boxes shall be cast iron, two-piece, slip or screw type.
C. Valve and boxes shall be as approved by the water department.

2.04 FIRE HYDRANTS

A. Fire hydrants shall be of the compression type with break flange and shall comply to AWWA Standard C-502. Hydrants shall be tested to 300 psi with a working pressure of 150 psi.
B. Hydrants nozzle arrangement shall be one 4" pumper nozzle and two, 2-1/2" hose nozzles equipped with caps and chains. Nozzle threads shall comply with the fire department standard.
C. Hydrant inlet shall be 6" with mechanical joint or flanged connection as required. Main valve shall be 5-1/4". Hydrants shall have conventional packing.
D. Install shutoff valve ahead of each hydrant with cast iron valve box. Valves shall be UL listed, 175 psi working pressure, iron body. Bronze mounted, non-rising stem.
E. Hydrants and valves are subject to approval by the local fire department.

PART 3 - EXECUTION

3.01 EXCAVATION AND BACKFILLING

A. General
   1. The underground pipe lines shall be constructed of the materials specified and as

shown on the drawings or as directed by the Engineer. The pipe shall be laid true to lines and grades shown on the drawings using batten boards. All pipe which has its grade or joint disturbed or is found to be defective or damaged after laying shall be taken up and re-laid or replaced as directed by the Engineer without additional charge. Trenches shall be kept free from water until pipe jointing material has set and pipe shall not be laid when the trench conditions or the weather is unsuitable for such work. At all times when work is not in progress, all open ends of pipe and fitting shall be securely closed to the satisfaction of the Engineer so that no trench water, earth or foreign substances will enter the pipe or fittings.

B. Excavation
   1. Perform all excavation of every description and of whatever substances encountered, to the depths indicated on the drawings. Unless otherwise indicated on the drawings, the minimum cover over the top of the water lines shall be 3'-0". All excavation materials not required for fill or backfill shall be removed from the site or utilized as directed by the Engineer. All excavation shall be made by open cut. The banks of trenches shall be kept as nearly vertical as practicable and where required, shall be properly sheeted and braced. Trenches shall be excavated true to line and shall not be less than 12" wider nor more than 16" wider than the outside diameter of the pipe to be laid therein. The maximum width of trench specified applies to the width at or below the level of the top of the pipe. The width of the trench above that level maybe made as wide as necessary for sheeting and bracing and the proper installation of the work. The bottom of trenches shall be accurately graded and shaped so that each section of pipe for at least one-third (1/3) of its exterior circumference and for its entire length shall rest firmly on undisturbed soil, except for portions of the pipe sections where it is necessary to excavate for bell holes and for the proper sealing of pipe joints. Provide a 4" sand or crushed rock base under all underground piping. Piping shall have 12" of sand or crushed rock cover properly compacted.
   2. Where rock, clay, hardpan, or similar formation is encountered, it shall be removed and replaced with suitably selected sand or crushed rock.
   3. See the applicable section of these specifications for contract payment provisions for removal of rock.

C. Drainage and Removal of Water
   1. The Contractor shall control the grades around all excavations so as to prevent water from running into the excavated areas or tunnels. Any water which accumulates in excavations or tunnels shall be removed promptly. Grading shall be brought to meet existing adjacent grade.

D. Bracing and Shoring
   1. This Contractor shall do all shoring and bracing necessary to retain earth banks and prevent caving in and displacement of adjacent soil, furnishing all necessary timbers, cribbing, planking or sheet piling for that purpose. Proper shoring for safety of working is the exclusive responsibility of the contractor.

E. Protection of Existing Utilities
   1. All existing utilities shall be protected from damage during the entire construction, including the excavation and backfilling of trenches and, if damaged, shall be repaired by the Contractor at his expense.

F. Installation of Pipe
   1. Pipe lines shall be laid to the grades and alignment indicated on the drawings or as directed by the Engineer. All pipe lines shall be laid at a constant grade as required by code.
   2. Install piping in accordance with the following standards:

a. Ductile - iron pipe - AWWA C600.
b. Polyvinyl chloride - per manufacturer’s instructions

3. Provide anchorage for tees, bends, valves, hydrants, etc. Thrust blocks shall be concrete, 2500 psi.

G. Backfilling

1. The trenches shall not be backfilled until all required tests are performed and until the systems, as installed, conform to the requirements of the Specifications. After the trench bottom or bedding has been prepared and the pipe installed, sand or gravel at a moisture content which will facilitate compaction, shall be carefully placed alongside the pipe in layers not exceeding 6" in depth. Care shall be taken to insure thorough compaction of the fill. Each layer shall be thoroughly compacted to 95% proctor density by tamping.
2. The remainder of the backfill under pavements, curbs, gutters, sidewalks, and driveways shall consist of sand, gravel, or crushed rock as approved by the Engineer. Rock, broken concrete or pavement, large boulders, and frozen earth shall not be used as backfill material.
3. The Contractor shall be responsible for backfilling all ditches, trenches or excavation covered by this contract.

H. Replacement of Pavements, Walks, Curbs, and Lawn Areas.

1. Pavements, walks, streets, curbs, and lawn areas which are cut or damaged during construction of the sewers, gas lines, water lines, etc. shall be replaced and restored to the original conditions by this Contractor.

3.02 LINES, GRADES, AND ELEVATIONS

A. Sewer lines, grades and elevations shall be laid out with a surveyor's transit and level to offset stakes set to one side of the trench. After the trench is excavated, these lines and grades shall be transferred to a string stretched between batter boards set at 50 ft. intervals across the trench. During the pipe laying, the line shall be determined by hanging a plumb bob from the grade string. The invert of each length of pipe shall be set to the proper elevation by measuring down from the string with a grade rod.

B. No blocking of any kind shall be used to adjust the pipe to grade except when used with embedment concrete. Bedding shall be required for all sewer construction, except ductile iron pipe, and shall be of a minimum thickness equal to 1/4 of the outside diameter of the sewer pipe but shall not be less than four inches (4").

C. Each section shall be unobstructed, smooth, straight, true, and with uniform slope. Compliance with this requirement shall be demonstrated to Engineer by arranging for visual inspection by him and by shining a light from one end of the section to the other end.

3.03 SEWER INSTALLATION

A. Take great care in working on existing sewers so as not to interrupt service to any existing building without permission.

B. Where sewer pipes do not rest on natural ground but cross building excavation, the pipes in this area shall be supported on 8" concrete block or 6" poured concrete walls which are built up from undisturbed ground.

C. Where branch sewers connect to main sewer, they shall drop at 22-1/2° or 45° and connect at 22-1/2° or 45°. 90° connections will not be permitted. Flow line of two sewers shall be continuous or shall drop in direction of flow.

3.04 FIELD QUALITY CONTROL

A. Water Line Testing: Before joints are painted or covered, test underground water lines to hydrostatic pressure of at least 150 lbs. psi. Leakage shall not exceed 200 gal. per inch of pipe diameter per mile per 24 hours. Contractor shall be responsible for discovering leaks and making necessary repairs.
B. Underground sewers shall be tested in one or more sections by closing outlets; extending connections to 4'-0" above grade; filling system to top of lowest extensions. Inward (from wet trench) or outward (to dry trench), infiltration shall not exceed 200 gallons per 24 hours per mile per inch diameter of pipe.
C. Leaks shall be repaired, and tests repeated until leakage or infiltration is within above limits.
D. Substitution of air testing is not permitted.

3.05 CONTINUITY OF SERVICES (UTILITY OUTAGES)

A. All existing services must be kept in continuous operation with no interruption of services (sewer, water, gas, etc.). Contractor shall install temporary services as required to maintain this continuous operation and shall remove all temporary services when work is completed. Where interruptions are absolutely mandatory, they shall be kept to an absolute minimum and coordinated with Engineer.

3.06 EQUIPMENT INSTALLATION

A. All fire hydrants, valves, valve boxes, etc. shall be installed as detailed and per manufacturer's instructions and recommendations.

END OF SECTION

SECTION 33 40 00

STORM DRAINAGE SYSTEMS

PART 1 – GENERAL

1.01 SUMMARY

A. Provide storm drainage systems where indicated.

1.02 SUBMITTALS

A. Comply with Section 01 33 00.

B. Submit for approval shop drawings, product data, test reports for the following items where indicated:
   1. Manholes and Catch Basins
   2. Steps
   3. Frames and Covers

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

B. Standards: Comply with the provisions of the following specifications and standards, except as otherwise noted or specified. .
   1. ASTM A760-10 Standard Specification for Corrugated Steel Pipe, Metallic Coated for Sewers and Drains.
   2. ASTM C76-13a, Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
   3. ASTM C478-13 Standard Specification for Precast Reinforced Concrete Manhole Sections.
   4. ASTM C507-13a Standard Specification for Reinforced Concrete Elliptical Culver, Storm Drain, and Sewer Pipe.
   5. ASTM C858-10e1 Standard Specification for Underground Precast Concrete Utility Structures.
   6. ASTM D2751-05 Standard Specification for Acrylonitrile Butadiene Styrene (ABS) Sewer Pipe and Fittings.
   7. ASTM D3034-08, Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
   8. ASTM D3350-12e1 Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
   9. AASHTO M-294, 12 to 36 inch pipe, Specification for Corrugated Polyethylene Pipe.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Pipe and Fittings:
   1. Corrugated Metal Pipe (CMP):
      a. Meet requirements of ASTM A760-10.
      b. 16-gauge, standard round, galvanized with 2 ounces zinc per square foot sheet metal.
      c. Corrugations:
         1). 6” to 10” pipe: 1-1/2” x ¼” depth helical corrugations.
         2). 12” to 60” pipe: 2-2/3” x ½” depth helical corrugations.
      d. Banded joints.
   2. Polyvinyl Chloride (PVC) Pipe & Fittings:
      a. Meet requirements of ASTM D3034-08, SDR 35.
      b. Fittings: Slip joint with elastomeric seals.
   3. Acrylonitrile-Butadiene-Styrene (ABS) Pipe and Fittings:
      a. Meet requirements of ASTM D2751-05.
      b. Solvent-cemented or gasketed joints.
   4. Reinforced Concrete Pipe (RCP) and Fittings:
      a. Meet requirements of ASTM C76-13a, Class III.
      b. Tongue and groove mastic joints.
   5. Elliptical reinforced concrete pipe:
      a. Meet requirements of ASTM C507-13a.
      b. Tongue and groove mastic joint.
   6. High density Polyethylene (HDPE) pipe & fittings:
      a. Meet requirements of ASTM D3350-12e1, AASHTO M 294.
      b. Silt tight joints ASTM D3350-12e1.
   7. Gaskets: Compatible with pipe materials joined.

