

MDOT Use Only  
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Keyed \_\_\_\_\_

24 -



SM No. CBWO5123350011

# **PROPOSAL AND CONTRACT DOCUMENTS**

**FOR THE CONSTRUCTION OF  
(STATE DELEGATED)**

24  
Construction necessary to build Headquarters Building, Equipment Shed and Storage Bins at Dekalb, known as State Project Nos. BWO-5123-35(001), BWO-5214-35(001), BWO-5067-35(003), BWO-5221-35(001), & LWO-5035-35 (002) / 502587301, 302, 303, 304 & 305 in Kemper County.  
Project Completion: June 30, 2015

**SECTION 900**  
**OF THE CURRENT**  
**2004 STANDARD SPECIFICATIONS FOR ROAD**  
**AND BRIDGE CONSTRUCTION MISSISSIPPI**  
**DEPARTMENT OF TRANSPORTATION JACKSON,**  
**MISSISSIPPI**

**BIDDER CHECK LIST  
(FOR INFORMATION ONLY)**

- | \_\_\_\_\_ All unit prices have been entered **into Expedite Bid** in accordance with Subsection 102.06 of the Mississippi Standard Specifications for Road and Bridge Construction.
- | \_\_\_\_\_ **Expedite bid** sheets have been stapled and inserted into the proposal package.
- \_\_\_\_\_ First sheet of SECTION 905--PROPOSAL has been completed.
- \_\_\_\_\_ Second sheet of SECTION 905--PROPOSAL has been completed and signed.
- \_\_\_\_\_ Addenda, if any, have been acknowledged. Second sheet of Section 905 listing the addendum number has been substituted for the original second sheet of Section 905. Substituted second sheet of Section 905 has been properly completed, signed, and added to the proposal.
- \_\_\_\_\_ DBE/WBE percentage, when required by contract, has been entered on last sheet of the bid sheets of SECTION 905 - PROPOSAL.
- \_\_\_\_\_ Form OCR-485, when required by contract, has been completed and signed.
- | \_\_\_\_\_ The last sheet of the **Expedite** bid sheets of SECTION 905--PROPOSAL has been signed.
- \_\_\_\_\_ Combination Bid Proposal of SECTION 905--PROPOSAL has been completed for each project which is to be considered in combination (See Subsection 102.11).
- \_\_\_\_\_ Equal Opportunity Clause Certification, when included in contract, has been completed and signed.
- \_\_\_\_\_ The Certification regarding Non-Collusion, Debarment and Suspension, etc. has been executed in duplicate.
- \_\_\_\_\_ A certified check, cashier's check or bid bond payable to the State of Mississippi in the principal amount of 5% of the bid has been included with project number identified on same. A bid bond has been signed by the bidder and has also been signed or countersigned by a Mississippi Agent or Qualified Nonresident Agent for the Surety with Power of Attorney attached.
- \_\_\_\_\_ ON FEDERAL FUNDED PROJECTS, the Notice To Bidders regarding DUNS Requirements has been completed and included in the contract documents.
- \_\_\_\_\_ Non-resident Bidders: ON STATE FUNDED PROJECTS ONLY, a copy of the current laws regarding any preference for local Contractors from State wherein domiciled has been included. See Subsection 103.01, Mississippi Standard Specifications for Road and Bridge Construction, and Section 31-7-47, MCA, 1972 regarding this matter.
- | Return the **MDOT flash drive with completed EBS file**, proposal and contract documents in its entirety in a sealed envelope. DO NOT remove any part of the contract documents; exception - an addendum requires substitution of second sheet of Section 905. A stripped proposal is considered as an irregular bid and will be rejected.

Failure to complete any or all of the applicable requirements will be cause for the proposal to be considered irregular.

# MISSISSIPPI DEPARTMENT OF TRANSPORTATION

## TABLE OF CONTENTS

PROJECT: **BWO-5123-35(001) / 502587301,**  
**BWO-5214-35(001) / 502587302,**  
**BWO-5067-35(003) / 502587303,**  
**BWO-5221-35(001) / 502587304, &**  
**LWO-5035-35(002) / 502587305 -- Kemper County**

901--Advertisement

904--Notice to Bidders:   Governing Specs. - # 1  
                                  Final Cleanup - # 3  
                                  Fiber Reinforced Concrete - # 640  
                                  Errata & Modifications to 2004 Standard Specifications - # 1405  
                                  Federal Bridge Formula - # 1928  
                                  Non-Quality Control/Quality Assurance Concrete - # 2818  
                                  Reduced Speed Limit Signs - # 2937  
                                  Alternate Asphalt Mixture Bid Items - # 3039  
                                  Storm Water Discharge Associated w/ Construction Activities ( $\geq 1$  and  $< 5$   
                                  Acres) - # 3067  
                                  Temporary Traffic Paint - # 3131  
                                  Additional Erosion Control Requirements - # 3612  
                                  Type III Barricade Rails - # 3655  
                                  Use of Precast Drainage Units - # 3704  
                                  Petroleum Products Base Price - # 3893  
                                  Questions Regarding Bidding - # 3980  
                                  Safety Apparel - # 4214  
                                  Alternate Crushed Stone Base Bid Items - # 4473  
                                  Warm Mix Asphalt (WMA) - # 4524  
                                  Electronic Addendum Process - # 4526  
                                  Manual on Uniform Traffic Control Devices (MUTCD) - # 4565  
                                  Adjustments for Bituminous Materials - # 4612  
                                  Payroll Requirements - # 4661  
                                  Contract Time - # 4887  
                                  Asphalt Tack Coat - # 4888  
                                  Project Number Change - # 4932  
                                  Solid Sodding - # 4933

907-101-4:   Definitions  
907-102-10:   Bidding Requirements and Conditions  
907-103-8:   Award and Execution of Contract  
907-104-5:   Scope of Work  
907-105-7:   Control of Work  
907-107-13:   Legal Relations & Responsibility to Public  
907-107-14:   Contractor's Protection Plan), W/ Supplement  
907-108-30:   Prosecution and Progress  
907-109-6:   Measurement and Payment, W/ Supplement  
907-216-1:   Solid Sodding  
907-225-3:   Grassing  
907-226-2:   Temporary Grassing

-- CONTINUED ON NEXT PAGE --

PAGE 2      PROJECT: **BWO-5123-35(001) / 502587301,**  
**BWO-5214-35(001) / 502587302,**  
**BWO-5067-35(003) / 502587303,**  
**BWO-5221-35(001) / 502587304, &**  
**LWO-5035-35(002) / 502587305 -- Kemper County**

- 907-227-10: Hydroseeding
- 907-237-4: Wattles
- 907-242-33: Site Improvement
- 907-246-3: Sandbags & Rockbags
- 907-290-3: Flagpole
- 907-304-13: Granular Courses
- 907-401-2: Hot Mix Asphalt (HMA), W/ Supplement
- 907-401-6: Warm Mix Asphalt (WMA)
- 907-403-4: Hot Mix Asphalt (HMA), W/ Supplement
- 907-403-12: Warm Mix Asphalt (WMA)
- 907-407-1: Tack Coat
- 907-601-1: Structural Concrete
- 907-603-8: Culverts & Storm Drains
- 907-618-9: Placement of Temporary Traffic Stripe
- 907-626-24: Thermoplastic Blue ADA Markings
- 907-626-25: Thermoplastic Traffic Markings
- 907-699-5: Construction Stakes
- 907-701-4: Hydraulic Cement
- 907-702-3: Polyphosphoric Acid (PPA) Modification of Petroleum Asphalt Cement
- 907-703-11: Aggregates
- 907-708-6: Non-Metal Drainage Structures
- 907-709-1: Metal Pipe
- 907-710-1: Fast Dry Solvent Traffic Paint
- 907-711-4: Synthetic Structural Fiber Reinforcement
- 907-713-3: Admixtures for Concrete
- 907-714-8: Miscellaneous Materials
- 907-715-4: Roadside Development Materials
- 907-720-2: Pavement Marking Materials
- 907-804-13: Concrete Bridges and Structures, W/ Supplement

SECTION 905 - PROPOSAL, PROPOSAL BID ITEMS,  
COMBINATION BID PROPOSAL,  
STATE BOARD OF CONTRACTORS REQUIREMENTS,  
STATE CERTIFICATION REGARDING NON-COLLUSION, DEBARMENT AND SUSPENSION,  
SECTION 902- CONTRACT FORM, AND SECTION 903 - CONTRACT BOND FORMS,

(REVISIONS TO THE ABOVE WILL BE INDICATED ON THE SECOND SHEET  
OF SECTION 905 AS ADDENDA)



# MISSISSIPPI DEPARTMENT OF TRANSPORTATION

## SECTION 901 - ADVERTISEMENT

Sealed bids will be received by the Mississippi Transportation Commission in the Office of the Contract Administration Engineer, Room 1013, Mississippi Department of Transportation Administration Building, 401 North West Street, Jackson, Mississippi, until 10:00 o'clock A.M., Tuesday, March 25, 2014, and shortly thereafter publicly opened on the Sixth Floor for:

Construction necessary to build Headquarters Building, Equipment Shed, and Storage Bins at Dekalb, known as State Project Nos. BWO-5123-35(001), BWO-5214-35(001), BWO-5067-35(003), BWO-5221-35(001), and LWO-5035-35(002) / 502587301, 302, 303, 304, & 305 in Kemper County.

The attention of bidders is directed to the predetermined minimum wage rate set by the U. S. Department of Labor under the Fair Labor Standards Act.

The Mississippi Department of Transportation hereby notifies all bidders that it will affirmatively insure that in any contract entered into pursuant to this advertisement, disadvantaged business enterprises will be afforded full opportunity to submit bids in response to this invitation and will not be discriminated against on the grounds of race, color, sex, age, disability, religion or national origin in consideration for an award.