B. Manholes and Catch Basins:
   1. Precast Concrete Manholes and Catch Basins: ASTM C478-13 or ASTM C858-10e1.
      a. Materials shall be in conformance with Section 03 30 00.
      b. Cones and sections shall be substantially free of gravel pockets.
      c. Joints between precast sections shall be designed for rubber gaskets, or bituminous material.
      d. Base sections shall be placed on a well graded 6” granular bedding course firmly tamped and level extending to the limits of the excavation assuring uniform contact and support of precast element.
      e. After placement and before damp proofing, the lift holes shall be completely filled with a non-shrink grout to provide a smooth exterior surface.
   2. Cast-In-Place Concrete Manholes and Catch Basins: 4000 psi.
      a. Materials shall be in conformance with Section 03 30 00.
      b. Monolithic concrete structures shall conform to detailed shop drawings submitted to the Civil Engineer for approval prior to beginning work and shall conform to the dimensional requirements shown on the plans.
      c. Unless otherwise specified, cast-in-place bases shall be at least 12” in thickness and shall extend at least 12” radially outside of the outside dimension of the manhole or catch basin section.
   3. Protective Coatings: All concrete manholes and catch basins, precast or cast-in-place, shall be coated as follows:

a. Internally: Two (2) coats Koppers Bituastic 300-M, Porter's No. 7080 Maxi-Build II, or approved, coal tar epoxy. Each coat shall provide not less than 10 mils dry thickness, to result in a total dry mil thickness of 20. Follow manufacturer's recommendations.
b. Externally: Two (2) coats Tnemec 47-461 Asphalt Base Foundation Coating, or approved equal. Application shall produce as 8 mil dry film first coat and a 5.5 mil dry film second coat. Follow manufacturer's recommendations.
c. Test may be requested by Engineer to demonstrate mil thickness and Holiday Detector Test compliance.

4. Steps: Type and model as shown on plans.
   a. Steel reinforcing rods with load and pullout ratings meeting OSHA Standards and conforming to ASTM C478-13 or equivalent.
   b. Polypropylene coating shall conform to ASTM D4101-11 under Type II, Grade 16906.
   c. Steel reinforcing rods shall be ½" deformed reinforcing rod, Grade 60, conforming to ASTM A615-12.
5. Frames and Covers: Type and model as shown on plans with machined horizontal bearing surfaces.
   a. Gray iron conforming to requirements of ASTM A48-03 (2012).
   b. Ductile iron conforming to requirements of ASTM A536-84 (2009), Grade 60-40-18, heavy-duty ductile iron with lettering.
   c. Set unit in full mortar beds or bituminous mastic beds. Mortar shall be mixed in portion of one-part cement to three parts sand, by volume, based on dry materials.
   d. Castings shall be set accurately to the finished elevation so that no subsequent adjustment will be necessary.
6. Poured Inverts: Poured inverts shall be made to conform accurately to the flow grade and shall be brought together smoothly with well rounded junctions, satisfactory to the Civil Engineer, and in conformance with details shown on plans.

C. Outfalls for Storm Sewerage System: Cast-in-place reinforced concrete pipe, head wall apron, tapered sides, and rip rap systems as indicated on plans.

D. Trench Drains for Storm Sewerage System: Interlocking precast polymer concrete modular units with grates, channel caps, and related accessories.

E. Identification: Metallic-core plastic underground warning tapes.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction. Coordinate with work of other sections.

B. Earthwork shall comply with requirements of section 31 00 00.

C. All pipe and appurtenances shall be constructed at the location and elevations indicated on the plans or as established by the Civil Engineer.

D. Prior to the construction of any storm drainage systems, the Contractor shall place adequate line and grade stakes and shall also set stakes and furnish grades so that all structure tops can be set to finish grade as indicated.

E. Pipe connections: Special care shall be taken to see that the openings through which pipes enter the manhole structure are completely watertight. Those materials designed on plans as RCP type piping shall be required to be installed with closure pieces, four feet in length, at every manhole or catch basin, for all pipe entering or exiting.

F. Where connections are made to existing systems, rout out old drainage lines.

G. All newly constructed systems shall be cleaned of any accumulation of silt, debris, or foreign matter of any kind, and shall be free from such accumulations at time of final inspection.

H. Test for proper operation. Protect work from damage.

END OF SECTION

APPENDIX "A"

INFORMATION AVAILABLE TO BIDDERS

1. The following items are included herein for Bidder information.
   a. Geotechnical Engineering Report Camp Crowder Missouri National Guard Facility, Neosho, Missouri (Dated February 13, 2019), Project No. 018-3101

END OF DOCUMENT

GEOTECHNICAL ENGINEERING REPORT
CAMP CROWDER
MISSOURI NATIONAL GUARD FACILITY
NEOSHO, MISSOURI

Prepared For:

GLMV Architecture Inc.
Kansas City, Missouri

February 13, 2019
Olsson Project No. 018-3101

olsson

February 13, 2019

GLMV Architecture Inc.
Attn: Mr. Ryan Kremer
9229 Ward Parkway, Suite 210
Kansas City, Missouri 64114

Re: Geotechnical Engineering Report
Camp Crowder Missouri National Guard Facility
Neosho, Missouri
Olsson Project No. 018-3101

Dear Mr. Kremer,

Olsson has completed the geotechnical engineering report for the above referenced project. This report summarizes our understanding of the project, presents the findings of the borings and laboratory tests, discusses the observed subsurface conditions, and based on those conditions, provides our opinion and geotechnical engineering recommendations for this project.

We appreciate the opportunity to provide our geotechnical engineering services for this project. If you have any questions or need further assistance, please contact us at your convenience.

Respectfully submitted,
Olsson, Inc.

Suchan Lamichhane, Ph.D., P.E.
Geotechnical Engineer

James M. Landrum, P.E.
Senior Engineer

STATE OF MISSOURI
JAMES M. LANDRUM
NUMBER
E-22954
REGISTERED PROFESSIONAL ENGINEER

2/13/19

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TABLE OF CONTENTS

Page

A. PROJECT UNDERSTANDING 1
- A.1. Geotechnical Scope 1
- A.2. Site Information 1
- A.3. Project Information 2

B. EXPLORATORY AND TEST PROCEDURES 3
- B.1. Field Exploration 3
- B.2. Laboratory Testing 3

C. SUBSURFACE CONDITIONS 4
- C.1. Soil Stratigraphy 4
- C.2. Groundwater Observation 4

D. GEOTECHNICAL CONSIDERATIONS 5
- D.1 Karstic Features 5
- D.2 Existing Fill 6

E. SITE PREPARATION 7
- E.1. General Site and Subgrade Preparation 7
- E.2. Structural Fill 7
- E.3. Drainage and Groundwater Considerations 8

F. BUILDING AND STRUCTURES 10
- F.1. Foundation Design 10
- F.2. Floor Slab Design and Subgrade Preparation 10
- F.3. Seismic Classification 11

G. PAVEMENTS 12
- G.1. Pavement Subgrade Preparation 12
- G.2. Pavement Design 12

H. CONCLUSIONS AND LIMITATIONS 15
- H.1 Construction Observation and Testing 15
- H.2 Limitations 15

Appendices

Appendix “A” Boring Location Map

Appendix “B” Symbols and Nomenclature, Boring Logs

Appendix “C” Laboratory Test Results

A. PROJECT UNDERSTANDING

A.1. GEOTECHNICAL SCOPE

This Geotechnical Engineering Report presents the results of the subsurface exploration completed for the proposed 30-man and 60-man barracks, fitness center, dining building, and administration/headquarters building at Camp Crowder in Neosho, Missouri. Twenty-five (25) borings were drilled at the site for the new structures and associated pavement areas. Based on the subsurface conditions encountered in the borings, this Geotechnical Report presents our recommendations and opinions for the support of foundations, floor slabs and pavements associated with the proposed buildings.

A.2. SITE INFORMATION

The project site is located within the Camp Crowder Missouri Nation Guard Facility in Neosho, Missouri. The proposed buildings are located as shown in Figure A.1. At the time of our exploration, most of the building sites were vacant tracts covered with native shrubs and weeds except for two building sites, which were covered with an aggregate surface.

Based on our review of readily available historical aerial images obtained from Google Earth dating back to 1997, the individual project sites for the buildings have been essentially unchanged; however, many of the surrounding buildings were built since 1997. The two aggregate surface pads were also constructed sometime between 1997 and 2003.

Figure A.1: Site Location

A.3. PROJECT INFORMATION

We understand the following five buildings will be located as shown in Figure A.1:

- Administrative / Headquarters Building
- 200 Man Dining Building
- Fitness Center
- 30 Man Barracks
- 60 Man Barracks

Maximum column and wall loads for these structures are assumed to be 60 kips and 4 kips per lineal foot or less. One at-grade parking lot is planned south of the 200 Man Dining Building and another is planned north of the 30 Man Barracks.

We anticipate each building pad and parking area will be graded to achieve a relatively flat surface. We expect the site grading to consist of minimal cuts and fills of less than two feet.

The geotechnical recommendations presented herein are based on the available project information, proposed project location, and the subsurface conditions described in this report. If the loads or any of the noted information is incorrect, please inform ***Olsson*** so that we may amend the recommendations presented in this report if appropriate.

B. EXPLORATORY AND TEST PROCEDURES

B.1. FIELD EXPLORATION

Twenty-five (25) borings were drilled across the project site to approximate depths ranging from 5 to 15 feet with a truck-mounted drill-rig using solid-stem, continuous flight augers. Five borings were drilled within the parking areas (borings PK-1 to PK-5) to approximate depths of 5 feet each. Four borings were drilled to an approximate depth of 15 feet within the footprint of each building:

- Administrative / Headquarters Building – borings HQ-6 to HQ-9
- 200 Man Dining Building – borings D-10 to D-13
- 60 Man Barracks – borings B-14 to B-17
- Fitness Center – borings F-18 to F-21
- 30 Man Barracks – borings B-22 to B-25

The general locations of the borings were selected by ***Olsson*** based on the proposed site layout. The boring locations were determined by ***Olsson's*** Survey Crew. Approximate locations of the borings are shown on the Boring Location Plan in Appendix A and the Boring Logs are provided in Appendix B.