Plans and specifications are on file in the offices of the Mississippi Department of Transportation.

Bid proposals must be purchased online at <https://shopmdot.ms.gov>. Specimen proposals may be viewed and downloaded online at no cost at <http://mdot.ms.gov> or purchased online. Proposals are available at a cost of Ten Dollars (\$10.00) per proposal plus a small convenience fee. Cash or checks will not be accepted as payment.

Plans must be purchased online at <https://shopmdot.ms.gov>. Costs of plans will be on a per sheet basis plus a small convenience fee. If you have any questions, you can contact the MDOT Plans Print Shop at (601) 359-7460, or e-mail at [plans@mdot.state.ms.us](mailto:plans@mdot.state.ms.us). Plans will be shipped upon receipt of payment. Cash or checks will not be accepted as payment.

Bid bond, signed or countersigned by a Mississippi Agent or Qualified Nonresident Agent, with Power of Attorney attached, a Cashier's check or Certified Check for five (5%) percent of bid, payable to STATE OF MISSISSIPPI, must accompany each proposal.

The attention of bidders is directed to the provisions of Subsection 102.07 pertaining to irregular proposals and rejection of bids.

MELINDA L. MCGRATH  
EXECUTIVE DIRECTOR

# MISSISSIPPI DEPARTMENT OF TRANSPORTATION

**SECTION 904 - NOTICE TO BIDDERS NO. 1**

**CODE: (IS)**

**DATE: 05/03/2004**

**SUBJECT: Governing Specifications**

The current (2004) Edition of the Standard Specifications for Road and Bridge Construction adopted by the Mississippi Transportation Commission is made a part hereof fully and completely as if it were attached hereto, except where superseded by special provisions, or amended by revisions of the Specifications contained herein. Copies of the specification book may be purchased from the MDOT Construction Division.

A reference in any contract document to controlling requirements in another portion of the contract documents shall be understood to apply equally to any revision or amendment thereof included in the contract.

In the event the plans or proposal contain references to the 1990 Edition of the Standard Specifications for Road and Bridge Construction, it is to be understood that such references shall mean the comparable provisions of the 2004 Edition of the Standard Specifications.

## MISSISSIPPI DEPARTMENT OF TRANSPORTATION

**SECTION 904 - NOTICE TO BIDDERS NO. 3**

**CODE: (SP)**

**DATE: 05/03/2004**

**SUBJECT: Final Clean-Up**

Immediately prior to final inspection for release of maintenance, the Contractor shall pick up, load, transport and properly dispose of all litter from the entire highway right-of-way that is within the termini of the project.

Litter shall include, but not be limited to, solid wastes such as glass, paper products, tires, wood products, metal, synthetic materials and other miscellaneous debris.

Litter removal is considered incidental to other items of work and will not be measured for separate payment.

## MISSISSIPPI DEPARTMENT OF TRANSPORTATION

| SECTION 904 - NOTICE TO BIDDERS NO. 640

CODE: (IS)

| DATE: 09/26/2005

SUBJECT: Fiber Reinforced Concrete

Bidders are hereby advised that synthetic structural fibers meeting the requirements of Subsection 907-711.04 may be used in lieu of wire mesh in some items of construction. Substitution of fibers for wire mesh will be allowed in the construction of paved ditches, paved flumes, paved inlet apron, driveways, guard rail anchors and pile encasements. Substitution in any other items of work must be approved by the State Construction Engineer prior to use.

# MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SECTION 904 - NOTICE TO BIDDERS NO. 1405

CODE: (IS)

DATE: 03/15/2007

SUBJECT: ERRATA AND MODIFICATIONS TO THE 2004 STANDARD SPECIFICATIONS

<u>Page</u>	<u>Subsection</u>	<u>Change</u>
101	201.01	In the second sentence of the first paragraph, change “salvable” to “salvageable”.
107	202.04	In the fourth sentence of the fourth paragraph, change “yard” to “feet”.
107	202.05	In the list of units measurements for 202-B, add “square foot”.
132	211.03.4	In the second sentence of the second paragraph, change “planted” to “plated”.
192	306.02.4	In the first line of the first paragraph, delete the word “be”.
200	307.03.7	In the fourth sentence of the second paragraph, change “lime-fly ash” to “treated”.
236	401.01	Change the header from “Section 403” to “Section 401”.
242	401.02.3.2	In the first sentence of the third full paragraph, add “1/8” in the blank before the inch mark.
250	401.02.6.3	In the second sentence of the first paragraph on page 250, change “rutting over ” to “rutting over 1/8” ”.
253	401.02.6.4.2	In the paragraph preceding the table, change “91.0” to “89.0”.
259	401.03.1.4	In the first paragraph, change “92.0 percent” to “the specified percentage (92.0 or 93.0)”.
269	403.03.2	In the table at the top of page 269, change the PI requirement from “=” to “≤”.

- 278 404.04 In the second sentence, change the subsection from “401.04” to “403.04”.
- 283 409.02.2 Change “PG 64-22” to “PG 67-22”.
- 294 413.02 In the first sentence of the second paragraph, change “707.02.1.3” to “Subsection 707.02.1.3”.
- 340 511.04 In the second sentence of the second paragraph, change “412” to “512”.
- 349 601.03.3 In the first sentence, change “804.03.2” to “804.03.5”.
- 355 603.02 Change the subsection reference for Joint mortar from “707.03” to “714.11”.
- 369 604.04 In the first sentence, change “601.04” to “Subsection 601.04”.
- 427 619.04 Delete the second paragraph.
- 442 625.04 In the third paragraph, change “626.04” to “Subsection 626.04”.
- 444 626.03.1.2 Delete the third sentence of the first paragraph.
- 464 631.02 Change the subsection reference for Water from “714.01.0” to “714.01.1”.
- 570 682.03 Change the subsection number from “682-03” to “682.03”.
- 575 683.10.4 Change the subsection number from “683.10.4” to “683.04”.
- 575 683.10.5 Change the subsection number from “683.10.5” to “683.05”.
- 596 701.02 In the table under the column titled “Cementations material required”, change “Class F, FA” to “Class F FA,”.
- 603 702.11 In the first sentence, change “702.12” to “Subsection 702.12”.
- 612 703.04.2 In the fifth paragraph, delete “Subsection 703.11 and”.
- 616 703.07.2 In the Percentage By Weight Passing Square Mesh Sieves table, change the No. 10 requirement for Class 7 material from “30 - 10” to “30 - 100”.

- 618 703.13.1 In the first sentence of the first paragraph, change “703.09” to “703.06”.
- 618 703.13.2 In the first sentence, change “703.09” to “703.06”.
- 671 712.06.2.2 In the first sentence, change “712.05.1” to “Subsection 712.05.1”.
- 689 714.11.2 In the first sentence, change “412” to “512”.
- 709 715.09.5 In the first sentence of the first paragraph, change “guage” to “gauge”.
- 717 717.02.3.4 In the top line of the tension table, change “1 1/2” to “1 1/8” and change “1 1/8” to “1 1/2”.
- 741 720.05.2.2 In the last sentence of this subsection, change “720.05.2.1” to “Subsection 720.05.2.1”.
- 827 803.03.2.3.7.5.2 In the first sentence of the second paragraph, change “803.03.5.4” to “803.03.2.3.4”.
- 833 803.03.2.6 In the first sentence, change “803.03.7” to “803.03.2.5”.
- 854 804.02.11 In the last sentence of the first paragraph, change “automatically” to “automatic”.
- 859 804.02.13.1.3 In the last sentence, change Subsection “804.02.12.1” to “804.02.12”.
- 879 804.03.19.3.2 In the first sentence of the third paragraph, change “listed on of Approved” to “listed on the Approved”.
- 879 804.03.19.3.2 In the last sentence of the last paragraph, change “804.03.19.3.1” to “Subsection 804.03.19.3.1”.
- 962 814.02.3 In the first sentence, change “710.03” to “Subsection 710.03”.
- 976 820.03.2.1 In the first sentence, change “803.02.6” to “803.03.1.7”.
- 976 820.03.2.2 In the first sentence, change “803.03.9.6” to “803.03.1.9.2”.
- 985 Index Change the subsection reference for Petroleum Asphalt Cement from “702.5” to “702.05”.

985	Index	Change the subsection reference for the Definition of Asphaltic Cement or Petroleum Asphalt from “700.2” to “700.02”.
985	Index	Change the subsection reference for Automatic Batchers from “501.03.2.4” to “804.02.10.4”.
986	Index	Delete “501.03.2” as a subsection reference for Batching Plant & Equipment.
988	Index	Change the subsection reference for the Central Mixed Concrete from “501.03.3.2” to “804.02.11”.
988	Index	Change the subsection reference for the Concrete Batching Plant & Equipment from “501.03.2” to “804.02.11”.
999	Index	Delete “501.03.3.3” as a subsection reference for Truck Mixers.
1001	Index	Change the subsection reference for Edge Drain Pipes from “605.3.5” to “605.03.5”.
1002	Index	Change the subsection reference for Metal Posts from “713.05.2” to “712.05.2”.
1007	Index	Change the subsection reference for Coarse Aggregate of Cement Concrete Table from “703.3” to “703.03”.
1007	Index	Change the subsection reference for Composite Gradation for Mechanically Stabilized Courses Table from “703.8” to “703.08”.
1009	Index	Delete “501.03.3.3” as a subsection reference for Truck Mixers and Truck Agitators.
1010	Index	Delete reference to “Working Day, Definition of”.



## MISSISSIPPI DEPARTMENT OF TRANSPORTATION

| SECTION 904 - NOTICE TO BIDDERS NO. 1928

CODE: (IS)

| DATE: 04/14/2008

SUBJECT: Federal Bridge Formula

Bidders are hereby advised that Federal Highway Administration Publication No. FHWA-MC-94-007, **BRIDGE FORMULA WEIGHTS**, dated January 1994, is made a part of this contract when applicable.