Soil samples were obtained at selected intervals in the borings using a split spoon sampler during the Standard Penetration Tests (SPT; "SS" on the boring logs). The standard split spoon sampler was driven in three 6-inch intervals into the substrata with blows from a 140-pound automatic hammer free-falling 30 inches. Penetration resistance (blow counts) were recorded for each 6-inch drive. Penetration resistance of the final 12 inches is considered SPT "N" values for the SS sampler. The blow counts and SPT "N" values are shown on the boring logs at the respective depths the samples were taken. The sample were sealed and transported to our laboratory for testing and classification.

B.2. LABORATORY TESTING

At our laboratory, all recovered soil samples were visually classified using the Unified Soil Classification System (USCS). The moisture contents of all samples were measured. In addition, Atterberg limits tests were performed on three selected samples. The field logs that were prepared by the drill crew were modified based on our observations of the samples and the results of the laboratory tests. Copies of the final boring logs are provided in Appendix B. The laboratory test results are presented on the respective boring logs and in the laboratory test result graphs in Appendix C.

C. SUBSURFACE CONDITIONS

C.1. SOIL STRATIGRAPHY

The appended boring logs show soil and bedrock conditions at the boring locations at the time they were drilled. The stratification boundaries shown on the boring logs represent the approximate locations of changes in the soil and bedrock types. In-situ, this transition is usually gradual. The boring logs do not reflect variations that may occur between borings or across the project site. The nature and extent of such variations may not become evident until construction.

Beneath the surficial materials, the subsurface conditions encountered in the borings consisted of clay soils with varying amounts of chert. Existing fill was encountered in several borings to depths of up to 6 feet. It is possible that the fill could be deeper in other areas across the site. Thin layers of chert, typically 1 foot or less, were encountered in borings HQ-8, F-19, F-20, B-22, and B-23 at varying depths. Weathered limestone or, possibly, a chert seam, was encountered in boring D-11 at an approximate depth of 14 feet. This boring terminated in the apparent limestone at a depth of 15 feet. The remaining borings terminated in clay soils at depths of 5 feet (parking lot borings) to 15 feet (building borings).

C.2. GROUNDWATER OBSERVATION

At borings PK-1 and PK-2, water was observed while drilling at a depth of 4 feet. Water was not observed in any of the other borings either during drilling or immediately upon completion. Variations and uncertainties exist with relatively short-term water level observations that were recorded during this exploration. Water levels can and should be anticipated to vary between boring locations, as well as with time within a specific boring. Water also tends to be present near the soil and bedrock interface and can flow through joints in the bedrock. Groundwater levels may be expected to fluctuate with precipitation, site grading, drainage and adjacent land use. Long term monitoring with piezometers generally provides a more representative indication of the potential range of groundwater conditions.

D. GEOTECHNICAL CONSIDERATIONS

D.1 KARSTIC FEATURES

To help evaluate the geologic hazards at this site, we reviewed information gathered from the Center for Applied Research and Environmental Systems (CARES) website. The CARES website has information related to current and past mines, mapped sinkholes, known faults and karst prone areas. According to the CARES website, this site is located within the Meramecian Series geologic unit that contains carbonate rocks such as limestone at or near the land surface in a humid climate, but is outside of karst prone soil zones as shown in Figure D.1. Fault lines are also shown in Figure D.1 with the closest fault approximately 6 miles from the project site.

Carbonate rocks are a potential geologic hazard, since these rocks may dissolve in water resulting in voids and cavities within the rock. When these cavities collapse, sinkholes can form at the ground surface. The nearest mapped sinkhole to this site is located approximately 4 miles of the project site as shown in Figure D.1. While carbonate rocks were not encountered in many of the borings, a layer of weathered limestone was encountered in borings PK-3 and D-11 at varying depths suggesting the presence of rock pinnacles as shown in Figure D.2. Pinnacles are columns or cones of limestone left by dissolution of the surrounding rock.

Figure D.1: Karst, Sinkhole, and Fault Map from CARES Website

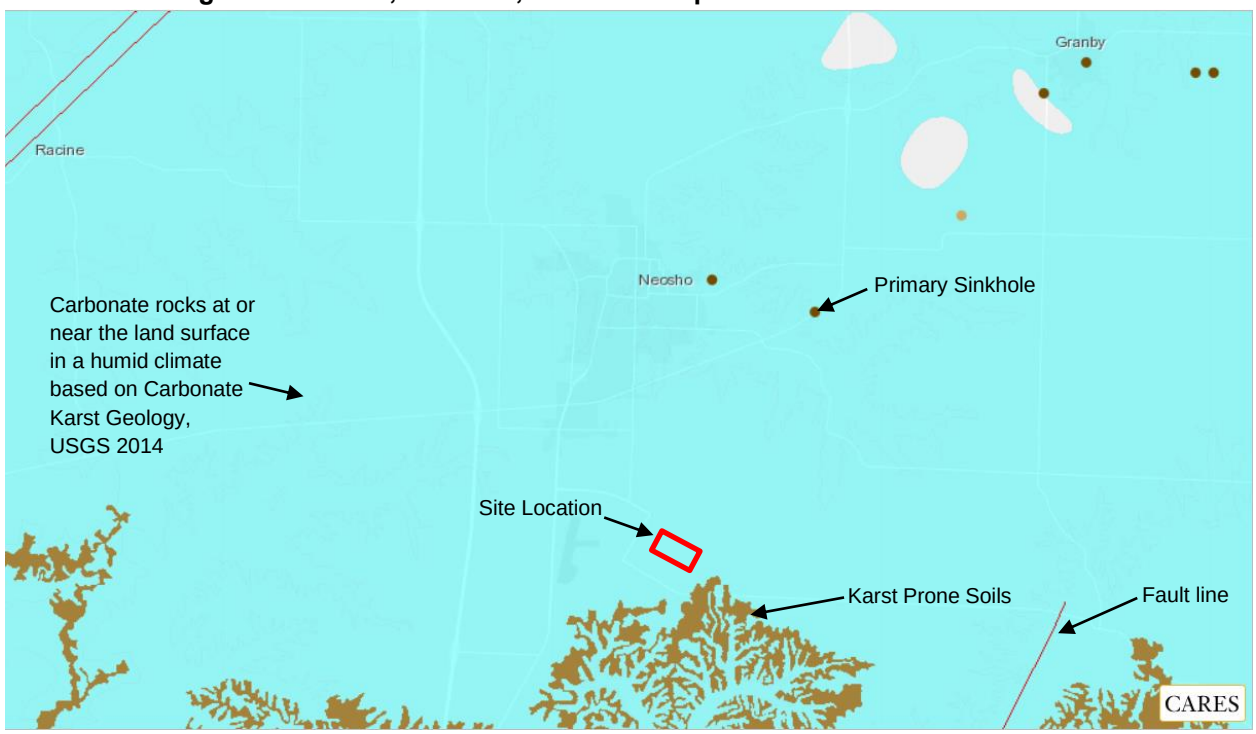
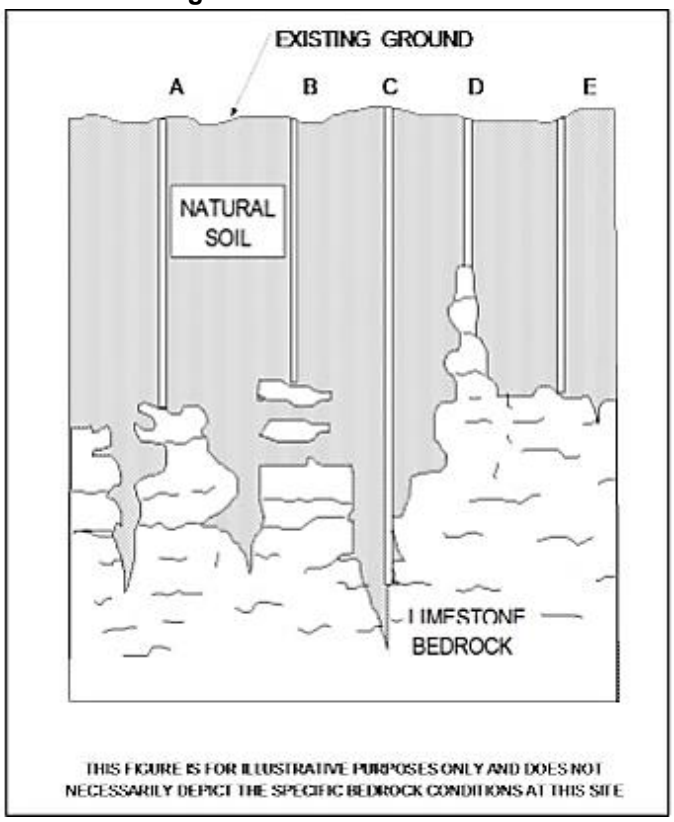


Figure D.2: Rock Pinnacles



D.2 EXISTING FILL

Up to 4 feet of potential fill material was observed at our borings. As the widely spaced, small diameter borings provide only a limited amount of data regarding the extent and composition of the existing fill, the existing fill may contain soft zones, debris or significantly greater amounts of unsuitable materials than could be reasonably inferred from the boring information. In addition, the lateral extent and depth of the fill could be greater that inferred by the boring logs. Test pits could be excavated prior to construction to further evaluate the extent and composition of the existing fill. Records regarding past fill placement on the site could also be reviewed, if available.

Based on the borings, the existing fill did not appear to have been placed with strict moisture, density, and material control necessary for the support of future structures. Foundations, floor slabs, and pavements supported on the existing fills that have not been compacted under controlled conditions may not perform predictably and could experience unacceptable amounts of total and differential settlement, including voiding beneath floor slabs. The settlement, in turn, could lead to cracking within walls and grade supported floor slabs, depressions and cracking in parking and drive areas, misaligned doors and windows, and other related issues. We recommend that unsuitable existing fill material be entirely removed from the building footprint and parking lot areas, as well as any other settlement sensitive areas, and replaced with structural fill. The zone of fill removal should extend laterally at least five feet beyond the edges of the proposed building footprint and three feet beyond the edges of new pavement areas.

E. SITE PREPARATION

E.1. GENERAL SITE AND SUBGRADE PREPARATION

Prior to commencement of grading operations, any existing organic topsoil, vegetation and related major root systems, organic soils, and any loose, soft or otherwise unsuitable or deleterious material should be stripped and removed from the entire construction area. This removal should also include unsuitable existing fill. Stripping depths and fill thicknesses will likely vary and should be adjusted as necessary. We recommend that the project budget allow for a contingency for removal of unsuitable fill. Site clearing, grubbing, and stripping should be completed during periods of dry weather. Operating heavy equipment on the site during periods of wet weather could result in excessive pumping and rutting of the subgrade soils. These stripped materials should be carefully separated to avoid incorporation into structural fill.