Prior to the preconstruction conference, the Contractor shall advise the Engineer, in writing, what materials, if any, will be delivered to the jobsite via Interstate route(s).

Copies of the **BRIDGE FORMULA WEIGHTS** publication may be obtained by contacting:

Federal Highway Administration  
400 7<sup>th</sup> Street, SW  
Washington, DC 20590  
(202) 366-2212

or

| [http://ops.fhwa.dot.gov/freight/sw/brdgcalc/calc\\_page.htm](http://ops.fhwa.dot.gov/freight/sw/brdgcalc/calc_page.htm)

**MISSISSIPPI DEPARTMENT OF TRANSPORTATION**

**SECTION 904 - NOTICE TO BIDDERS NO. 2818**

**CODE: (SP)**

**DATE: 10/01/2009**

**SUBJECT: Non-Quality Control / Quality Assurance Concrete**

Bidders are advised that the following pay items will not be accepted based on the Quality Control / Quality Assurance (QC/QA) requirements of Section 804 of the specifications. The acceptance of these pay items will be based on sampling and testing at the project site by MDOT forces. The Contractor is required to submit mix designs to accomplish this work in accordance with Section 804 and perform normal Quality Control functions at the concrete plant. Acceptance will be in accordance with the requirements of 907-601, Structural Concrete, and TMD-20-04-00-000. At the discretion of the Engineer, the Contractor may request that the concrete be accepted based on QC/QA requirements.

<b><u>Pay Item</u></b>	<b><u>Description</u></b>
221	Paved Ditches
601	Minor Structures - manholes, inlets, catch basins, junction boxes, pipe headwalls, and pipe collars.
606	Guardrail Anchors
607	Fence Post Footings
608	Sidewalks
609	Curb and Gutter
614	Driveways
616	Median and Island Pavement
630	Sign Footings, except Overhead Sign Supports

**MISSISSIPPI DEPARTMENT OF TRANSPORTATION**

**SECTION 904 - NOTICE TO BIDDERS NO. 2937**

**CODE: (SP)**

**DATE: 01/11/2010**

**SUBJECT: Reduced Speed Limit Signs**

Bidders are advised that all black and white speed limits signs that are used to reduce the speed limit through construction zones shall be covered or removed during times when the Contractor is not performing work. If the Contractor has a routine daytime operation and is not working at night, the signs shall be covered or removed during the nighttime when there is no work activity.

**MISSISSIPPI DEPARTMENT OF TRANSPORTATION**

**SECTION 904 - NOTICE TO BIDDERS NO. 3039**

**CODE: (SP)**

**DATE: 03/23/2010**

**SUBJECT: Alternate Asphalt Mixture Bid Items**

Bidders are advised that the asphalt mixture used on this project will be bid as an alternate pay item: Hot Mix Asphalt (HMA) or Warm Mix Asphalt (WMA). Bidders must select one of the alternates at the time of bid. **The Contractor must use the selected asphalt mixture, HMA or WMA, throughout the entire project.**

## MISSISSIPPI DEPARTMENT OF TRANSPORTATION

| SECTION 904 - NOTICE TO BIDDERS NO. 3067

CODE: (SP)

| DATE: 04/14/2010

SUBJECT: Storm Water Discharge Associated with Construction Activity  
(≥ 1 and < 5 Acres)

Construction Storm Water General NPDES Permit MSR 15 to discharge storm water associated with construction activity is required. This project is granted permission to discharge treated storm water into State waters. Copies of said permit and Storm Water Pollution Prevention Plan (SWPPP) are on file with the Department.

Prior to the execution of the contract, the successful bidder shall execute and deliver to the Executive Director an original signed copy of the completed Prime Contractor Certification (Form No. 1).

Failure of the bidder to execute and file the completed Prime Contractor Certification (Form No. 1) shall be just cause for the cancellation of the award.

The executed Prime Contractor Certification (Form No. 1) shall be prima facie evidence that the bidder has examined the permit, is satisfied as to the terms and conditions contained therein, and that the bidder has the primary responsibility for meeting all permit terms and conditions including, but not limited to, the inspection and reporting requirements of Part IV. For this project, the Contractor shall furnish, set up and read, as needed, an on-site rain gauge.

The Contractor must furnish the Project Engineer a completed copy of the Small Construction Notice of Intent (SCNOI) along with the Contractor's Erosion Control Plan.

| The Contractor shall make inspections in accordance with [condition No. S-4, Page 13](#), and shall furnish the Project Engineer with the results of each weekly inspection as soon as possible following the date of inspection. The weekly inspections must be documented monthly on the Inspection and Certification Form, [a copy of which is provided](#). The Contractor's representative and the Project Engineer shall jointly review and discuss the results of the inspections so that corrective action can be taken. The Project Engineer shall retain copies of the inspection reports.