After grubbing, stripping, rough grading, and any required excavations, but prior to any fill being placed, we recommend that the exposed soil subgrades be proofrolled with a loaded tandem axle dump truck weighing at least 20 tons, or similar equipment, where access is feasible. Proofrolling operations should be observed by a representative of ***Olsson***. Once proofrolling is complete, but prior to the placement of fill, the upper 8 inches of exposed surface should be scarified, moisture conditioned, and recompacted to a minimum of 95 percent of maximum dry density as determined by Standard Proctor (ASTM D-698) at a moisture content between optimum and 4 percent above optimum. Once the subgrade has been compacted, the excavated areas should be filled in accordance with the recommendations presented in this report.

E.2. STRUCTURAL FILL

All structural fill and backfill should consist of approved materials, free of debris, organics (organic content less than 5 percent), and other unsuitable materials and should not have any particles larger than 3 inches. The on-site clay soils would be acceptable for use as structural fill except within the recommended low volume change (LVC) zone below the floor slab. Imported fill soils should generally exhibit a liquid limit less than 60 and a plasticity index less than 30 or soils with a minimum chert content of 35 percent contained on the No. 4 sieve. Samples of all proposed fill materials should be submitted to the geotechnical engineer of record prior to use on the site. Laboratory Proctor compaction tests and classification tests should be performed on any fill material placed during mass grading operations.

To reduce the potential for swelling of the subgrade soils and to provide a stable base for the floor slab, material placed within a minimum of 18 inches of the base of the floor slab granular leveling course for the building pad should consist of LVC material having a liquid limit less than 50 percent and a plasticity index less than 25 or a well graded granular material such as MoDOT Type 5 baserock.

We recommend that structural fill and backfill be compacted in accordance with the criteria provided in Table E.1. An ***Olsson*** representative should observe fill placement operations and perform field density tests concurrently to indicate if the specified compaction is being achieved.

Table E.1: Fill Placement Guidelines

Areas of Fill Placement	Material	Minimum Compaction Recommendation*	Moisture Content (% of Optimum)
Granular Layer – 4" beneath floor slab	ASTM C-33, #57 Stone	65% of Relative Density	As necessary to obtain density
Low Volume Change (LVC) – 18" below the based of granular layer in floor slabs	LL < 50 PI < 25	95%	0 to +4 percent
	MoDOT Type 5 Baserock	95%	As necessary to obtain density
Structural Fill – on-site	On-site Cherty Clay Soils	95%	0 to +4 percent
Structural Fill – imported	LL < 60 PI < 30	95%	0 to +4 percent
	Min 35% Chert Retained on No. 4 Sieve		
Pavement Subgrade – 12" below the base of the pavement or aggregate base	LL < 50 PI < 25	95%	0 to +4 percent
	Min 35% Chert Retained on No. 4 Sieve		
Aggregate base for pavement	MoDOT Type 5 Baserock	95%	As necessary to obtain density

*According to ASTM D-698 – Standard Proctor

Suitable fill materials should be placed in thin loose lifts of 8 inches or less. Within small excavations, such as in utility trenches, around manholes, or behind retaining walls, the use of vibrating plate compactors, jumping jack compactors or walk behind sheepsfoot compactors may be used to facilitate compaction in these areas. Loose lift thicknesses of 4 inches or less are recommended where small compaction equipment is used.

The moisture content for the structural fill and backfill at the time of compaction should generally be maintained between the ranges specified above. More stringent moisture limits may be necessary with certain soils and some adjustments to moisture contents may be necessary to achieve compaction in accordance with project specifications.

E.3. Drainage and Groundwater Considerations

Water should not be allowed to collect at the ground surfaces near foundations, floor slabs, or areas of new pavements, either during or after construction. Provisions should be made to quickly remove accumulating seepage water or storm water runoff from excavations. Undercut or excavated areas should be sloped toward one corner to allow rainwater or surface runoff to be quickly collected and gravity drained or pumped from construction areas. Subgrade soils that are exposed to precipitation or runoff should be evaluated by ***Olsson*** prior to the placement of new fill, reinforcing steel, or concrete, to determine if corrective action is required.

To minimize concerns related to improper or inadequate drainage away from foundation bearing subgrades or from cohesive backfill materials used in utility or foundation trenches, we recommend the following:

- Site grading should provide for efficient drainage of rainfall or surface runoff away from new structures and pavement.
- Roof run-off should be collected and discharged directly to the storm sewer system or directed to a location with positive and rapid drainage away from new structures and pavements.
- External hose connections in unpaved areas should incorporate splash blocks to prevent accidental flooding of foundation bearing or backfill soils. External hose connections should have cut-off valves inside the building to prevent accidental or unauthorized use.
- Maintenance personnel should be informed of the potential problems associated with watering near the building.

F. BUILDING AND STRUCTURES

F.1. FOUNDATION DESIGN

In our opinion, shallow foundations bearing on stiff native clay soils or structural fill can be used to support the new buildings. Shallow foundations supported on stiff native clay soils or structural fill can be designed and proportioned for a maximum net allowable net bearing pressure of 2,500 pounds per square foot (psf). The net allowable bearing pressure is the pressure at foundation level in excess of the surrounding overburden pressure. The net allowable bearing capacity can be increased by 1/3 for transient loadings (short term loading such as wind load or seismic load) when used with the alternative basic load combinations of Section 1605.3.2 of IBC 2015.

Perimeter/exterior footings and footings in unheated areas should bear at a minimum depth of 24 inches below the lowest adjacent finished grade for protection against frost and moisture fluctuations. Footings should have a minimum width of 24 inches for isolated column footings and 16 inches for continuous/strip footings. Earth formed trench footings shall be at least 12 inches wide and should be designed with sufficient structural reinforcement to span a minimum of 10 feet when acting as a continuous grade beam under the foundation loads.

Lightly loaded interior partition walls (applying less than 0.75 kips per linear foot) may be supported directly on the slab-on-grade floor. Depending on the floor slab design and the specific wall loads, it may be appropriate to increase the floor slab reinforcement or provide a thickened slab cross section below interior walls. For interior walls with loads greater than 0.75 klf, ***Olsson*** recommends that a footing be installed, independent from the floor slab to properly distribute the wall loads to the underlying soils and reduce the potential for floor slab damage.

Foundations designed and constructed as recommended above would be expected to experience total settlements on the order of 1 inch and differential settlements on the order of ½ inch.

Olsson should observe the bearing conditions at all foundations. It is possible that softer soils could be present near the foundation bearing elevation. If the soils are not suitable to support the foundation design bearing pressure, footings should be deepened to suitable soils. After foundation subgrades have been observed and evaluated by an ***Olsson*** representative, concrete should be placed as soon as possible to avoid subjecting the exposed soils to drying, wetting, or freezing conditions. If foundation subgrade soils are subjected to such conditions, the Geotechnical Engineer should be contacted to reevaluate the foundation bearing materials.

F.2. FLOOR SLAB DESIGN AND SUBGRADE PREPARATION

We recommend the soil within the building footprint be undercut to a depth of 22 inches below the base of the floor slab. We recommend 18 inches MoDOT Type 5 baserock, be placed and compacted beneath the floor slab. Above the LVC zone, we recommend a free draining, 4-inch thick granular leveling and drainage course consisting of ASTM C-33 size No. 57 stone, or equivalent, be installed beneath the concrete floor slab for uniform

support and to act as a capillary break. For moisture sensitive floors, an additional vapor retarder may be required per American Concrete Institute (ACI) 360R recommendations.

The soil subgrade in the areas of concrete slab-on-grade support is often disturbed during foundation and superstructure construction. As such, the moisture content of the LVC zone should be checked and reworked as necessary prior to slab construction. Assuming the above recommendations are implemented, a subgrade modulus of 100 pci can be used for design.

The procedures recommended above may not eliminate all future subgrade volume change and resultant floor slab movement. Common construction practice is to tie the slab-on-grade into the foundation elements to limit the impact of differential movement at doorways. Depending on many factors, including the size and shape of the floor area, the location of construction joints in the slab, the rigidity of the slab and foundation connection, and the magnitude of actual movement that occurs, cracks within the floor slab should be anticipated. Leaking utility lines or water allowed to accumulate beneath the slab could lead to significant movements of the slab.

F.3. Seismic Classification

The soil conditions encountered at this site are consistent with the definition of Site Class “D” (Stiff soil profile) as per ASCE-07/10 site class.

G. PAVEMENTS

G.1. PAVEMENT SUBGRADE PREPARATION

Where high plasticity soils are encountered with a chert content less than 35 percent at the proposed finished pavement elevation, such soils should be overexcavated to a minimum depth of 12 inches below the pavement section and replaced with material that has a liquid limit less than 50 and a plasticity index less than 25 or on-site soils with a minimum chert content of 35 percent contained on the No. 4 sieve. The overexcavation backfill should be compacted as recommended in *Section E.2*.

As the time for pavement construction approaches, the pavement subgrades initially prepared early in the project should be carefully evaluated. We recommend that the moisture content and density of the top 8 inches of the subgrade be checked and the pavement subgrades be evaluated by proofrolling within two days prior to commencement of actual paving operations. Particular attention should be paid to high traffic areas that were rutted and disturbed earlier and to areas where backfilled trenches are located. If the material is not in compliance with the required ranges of moisture or density, the subgrade should then be moisture conditioned and recompacted. If any significant event (such as precipitation) occurs after the evaluation, the subgrade should be reviewed by qualified personnel immediately prior to paving. The subgrade should be in its finished form at the time of the final review.

On most project sites, the site grading is accomplished relatively early in the construction phase, and controlled fills are placed and compacted in a uniform manner. However, as construction proceeds, excavations are made into these areas, rainfall and surface water saturates some areas, heavy construction traffic disrupts the subgrade and many surface irregularities are filled in with loose soils to temporarily improve trafficability. A non-uniform subgrade can result in poor pavement performance and local failures relatively soon after pavements are constructed. If soft areas are identified during the subgrade preparation or if the subgrade soils have been exposed to adverse weather conditions, frost, excessive construction traffic, standing water, or similar conditions, ***Olsson*** should be consulted to determine if corrective action is necessary.

It is important that the subgrade support be relatively uniform, with no abrupt changes in the degree of support. Non-uniform roadway support can occur at the transition from cut to fill areas, or as a result of varying soil moisture contents or soil types, or where improperly placed utility backfill has been placed across or through areas to be paved. Improper subgrade preparation such as inadequate vegetation removal, failure to identify soft or unstable areas, and inadequate or improper compaction can also produce non-uniform subgrade support.