The Engineer will have the authority to suspend all work and/or withhold payments for failure of the Contractor to carry out provisions of MDEQ's Storm Water Construction General Permit, the erosion control plan, updates to the erosion control plan, and /or proper maintenance of the BMPs.

Securing a permit (s) for storm water discharge associated with the Contractor's activity on any other regulated area the Contractor occupies, shall be the responsibility of the Contractor.

**MISSISSIPPI DEPARTMENT OF TRANSPORTATION**

**SECTION 904 - NOTICE TO BIDDERS NO. 3131**

**CODE: (SP)**

**DATE: 06/24/2010**

**SUBJECT: Temporary Traffic Paint**

Bidders are hereby advised that the temporary traffic paint for this project can be waterborne paint as specified in the 2004 Mississippi Standard Specifications For Road and Bridge Construction or fast dry solvent traffic paint meeting the requirements set out in 907-710-1 (Fast Dry Solvent Traffic Paint).

Payment for all temporary traffic paint shall be paid under the appropriate 619 pay items.

When using fast dry solvent traffic stripe, no paint can be sprayed or placed on the ground during set-up or clean-up.

## MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SECTION 904 - NOTICE TO BIDDERS NO. 3612

CODE: (SP)

DATE: 08/10/2011

SUBJECT: Additional Erosion Control Requirements

Bidders are hereby advised of the following requirements that relate to erosion control activities on the project.

**THE MAXIMUM TOTAL ACREAGE THAT CAN BE DISTURBED, AT ONE TIME, ON THE PROJECT IS NINETEEN (19) ACRES. THE CONTRACTOR SHALL BE REQUIRED TO STABILIZE DISTURBED AREAS PRIOR TO OPENING UP ADDITIONAL SECTIONS OF THE PROJECT. STABILIZED SHALL BE WHEN THE DISTURBED AREA MEETS ONE OF THE FOLLOWING CRITERIA:**

- **THE AREA HAS BEEN GRASSED, EITHER TEMPORARY OR PERMANENT, AND MULCHED ACCORDING TO THE SPECIFICATIONS, OR**
- **A CRUSHED STONE COURSE OR A LIFT OF ASPHALT PAVEMENT HAS BEEN PLACED, OR**
- **THE AREA HAS BEEN CHEMICALLY TREATED USING PORTLAND CEMENT OR LIME-FLY ASH, AND SEALED.**

**DISTURBED AREAS INCLUDE THE ROADBED, SLOPES AND REMAINING AREA OUT TO THE ROW LINE.**

**Clearing and Grubbing:** Prior to beginning any clearing and grubbing operations on the project, controls shall be in place to address areas such as drainage structures, wetlands, streams, steep slopes and any other sensitive areas as directed by the Engineer. Clearing and grubbing should be limited to the minimum area necessary to construct the project. Grubbing operations should be minimized in areas outside the construction limits and stumps should be cut off flush with the existing ground elevations. A buffer area of at least fifteen (15) feet shall be in place adjacent to the right-of-way line and at least five (5) feet adjacent to stream banks. The buffer area can either be the existing vegetation that is left undisturbed or re-established by planting new vegetation if clearing and grubbing was required.

**Unclassified Excavation:** Cut sections shall be graded in accordance with the typical sections and plan grades. Permanent erosion control BMP's should be placed as soon as possible after the cut material has been moved. Fill sections that are completed shall have permanent erosion control BMP's placed. Fill sections that are not completed will be either permanently or temporarily grassed until additional material is made available to complete these sections. All unclassified excavation on the project will still be required to be moved prior to incorporating any borrow excavation on the project. The contractor may have to stockpile unclassified excavation in order to comply with the nineteen (19) acre requirement. No additional compensation will be made for stockpiling operations.

Disturbed areas that remain inactive for a period of more than fourteen (14) days shall be temporary grassed and mulched. Temporary grassing and mulching shall only be paid one time for a given area.

## MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SECTION 904 - NOTICE TO BIDDERS NO. 3655

CODE: (SP)

DATE: 10/04/2011

SUBJECT: Type III Barricade Rails

Bidders are advised that the use of 2-inch nominal thickness timber for rails on Type III barricades has not been approved by NCHRP as a crashworthy device. Therefore, the use of 2-inch nominal thickness timbers will not be allowed for rails on Type III Barricades. Timber rails for Type III Barricades shall be as follows.

- For barricades up to four feet (4') wide, the maximum thickness of timber rails shall be one inch (1") and the material shall be pine timber or ¾-inch ACX plywood.
- For barricades more than four feet (4') wide, timber rails shall be constructed of ¾-inch ACX plywood.

A list of crashworthy Type III Barricades can be found at the below FHWA website.

[http://safety.fhwa.dot.gov/roadway\\_dept/policy\\_guide/road\\_hardware/wzd/](http://safety.fhwa.dot.gov/roadway_dept/policy_guide/road_hardware/wzd/)



**MISSISSIPPI DEPARTMENT OF TRANSPORTATION**

**SECTION 904 - NOTICE TO BIDDERS NO. 3704**

**CODE: (SP)**

**DATE: 11/30/2011**

**SUBJECT: Use of Precast Drainage Units**

Bidders attention is brought to the content of Subsection 601.02.3 regarding precast units. MDOT Drawing Sheet Nos. PCU-1 and PCU-2 address MDOT approved precast drainage units. The Contractor must make a request to the Project Engineer for approval to use precast units other than the ones shown on Drawing Sheet No. PCU-1 or PCU-2.

Bidders are advised that precast drainage unit tops are only allowed on units shown on Drawing Sheet No. PCU-1. Cast-In-Place drainage unit tops are required on units shown on Drawing Sheet No. PCU-2.

**MISSISSIPPI DEPARTMENT OF TRANSPORTATION**

**SECTION 904 - NOTICE TO BIDDERS NO. 3893**

**CODE: (SP)**

**DATE: 04/10/2012**

**SUBJECT: Petroleum Products Base Prices**

Bidders are advised that monthly petroleum products base prices will be available at the web site listed below. Current monthly prices will be posted to this web site on or before the 15<sup>th</sup> of each month. Bidders are advised to use the petroleum base prices on this web site when preparing their bids. The current monthly petroleum products base prices will be acknowledged by the Bidder and become part of the contract during the execution process.

Monthly Petroleum Products Base Prices can be viewed at:

<http://sp.gomdot.com/Contract%20Administration/BidSystems/Pages/letting%20calendar.aspx>

## MISSISSIPPI DEPARTMENT OF TRANSPORTATION

**SECTION 904 - NOTICE TO BIDDERS NO. 3980**

**CODE: (SP)**

**DATE: 07/25/2012**

**SUBJECT: Questions Regarding Bidding**

Bidders are advised that all questions that arise regarding the contract documents (proposal) or plans on this project shall be directed to the [www.gomdot.com](http://www.gomdot.com) current letting webpage. Click on the call number for this project to open an email form to submit your question. Questions must be submitted by 8:00 a.m. on Monday prior to the letting on Tuesday. Answers to questions will be posted by 6:00 p.m. on Monday prior to the letting on Tuesday. Answers can be viewed by clicking on Q&A link under the Proposal Addenda column.

It shall be the Bidders responsibility to familiarize themselves with the questions and answers that have been submitted on this project.

## MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SECTION 904 - NOTICE TO BIDDERS NO. 4214

CODE: (IS)

DATE: 11/29/2012

SUBJECT: Safety Apparel

Bidders are advised that the Code of Federal Regulations CFR 23 Part 634 final rule was adopted November 24, 2006 with an effective date of November 24, 2008. This rule requires that "All workers within the right-of-way of a Federal-Aid Highway who are exposed either to traffic (vehicles using the highway for the purposes of travel) or to construction equipment within the work area shall wear high-visibility safety apparel". High-visibility safety apparel is defined in the CFR as "personnel protective safety clothing that is intended to provide conspicuity during both daytime and nighttime usage, and that meets the Performance Class 2 or 3 requirements of the ANSI/ISEA 107-2004 publication entitled American National Standard for High-Visibility Safety Apparel and Headwear". All workers on Mississippi State Highway right-of-way shall comply with this Federal Regulation. Workers are defined by the CFR as "people on foot whose duties place them within the right-of way of a Federal-Aid Highway, such as highway construction and maintenance forces, survey crews, utility crews, responders to incidents within the highway right-of-way, and law enforcement personnel when directing traffic, investigating crashes, and handling lane closures, obstructed roadways, and disasters within the right-of-way of a Federal-Aid Highway".

More information regarding high visibility safety apparel can be found at the following sites.

<http://www.gpo.gov/fdsys/pkg/CFR-2008-title23-vol1/pdf/CFR-2008-title23-vol1-sec634-1.pdf>

<http://ops.fhwa.dot.gov/wz/resources/policy.htm#hv>

**MISSISSIPPI DEPARTMENT OF TRANSPORTATION**

**SECTION 904- NOTICE TO BIDDERS NO. 4473**

**CODE: (SP)**

**DATE: 04/08/2013**

**SUBJECT: Alternate Crushed Stone Base Bid Items**

Bidders are advised that the Crushed Stone Base used on this project will be bid as an alternate pay item:  $\frac{3}{4}$ " and Down Crushed Stone Base, Size 825B Crushed Stone Base, or Size 610 Crushed Stone Base. Bidders must select one of the alternates at the time of bid. **The Contractor must use the selected crushed stone base throughout the entire project.**

**MISSISSIPPI DEPARTMENT OF TRANSPORTATION**

**SECTION 904 - NOTICE TO BIDDERS NO. 4524**

**CODE: (SP)**

**DATE: 05/13/2013**

**SUBJECT: Warm Mix Asphalt**

Bidders are advised that MDOT approved products and processes for the production of Warm Mix Asphalt are available at the following MDOT website.