G.2. PAVEMENT DESIGN

Table G.2. summarizes typical pavement sections for full-depth asphaltic concrete (AC), AC with an aggregate base, and Portland cement concrete (PCC) used in light auto parking areas. The sections represent typical minimum thicknesses assuming routine maintenance and no truck traffic. Routine maintenance typically consists of periodic seal coats and possibly one intermediate mill, in addition to regular crack maintenance.

PCC pavements are recommended for trash receptacle pads and approaches, loading/unloading areas, and other areas where heavy wheel loads will be concentrated. Concrete pavements in these areas should have a minimum thickness of 8 inches with a 4-inch leveling and drainage course of clean, crushed rock placed below the pavements. The leveling and drainage course for the PCC pavements should have an appropriate sub-drainage or other connection to a suitable gravity outfall to remove water from the drainage layer. The pavement subgrade should be graded to provide positive drainage below the granular base section. We further recommend that the length of concrete sections be such that no heavy truck wheels are allowed to rest on AC sections during loading/unloading operations.

Table G.2.: Minimum Recommended Pavement Sections

Parking Areas	Drive Areas	Heavy Vehicle Areas*
Full Depth AC: 2” AC Surface 4” AC Base ACC with Granular Base: 2” AC Surface 3” AC Base 6” Compacted MoDOT Type 5 Full Depth PCC: 5” PCC 4” Clean Rock	Full Depth AC: 2” AC Surface 6” AC Base ACC with Granular Base: 2” AC Surface 4” AC Base 6” Compacted MoDOT Type 5 Full Depth PCC: 6” PCC 4” Clean Rock	Full Depth PCC: 8” PCC 4” Clean Rock *Heavy Vehicle Areas Consist of Loading Areas, Trash Receptacle Pads and Approaches, etc.

The performance of pavements will be dependent upon a number of factors, including subgrade conditions at the time of paving, rainwater runoff, and traffic. Rainwater runoff should not be allowed to seep below pavements from adjacent areas. Pavements should be sloped approximately 1/4 inch per foot to provide rapid surface drainage.

Surface drainage around the pavement and proper maintenance are also important to long-term performance. Curbs should be backfilled as soon as possible after construction of the pavement. Backfill should be compacted and should be sloped to prevent water from ponding and infiltrating under the pavement. All pavement joints should be caulked and any cracks should be quickly patched or sealed to prevent moisture from reaching and softening the subgrade.

Construction traffic on the pavements has not been considered in the above noted typical sections. If construction scheduling dictates that the pavements will be subject to traffic by construction equipment/vehicles, increasing the pavement thickness should be considered to include the effects of additional traffic loading. Construction traffic should not be allowed on partially completed pavements as the pavements will not have adequate structural capacity and could be damaged.

H. CONCLUSIONS AND LIMITATIONS

H.1 CONSTRUCTION OBSERVATION AND TESTING

We recommend that all earthwork during construction be monitored by a representative of ***Olsson***, including site preparation, placement of all engineered fill and trench backfill, construction of slabs, pavements and pavement subgrades, and all foundation excavations. The purpose of these services would be to provide ***Olsson*** the opportunity to observe the soil conditions encountered during construction, evaluate the applicability of the recommendations presented in this report to the soil conditions encountered, and recommend appropriate changes in design or construction procedures if conditions differ from those described herein.

H.2 LIMITATIONS

The conclusions and recommendations presented in this report are based on the information available regarding the proposed construction, the results obtained from our soil test borings and sampling procedures, the results of the laboratory testing program, and our experience with similar projects. The soil test borings represent a very small statistical sampling of subsurface soils and it is possible that conditions may be encountered during construction that are substantially different from those indicated by the soil test borings. In these instances, adjustments to design and construction may be necessary.

This geotechnical report is based on the site plan and information provided to ***Olsson*** and our understanding of the project as noted in this report. Changes in the location or design of new structures and/or pavements could significantly affect the conclusions and recommendations presented in this geotechnical report. ***Olsson*** should be contacted in the event of such changes to determine if the recommendations of this report remain appropriate for the revised site design.

This report was prepared under the direction and supervision of a Professional Engineer registered in the State of Missouri with the firm of **Olsson, Inc**. The conclusions and recommendations contained herein are based on generally accepted professional geotechnical engineering practices at the time of this report within this geographic area. No other warranty is expressed, intended or made. This report has been prepared for the exclusive use of **GLMV Architecture Inc.** and their authorized representatives for specific application to the proposed project.

Camp Crowder Missouri National Guard Facility

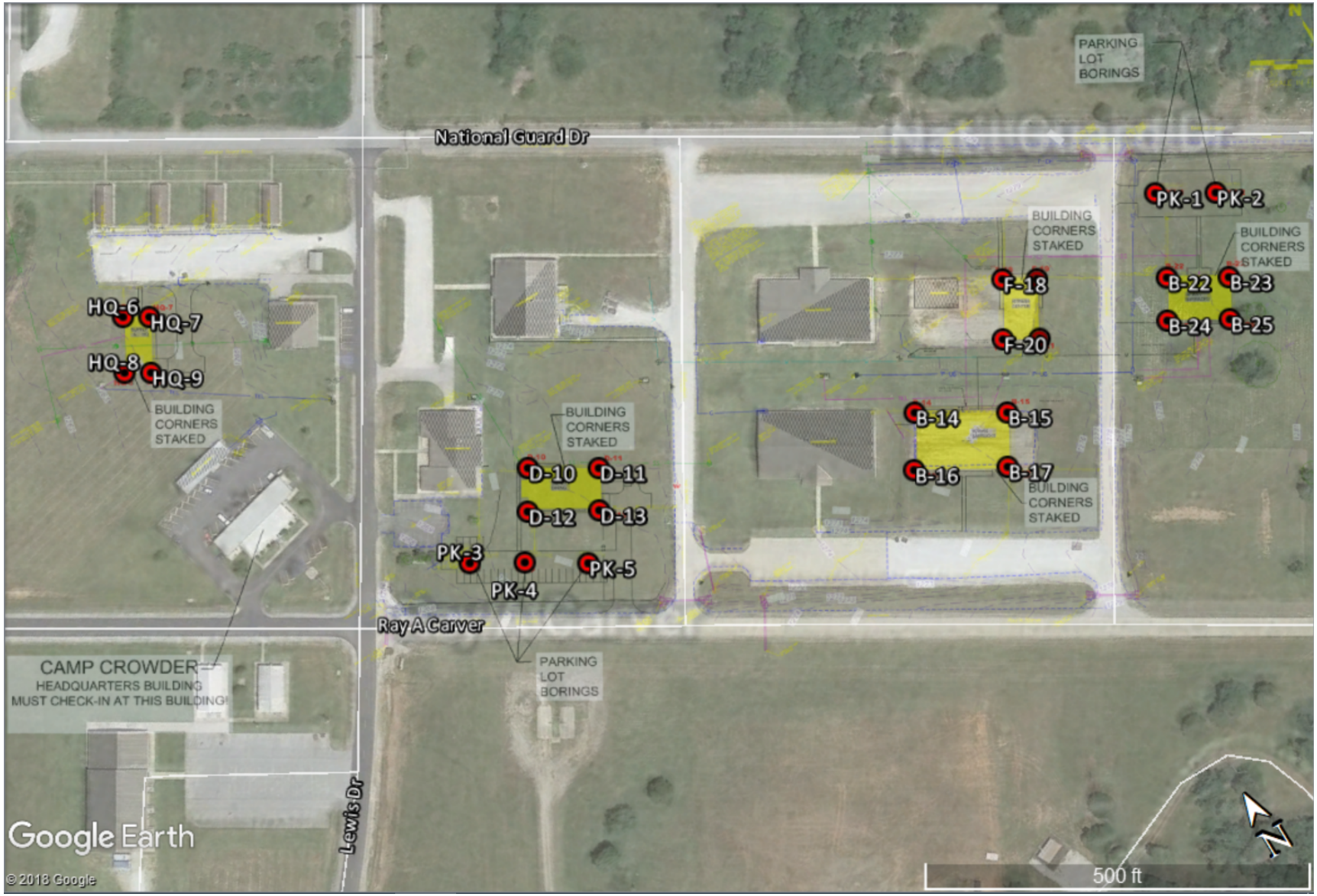
Neosho, Missouri 2019

February 13, 2019

Olsson Project No. 018-3101

APPENDIX A

BORING LOCATION PLAN



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	Boring Location Map
Scale: NTS	**Camp Crowder Missouri National Guard Facility Neosho, Missouri**
Project: 018-3101	
Approved by: JML	
Date: 2/11/2019	

APPENDIX B

SYMBOLS AND NOMENCLATURE
BORING LOGS

SYMBOLS AND NOMENCLATURE

DRILLING NOTES

DRILLING AND SAMPLING SYMBOLS

SS:	Split-Spoon Sample (1.375" ID, 2.0" OD)	HSA:	Hollow Stem Auger	NE:	Not Encountered
U:	Thin-Walled Tube Sample (3.0" OD)	CFA:	Continuous Flight Auger	NP:	Not Performed
CS:	Continuous Sample	HA:	Hand Auger	NA:	Not Applicable
BS:	Bulk Sample	CPT:	Cone Penetration Test	% Rec:	Percent of Recovery
MC:	Modified California Sampler	WB:	Wash Bore	WD:	While Drilling
GB:	Grab Sample	FT:	Fish Tail Bit	IAD:	Immediately After Drilling
SPT:	Standard Penetration Test Blows per 6.0"	RB:	Rock Bit	AD:	After Drilling
				CI:	Cave-In

DRILLING PROCEDURES

Soil samples designated as "U" samples on the boring logs were obtained in using Thin-Walled Tube Sampling techniques. Soil samples designated as "SS" samples were obtained during Penetration Test using a Split-Spoon Barrel sampler. The standard penetration resistance 'N' value is the number of blows of a 140 pound hammer falling 30 inches to drive the Split-Spoon sampler one foot. Soil samples designated as "MC" were obtained in using Thick-Walled, Ring-Lined, Split-Barrel Drive sampling techniques. Recovered samples were sealed in containers, labeled, and protected for transportation to the laboratory for testing.

WATER LEVEL MEASUREMENTS

Water levels indicated on the boring logs are levels measured in the borings at the times indicated. In relatively high permeable materials, the indicated levels may reflect the location of groundwater. In low permeability soils, the accurate determination of groundwater levels is not possible with only short-term observations.

SOIL PROPERTIES & DESCRIPTIONS

Descriptions of the soils encountered in the soil test borings were prepared using Visual-Manual Procedures for Descriptions and Identification of Soils.

PARTICLE SIZE

Boulders	12 in. +	Coarse Sand	4.75mm-2.0mm	Silt	0.075mm-0.005mm
Cobbles	12 in.-3 in.	Medium Sand	2.0mm-0.425mm	Clay	<0.005mm
Gravel	3 in.-4.75mm	Fine Sand	0.425mm-0.075mm		

COHESIVE SOILS

Consistency	Unconfined Compressive Strength (Qu) (tsf)
Very Soft	<0.25
Soft	0.25 – 0.5
Firm	0.5 – 1.0
Stiff	1.0 – 2.0
Very Stiff	2.0 – 4.0
Hard	> 4.0

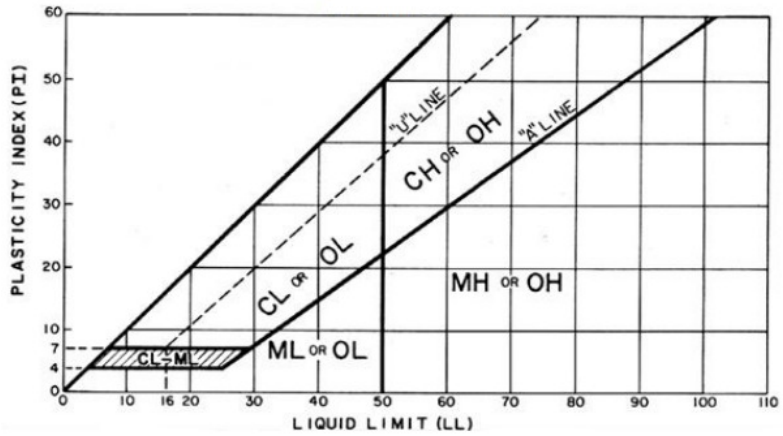
COHESIONLESS SOILS

Relative Density	'N' Value
Very Loose	0 – 3
Loose	4 – 9
Medium Dense	10 – 29
Dense	30 – 49
Very Dense	≥ 50

COMPONENT %

Description	Percent (%)
Trace	<5
Few	5 - 10
Little	15 - 25
Some	30 - 45
Mostly	50 - 100

PLASTICITY CHART



ROCK QUALITY DESIGNATION (RQD)

Description	RQD (%)
Very Poor	0 – 25
Poor	25 – 50
Fair	50 – 75
Good	75 – 90
Excellent	90 – 100

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SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

BOREHOLE REPORT NO. B-14

PROJECT NAME: Camp Crowder30 Barracks	CLIENT: GLMV Architecture Inc
PROJECT NUMBER: A18-3101	LOCATION: Joplin, Missouri

Split Spoon

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE ***0.3'***		0								
	FILL *Lean to fat clay, dark brown with red brown, silty, with chert*			SS 1		4-3-4 N=7		38.4			
	3.5'										
	FAT CLAY *Reddish brown with brown and gray, cherty*		5	SS 2		5-12-8 N=20		24.8			
	6.2' *Reddish brown, with chert and sand*										
			10	SS 3		17-47-40 N=87		27.1			
	15.0'		15	SS 4		9-9-23 N=32		48.2			

BASE OF BORING AT 15.0 FEET

WATER LEVEL OBSERVATIONS	
WD	Not Encountered
IAD	Not Encountered
AD	Not Performed

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	1/28/19	FINISHED:	1/28/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45
DRILLER:	K. PATTERSON	LOGGED BY:	K. PATTERSON
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. B-15

PROJECT NAME: Camp Crowder30 Barracks	CLIENT: GLMV Architecture Inc
PROJECT NUMBER: A18-3101	LOCATION: Joplin, Missouri

Split Spoon

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	CRUSHED AGGREGATE *1.0'*		0								
	FAT CLAY *Reddish brown, cherty* *3.5'*			SS 1		4-6-10 N=16		20.3			
	Reddish brown with light brown, cherty, sandy		5	SS 2		5-7-23 N=30		36.4			
			10	SS 3		7-10-13 N=23		39.1			
	15.0'		15	SS 4		16-23-12 N=35		38.7			

BASE OF BORING AT 15.0 FEET

WATER LEVEL OBSERVATIONS	
WD	Not Encountered
IAD	Not Encountered
AD	Not Performed

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	1/28/19	FINISHED:	1/28/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45
DRILLER:	K. PATTERSON	LOGGED BY:	K. PATTERSON
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. B-16

PROJECT NAME: Camp Crowder30 Barracks	CLIENT: GLMV Architecture Inc
PROJECT NUMBER: A18-3101	LOCATION: Joplin, Missouri

Split Spoon

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE ***0.3'***		0								
	FILL *Dark brown, silty, with chert* ***2.2'***			SS 1		4-4-4 N=8		28.9			
	FAT CLAY *Reddish brown* ***3.5'***										
	Reddish brown, cherty, sandy		5	SS 2		5-14-16 N=30		25.5			
			10	SS 3		5-11-11 N=22		44.1			
	15.0'		15	SS 4		6-13-14 N=27		52.3			

BASE OF BORING AT 15.0 FEET

WATER LEVEL OBSERVATIONS	
WD	Not Encountered
IAD	Not Encountered
AD	Not Performed

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	1/28/19	FINISHED:	1/28/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45
DRILLER:	K. PATTERSON	LOGGED BY:	K. PATTERSON
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. B-17

PROJECT NAME: Camp Crowder30 Barracks	CLIENT: GLMV Architecture Inc
PROJECT NUMBER: A18-3101	LOCATION: Joplin, Missouri

Split Spoon

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE 0.3'		0								
	LEAN TO FAT CLAY 1.0'										
	Brown with brown gray (possible fill)			SS 1		25-14-8 N=22		25.7			
	FAT CLAY										
	Reddish brown, cherty 3.5'										
	Reddish brown, cherty, sandy		5	SS 2		12-17-18 N=35		23.7			
	8.5'										
			10	SS 3		6-8-22 N=30		34.9			
			15	SS 4		8-8-22 N=30		42.3			

BASE OF BORING AT 15.0 FEET

WATER LEVEL OBSERVATIONS	
WD	Not Encountered
IAD	Not Encountered
AD	Not Performed

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	1/28/19	FINISHED:	1/28/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45
DRILLER:	K. PATTERSON	LOGGED BY:	K. PATTERSON
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. B-22

PROJECT NAME: Camp Crowder30 Barracks	CLIENT: GLMV Architecture Inc
PROJECT NUMBER: A18-3101	LOCATION: Joplin, Missouri

Split Spoon

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE 0.3'		0								
	LEAN TO FAT CLAY *Brown with reddish brown*			SS 1	CL	5-12-16 N=28		29.4		41/21	
	FAT CLAY 3.0' *Reddish brown, sandy, cherty*			SS 2		42-31-33 N=64		17.6			
	Reddish brown with light brown, with chert 6.7'		5								
				SS 3		10-26-50/3"		33.9			
			10								
	CHERT 13.8' 14.0'			SS 4		50		40.2			

BASE OF BORING AT 14.0 FEET

WATER LEVEL OBSERVATIONS	
WD	Not Encountered
IAD	Not Encountered
AD	Not Performed

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	1/25/19	FINISHED:	1/25/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45
DRILLER:	K. PATTERSON	LOGGED BY:	K. KEMPTON
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. B-23

PROJECT NAME: Camp Crowder30 Barracks	CLIENT: GLMV Architecture Inc
PROJECT NUMBER: A18-3101	LOCATION: Joplin, Missouri

Split Spoon

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE 0.3'		0								
	LEAN TO FAT CLAY *Dark brown to reddish brown, sandy, cherty, trace gravel (possible fill)* 3.0'			SS 1		6-4-4 N=8		18.8			
	FAT CLAY *Reddish brown with light brown and gray, cherty*		5	SS 2		4-8-8 N=16		25.2			
	9.7'			SS 3		9-5-36 N=41		39.0			
	CHERT 10.5'		10								
	FAT CLAY *Reddish brown, with chert* 13.5'										
	Reddish brown with light brown, trace chert and sand 15.0'		15	SS 4		8-9-10 N=19		45.7			

BASE OF BORING AT 15.0 FEET

WATER LEVEL OBSERVATIONS	
WD	Not Encountered
IAD	Not Encountered
AD	Not Performed

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	1/25/19	FINISHED:	1/25/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45
DRILLER:	K. PATTERSON	LOGGED BY:	K. KEMPTON
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. B-24

PROJECT NAME: Camp Crowder30 Barracks	CLIENT: GLMV Architecture Inc
PROJECT NUMBER: A18-3101	LOCATION: Joplin, Missouri

Split Spoon

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE 0.3'		0								
	FILL *Dark brown to brown, with organics*			SS 1		4-4-4 N=8		24.9			
	3.2' ***FAT CLAY*** 3.5' *Reddish brown, cherty* *Red to reddish brown, with chert, trace sand*		5	SS 2		14-18-10 N=28		19.4			
			10	SS 3		11-13-12 N=25		45.5			
	15.0'		15	SS 4		12-14-40 N=54		34.0			

BASE OF BORING AT 15.0 FEET

WATER LEVEL OBSERVATIONS	
WD	Not Encountered
IAD	Not Encountered
AD	Not Performed

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	1/25/19	FINISHED:	1/25/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45
DRILLER:	K. PATTERSON	LOGGED BY:	K. KEMPTON
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. B-25

PROJECT NAME: Camp Crowder30 Barracks	CLIENT: GLMV Architecture Inc
PROJECT NUMBER: A18-3101	LOCATION: Joplin, Missouri

Split Spoon

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE ***0.3'***		0								
	LEAN TO FAT CLAY *Dark brown* ***1.7'***			SS 1	CL	5-3-4 N=7		25.3		42/23	
	Light brown with red brown (possible fill) ***3.0'***										
	FAT CLAY *Red to reddish brown with light brown, with chert*		5	SS 2		23-13-16 N=29		32.7			
			10	SS 3		6-9-30 N=39		44.6			
	15.0'		15	SS 4		8-8-10 N=18		33.3			

BASE OF BORING AT 15.0 FEET

WATER LEVEL OBSERVATIONS	
WD	Not Encountered
IAD	Not Encountered
AD	Not Performed

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	1/25/19	FINISHED:	1/25/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45
DRILLER:	K. PATTERSON	LOGGED BY:	K. KEMPTON
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. D-10

PROJECT NAME: Camp Crowder30 Barracks	CLIENT: GLMV Architecture Inc
PROJECT NUMBER: A18-3101	LOCATION: Joplin, Missouri

Split Spoon

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE 0.3'		0								
	LEAN TO FAT CLAY *Brown to dark brown, trace organics* 2.5'			SS 1		7-7-9 N=16		28.3			
	Reddish brown, cherty, with sand										
			5	SS 2		9-6-9 N=15		36.6			
			10	SS 3		16-17-13 N=30		28.4			
	13.5'										
	Reddish brown to dark red brown, with sand 15.0'		15	SS 4		19-16-32 N=48		45.9			

BASE OF BORING AT 15.0 FEET

WATER LEVEL OBSERVATIONS	
WD	Not Encountered
IAD	Not Encountered
AD	Not Performed

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	1/23/19	FINISHED:	1/23/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45
DRILLER:	K. PATTERSON	LOGGED BY:	K. KEMPTON
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. D-11

PROJECT NAME: Camp Crowder30 Barracks	CLIENT: GLMV Architecture Inc
PROJECT NUMBER: A18-3101	LOCATION: Joplin, Missouri

Split Spoon

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE 0.3'		0								
	LEAN TO FAT CLAY *Dark brown to light gray with reddish brown* 2.2'			SS 1		3-5-14 N=19		25.7			
	FAT CLAY *Reddish brown, with weathered chert* 3.5'										
	Dark reddish brown to red brown, sandy, with chert		5	SS 2		21-12-23 N=35		38.4			
			10	SS 3		12-17-12 N=29		45.2			
	14.2' ***HIGHLY WEATHERED LIMESTONE*** *Yellow brown* 15.0'		15	SS 4		22-19-13 N=32		40.7			

BASE OF BORING AT 15.0 FEET

WATER LEVEL OBSERVATIONS	
WD	Not Encountered
IAD	Not Encountered
AD	Not Performed

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	1/24/19	FINISHED:	1/24/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45
DRILLER:	K. PATTERSON	LOGGED BY:	K. KEMPTON
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. D-12

PROJECT NAME: Camp Crowder30 Barracks	CLIENT: GLMV Architecture Inc
PROJECT NUMBER: A18-3101	LOCATION: Joplin, Missouri

Split Spoon

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE 0.3'		0								
	LEAN TO FAT CLAY *Brown, trace organics* 2.5'			SS 1		5-13-33 N=46		24.6			
	FAT CLAY *Reddish brown with gray, sandy, cherty* 3.5'										
	Reddish brown, sandy, cherty		5	SS 2		15-18-20 N=38		15.5			
	6.0' *Reddish brown, trace chert* 8.5'										
	Dark reddish brown to red brown, with chert and sand		10	SS 3		8-5-8 N=13		43.0			
	15.0'		15	SS 4		12-12-12 N=24		32.8			

BASE OF BORING AT 15.0 FEET

WATER LEVEL OBSERVATIONS	
WD	Not Encountered
IAD	Not Encountered
AD	Not Performed

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	1/23/19	FINISHED:	1/23/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45
DRILLER:	K. PATTERSON	LOGGED BY:	K. KEMPTON
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. D-13

PROJECT NAME: Camp Crowder30 Barracks	CLIENT: GLMV Architecture Inc
PROJECT NUMBER: A18-3101	LOCATION: Joplin, Missouri

Split Spoon

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE 0.3'		0								
	LEAN TO FAT CLAY *Dark brown with gray and red, with gravel and sand* 2.5'			SS 1		5-13-31 N=44		24.7			
	FAT CLAY *Dark reddish brown to red brown, cherty, with sand*		5	SS 2		15-21-16 N=37		26.0			
	8.5'										
	Reddish brown to red, sandy, cherty		10	SS 3		11-18-40 N=58		33.9			
	15.0'		15	SS 4		22-15-12 N=27		48.7			

BASE OF BORING AT 15.0 FEET

WATER LEVEL OBSERVATIONS	
WD	Not Encountered
IAD	Not Encountered
AD	Not Performed

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	1/23/19	FINISHED:	1/23/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45
DRILLER:	K. PATTERSON	LOGGED BY:	K. KEMPTON
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. F-18

PROJECT NAME: Camp Crowder30 Barracks	CLIENT: GLMV Architecture Inc
PROJECT NUMBER: A18-3101	LOCATION: Joplin, Missouri

Split Spoon

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	CRUSHED AGGREGATE *1.0'*		0								
	FILL *Lean to fat clay, brown, with organics* *3.0'*			SS 1		4-4-3 N=7		37.0			
	FAT CLAY *Gray with reddish brown, silty, with chert* *5.0'*		5	SS 2		44-18-14 N=32		18.1			
	Dark reddish brown to red brown, cherty *10.0'*		10	SS 3		13-13-38 N=51		39.6			
	Reddish brown, sandy, cherty *13.5'*										
	Red brown, with chert *15.0'*		15	SS 4		5-5-17 N=22		49.5			

BASE OF BORING AT 15.0 FEET

WATER LEVEL OBSERVATIONS	
WD	Not Encountered
IAD	Not Encountered
AD	Not Performed

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	1/25/19	FINISHED:	1/25/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45
DRILLER:	K. PATTERSON	LOGGED BY:	K. KEMPTON
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. F-19

PROJECT NAME: Camp Crowder30 Barracks	CLIENT: GLMV Architecture Inc
PROJECT NUMBER: A18-3101	LOCATION: Joplin, Missouri

Split Spoon

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	FILL		0								
	Lean to fat clay, reddish brown to light brown, cherty			SS 1		6-5-4 N=9		17.5			
	3.2'										
	FAT CLAY ***3.5'***										
	Reddish brown, cherty			SS 2		8-12-13 N=25		18.5			
	Grayish brown with red, with chert		5								
	5.7'										
	CHERT										
	6.5'										
	FAT CLAY										
	Reddish brown, cherty										
	9.1'										
	Red with light reddish brown, sandy, with chert		10	SS 3		6-17-25 N=42		43.4			
			15	SS 4		34-14-7 N=21		50.3			
	15.0'										

BASE OF BORING AT 15.0 FEET

WATER LEVEL OBSERVATIONS	
WD	Not Encountered
IAD	Not Encountered
AD	Not Performed

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	1/25/19	FINISHED:	1/25/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45
DRILLER:	K. PATTERSON	LOGGED BY:	K. KEMPTON
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. F-20

PROJECT NAME: Camp Crowder30 Barracks	CLIENT: GLMV Architecture Inc
PROJECT NUMBER: A18-3101	LOCATION: Joplin, Missouri

Split Spoon

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	CRUSHED AGGREGATE ***0.5'***		0								
	FILL *Fat clay, reddish brown, trace chert* ***3.8'***			SS 1		4-3-2 N=5		39.4			
	FAT CLAY *Gray with reddish brown, with sand and chert* ***6.1'***		5	SS 2		4-4-10 N=14		26.1			
	CHERT ***6.6'***										
	FAT CLAY *Reddish brown to light reddish brown, sandy, cherty*		10	SS 3		11-11-30 N=41		42.7			
	15.0'		15	SS 4		11-8-11 N=19		50.1			

BASE OF BORING AT 15.0 FEET

WATER LEVEL OBSERVATIONS	
WD	Not Encountered
IAD	Not Encountered
AD	Not Performed

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	1/25/19	FINISHED:	1/25/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45
DRILLER:	K. PATTERSON	LOGGED BY:	K. KEMPTON
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. F-21

PROJECT NAME: Camp Crowder30 Barracks	CLIENT: GLMV Architecture Inc
PROJECT NUMBER: A18-3101	LOCATION: Joplin, Missouri

Split Spoon

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE ***0.3'***		0								
	FILL *Lean to fat clay, reddish brown to dark brown, with chert*			SS 1		5-5-5 N=10		26.2			
	4.0' ***FAT CLAY*** *Reddish brown with light brown, sandy, cherty*		5	SS 2		7-23-20 N=43		22.3			
			10	SS 3		14-13-33 N=46		31.6			
	13.5' *Red brown, with chert* ***15.0'***		15	SS 4		6-4-4 N=8		47.9			

BASE OF BORING AT 15.0 FEET

WATER LEVEL OBSERVATIONS	
WD	Not Encountered
IAD	Not Encountered
AD	Not Performed

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	1/25/19	FINISHED:	1/25/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45
DRILLER:	K. PATTERSON	LOGGED BY:	K. KEMPTON
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. HQ-6

PROJECT NAME: Camp Crowder30 Barracks	CLIENT: GLMV Architecture Inc
PROJECT NUMBER: A18-3101	LOCATION: Joplin, Missouri

Split Spoon

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE 0.3'		0								
	LEAN TO FAT CLAY 1.0'										
	Dark gray brown ***LEAN TO FAT CLAY*** *Reddish brown with yellow brown, sandy, cherty* 3.5'			SS 1		14-24-42 N=66		16.0			
	FAT CLAY *Reddish brown, sandy, cherty*		5	SS 2		8-13-13 N=26		23.9			
			10	SS 3		4-7-7 N=14		38.7			
	15.0'		15	SS 4		28-17-18 N=35		38.1			

BASE OF BORING AT 15.0 FEET

WATER LEVEL OBSERVATIONS	
WD	Not Encountered
IAD	Not Encountered
AD	Not Performed

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	1/24/19	FINISHED:	1/24/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45
DRILLER:	K. PATTERSON	LOGGED BY:	K. KEMPTON
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. HQ-7

PROJECT NAME: Camp Crowder30 Barracks	CLIENT: GLMV Architecture Inc
PROJECT NUMBER: A18-3101	LOCATION: Joplin, Missouri

Split Spoon

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE 0.3'		0								
	LEAN TO FAT CLAY 0.9'										
	Dark gray brown			SS 1		17-24-23 N=47		16.2			
	Reddish brown with gray, with gravel and chert, trace silt 2.5'										
	FAT CLAY										
	Red to reddish brown, with chert, trace sand		5	SS 2		16-7-10 N=17		36.0			
	6.5'										
	Red to reddish brown with white, with chert		10	SS 3		6-5-7 N=12		33.4			
	13.5'										
	Red to reddish brown with white, sandy, with chert 15.0'		15	SS 4		11-14-22 N=36		33.1			

BASE OF BORING AT 15.0 FEET

WATER LEVEL OBSERVATIONS	
WD	Not Encountered
IAD	Not Encountered
AD	Not Performed

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	1/24/19	FINISHED:	1/24/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45
DRILLER:	K. PATTERSON	LOGGED BY:	K. KEMPTON
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. HQ-8

PROJECT NAME: Camp Crowder30 Barracks	CLIENT: GLMV Architecture Inc
PROJECT NUMBER: A18-3101	LOCATION: Joplin, Missouri

Split Spoon

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE 0.3'		0								
	LEAN TO FAT CLAY 1.0'										
	Brown ***FAT CLAY*** *Reddish brown with gray, sandy, cherty* 3.5'			SS 1		16-41-50/4"		14.4			
	Reddish brown, cherty 5.5'		5	SS 2		6-7-8 N=15		30.9			
	CHERT 6.0'										
	FAT CLAY *Reddish brown, with chert* 8.5'										
	Light reddish brown with white, cherty, with sand 10.0'		10	SS 3		15-11-11 N=22		35.0			
	Brown with red, trace sand and chert 15.0'		15	SS 4		10-10-20 N=30		40.6			

BASE OF BORING AT 15.0 FEET

WATER LEVEL OBSERVATIONS	
WD	Not Encountered
IAD	Not Encountered
AD	Not Performed

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	1/24/19	FINISHED:	1/24/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45
DRILLER:	K. PATTERSON	LOGGED BY:	K. KEMPTON
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. HQ-9

PROJECT NAME: Camp Crowder30 Barracks	CLIENT: GLMV Architecture Inc
PROJECT NUMBER: A18-3101	LOCATION: Joplin, Missouri

Split Spoon

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE 0.3'		0								
	LEAN TO FAT CLAY 1.0'										
	Dark brown to light brown ***FAT CLAY***			SS 1		9-28-35 N=63		14.9			
	Reddish brown with gray, sandy, cherty										
			5	SS 2		6-11-14 N=25		28.9			
	8.5'										
	Reddish brown with white, sandy, trace chert		10	SS 3		6-5-6 N=11		35.6			
	13.5'										
	Reddish brown with white, cherty, trace sand 15.0'		15	SS 4		6-11-20 N=31		38.2			

BASE OF BORING AT 15.0 FEET

WATER LEVEL OBSERVATIONS	
WD	Not Encountered
IAD	Not Encountered
AD	Not Performed

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	1/24/19	FINISHED:	1/24/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45
DRILLER:	K. PATTERSON	LOGGED BY:	K. KEMPTON
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. PK-1

PROJECT NAME **Camp Crowder30 Barracks**	CLIENT **GLMV Architecture Inc**
PROJECT NUMBER **A18-3101**	LOCATION **Joplin, Missouri**

ELEVATION (ft)	MATERIAL DESCRIPTION (Split Spoon)	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE ***0.3'***		0								
	FILL *Lean to fat clay, brown, trace organics* ***3.0'***			SS 1		4-6-10 N=16		32.8			
	FAT CLAY *Dark brown with reddish brown, cherty* ***5.0'***		5	SS 2		20-11-10 N=21		24.2			

BASE OF BORING AT 5.0 FEET

WATER LEVEL OBSERVATIONS	
WD	Not Encountered
IAD	Not Encountered
AD	Not Performed

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	1/24/19	FINISHED:	1/24/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45
DRILLER:	K. PATTERSON	LOGGED BY:	K. KEMPTON
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. PK-2

PROJECT NAME: Camp Crowder30 Barracks	CLIENT: GLMV Architecture Inc
PROJECT NUMBER: A18-3101	LOCATION: Joplin, Missouri

Split Spoon

ELEVATION (ft)	MATERIAL DESCRIPTION		GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE	***0.3'***		0								
	FILL											
	Lean to fat clay, brown				SS 1		6-5-7 N=12		30.8			
		3.0'										
	FAT CLAY	***3.5'***										
	Reddish brown				SS 2	CL	5-5-5 N=10		23.1		38/22	
	Reddish brown with light gray brown, trace chert and silt	***5.0'***		5								

BASE OF BORING AT 5.0 FEET

WATER LEVEL OBSERVATIONS	
WD	Not Encountered
IAD	Not Encountered
AD	Not Performed

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	1/24/19	FINISHED:	1/24/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45
DRILLER:	K. PATTERSON	LOGGED BY:	K. KEMPTON
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. PK-3

PROJECT NAME **Camp Crowder30 Barracks**	CLIENT **GLMV Architecture Inc**
PROJECT NUMBER **A18-3101**	LOCATION **Joplin, Missouri**

Split Spoon

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
			0								
	ROOT ZONE 0.3'										
	LEAN TO FAT CLAY 1.0'										
	Brown 2.0'			SS 1		11-14-20 N=34		15.2			
	Reddish brown, cherty										
	CHERT 3.5'										
	FAT CLAY										
	Reddish brown, cherty, trace silt 5.0'		5	SS 2		10-33-10 N=43		18.1			

BASE OF BORING AT 5.0 FEET

WATER LEVEL OBSERVATIONS	
WD	4.0 ft
IAD	Not Encountered
AD	Not Performed

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	1/23/19	FINISHED:	1/23/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45
DRILLER:	K. PATTERSON	LOGGED BY:	K. KEMPTON
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. PK-4

PROJECT NAME: Camp Crowder30 Barracks	CLIENT: GLMV Architecture Inc
PROJECT NUMBER: A18-3101	LOCATION: Joplin, Missouri

Split Spoon

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
			0								
	ROOT ZONE 0.3'										
	LEAN TO FAT CLAY *Brown, trace organics* 2.0'			SS 1		5-10-34 N=44		27.8			
	Reddish brown 3.5'										
	FAT CLAY *Reddish brown, sandy, with chert* 5.0'		5	SS 2		5-13-12 N=25		35.6			

BASE OF BORING AT 5.0 FEET

WATER LEVEL OBSERVATIONS	
WD	4.0 ft
IAD	Not Encountered
AD	Not Performed

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	1/23/19	FINISHED:	1/23/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45
DRILLER:	K. PATTERSON	LOGGED BY:	K. KEMPTON
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. PK-5

PROJECT NAME	CLIENT
Camp Crowder30 Barracks	GLMV Architecture Inc
PROJECT NUMBER	**LOCATION**
A18-3101	Joplin, Missouri

Split Spoon

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
			0								
	ROOT ZONE 0.3'										
	LEAN TO FAT CLAY *Brown, trace organics* 2.0'			SS 1		6-10-22 N=32		31.3			
	FAT CLAY *Reddish brown, sandy, cherty*										
	5.0'		5	SS 2		5-12-10 N=22		37.0			

BASE OF BORING AT 5.0 FEET

WATER LEVEL OBSERVATIONS	
WD	Not Encountered
IAD	Not Encountered
AD	Not Performed

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	1/23/19	FINISHED:	1/23/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45
DRILLER:	K. PATTERSON	LOGGED BY:	K. KEMPTON
METHOD: CONTINUOUS FLIGHT AUGER			

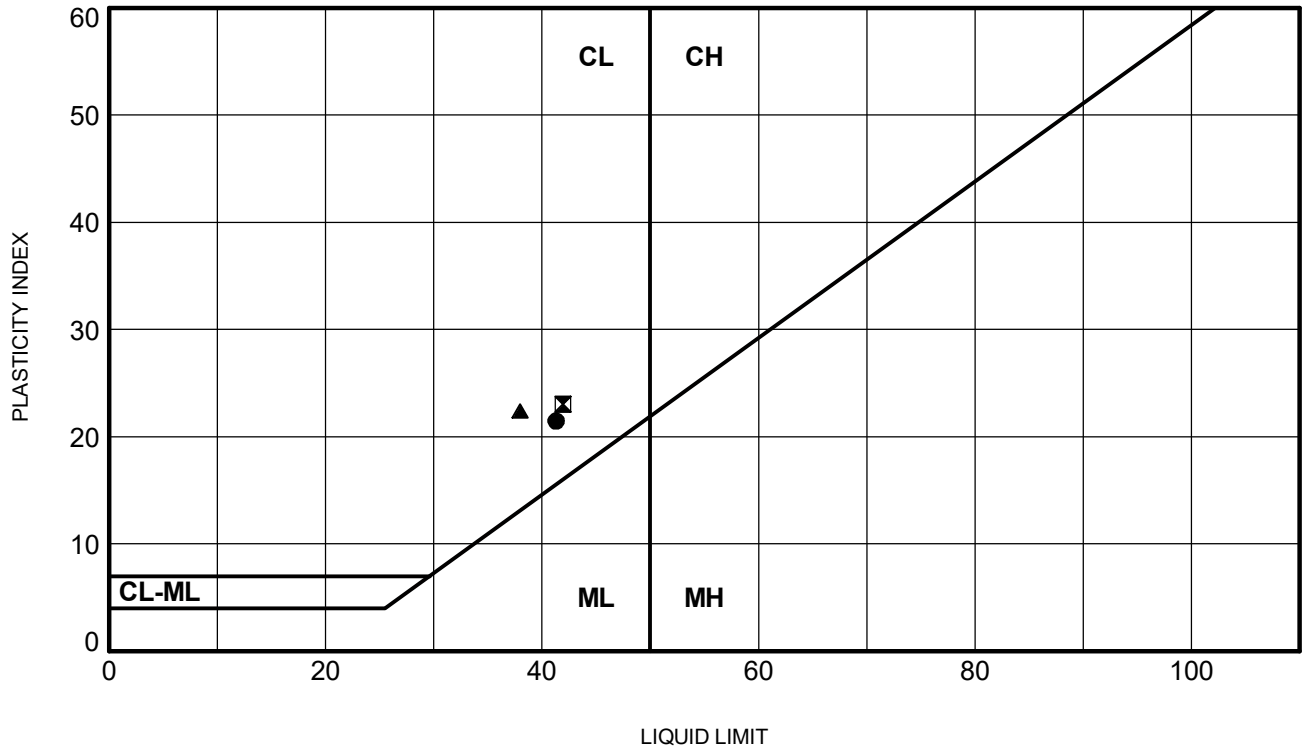
APPENDIX C

SUMMARY OF LABORATORY TEST RESULTS

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

ATTERBERG LIMITS RESULTS

PROJECT NAME: Camp Crowder30 Barracks **CLIENT:** GLMV Architecture Inc
PROJECT NUMBER: A18-3101 **PROJECT LOCATION:** Joplin, Missouri



Boring No.	Sample ID	Depth (ft)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Fines (%)	Classification (USCS)
● B-22	SS-1	1.0 - 2.5	41	20	21		CL
⊠ B-25	SS-1	1.0 - 2.5	42	19	23		CL
▲ PK-2	SS-2	3.5 - 5	38	16	22		CL