<http://sp.mdot.ms.gov/Materials/Pages/MPL.aspx>

## MISSISSIPPI DEPARTMENT OF TRANSPORTATION

**SECTION 904 - NOTICE TO BIDDERS NO. 4526**

**CODE: (SP)**

**DATE: 06/11/2013**

**SUBJECT: Electronic Addendum Process**

Bidders are advised that hard copies of any addenda for this project will no longer be mailed to prospective bidders. All addenda for this project will be posted to the [mdot.ms.gov](http://mdot.ms.gov) webpage under the Proposal Addenda column for the current letting and appropriate call number. Bidders will have to download addenda from the webpage and process the addenda in the same manner as previous lettings. Addenda will be posted by 10:00 a.m. on Friday prior to the letting. It will be the Bidder's responsibility to check and see if any addenda have been posted for this project. Any questions regarding the downloading process of the addenda shall be directed to the Contract Administration Division at 601-359-7700. Any questions regarding the content of the addenda shall be submitted as a question in accordance with the Notice To Bidders entitled "Questions Regarding Bidding".

**MISSISSIPPI DEPARTMENT OF TRANSPORTATION**

**SECTION 904 - NOTICE TO BIDDERS NO. 4565**

**CODE: (SP)**

**DATE: 06/27/2013**

**SUBJECT: Manual on Uniform Traffic Control Devices**

Any reference in the Standard Specifications or contract documents to a particular Section of the Manual on Uniform Traffic Control Devices (MUTCD) it shall mean that Section of the latest version of the Manual on Uniform Traffic Control Devices.



**MISSISSIPPI DEPARTMENT OF TRANSPORTATION**

**SECTION 904 - NOTICE TO BIDDERS NO. 4612**

**CODE: (SP)**

**DATE: 08/13/2013**

**SUBJECT: Adjustments for Bituminous Materials**

Bidders are advised that Subsection 907-402.03.1.2, Tack Coat, in Special Provision 907-402, allows the Contractor several options for OGFC tack coat. Regardless of the tack coat used, the monthly material adjustment, as referenced in Section 109 of the Standard Specifications, will be made using the base and current prices of tack coat Grade PG 76-22.

Bidders are also advised that the specifications allow the use of RC-70, RC-250, RC- 800, RS-1, RS-2, MC-30, MC-250, MS-2h, and CMS-2h in various other construction operations. If the Contractor uses one of these bituminous materials, the monthly material adjustment will be made using the base and current prices of the materials shown below.

<b>Materials Used</b>	<b>Material Adjustment Made Based on Prices For</b>
RC-70, 250, 800	MC-70
RS-1, 2	CRS-2
MC-30, 250	MC-70
MS-2h	SS-1
CMS-2h	SS-1

## MISSISSIPPI DEPARTMENT OF TRANSPORTATION

| SECTION 904 - NOTICE TO BIDDERS NO. 4661

CODE: (IS)

| DATE: 10/16/2013

**SUBJECT: Payroll Requirements**

Bidders are hereby advised that the Contractor and Subcontractor(s) are required to submit payroll information to the Project Engineers on a weekly basis.

On Federal-Aid Projects, CAD-880, CAD-881 and certified payroll submissions are required each week the Contractor or a Subcontractor performs work on the project. This is addressed in Section IV of Form FHWA-1273.

On State-Funded Projects, CAD-880 is required each week the Contractor or a Subcontractor performs work on the project.

| When no work is performed on either Federal-Aid or State-Funded Projects, the Contractor should only submit CAD-880 showing no work activities.

The Contractor shall make all efforts necessary to submit this information to the Project Engineer in a timely manner. The Engineer will have the authority to suspend the work wholly or in part and to withhold payments because of the Contractor's failure to submit the required information. Submission of forms and payrolls shall be current through the first full week of the month for the estimate period in order for the Project Engineer to process an estimate.

Bidders are advised to review the requirements regarding payroll submissions in Section 110 of the Standard Specifications.

**MISSISSIPPI DEPARTMENT OF TRANSPORTATION**

**SECTION 904 - NOTICE TO BIDDERS NO. 4887**

**CODE: (SP)**

**DATE: 02/18/2014**

**SUBJECT: Contract Time**

**PROJECT: BWO-5123-35(001) / 502587301,  
BWO-5214-35(001) / 502587302,  
BWO-5067-35(003) / 502587303,  
BWO-5221-35(001) / 502587304, &  
LWO-5035-35(002) / 502587305 -- Kemper County**

The calendar date for completion of work to be performed by the Contractor for this project shall be **June 30, 2015** which date or extended date as provided in Subsection 907-108.06 shall be the end of contract time. It is anticipated that the Notice of Award will be issued no later than **April 8, 2014** and the effective date of the Notice to Proceed / Beginning of Contract Time will be **June 9, 2014**.

Should the Contractor request a Notice to Proceed earlier than **June 9, 2014** and it is agreeable with the Department for an early Notice to Proceed, the requested date will become the new Notice to Proceed / Beginning of Contract Time date.

The available productive days for this project are **186**.

**MISSISSIPPI DEPARTMENT OF TRANSPORTATION**

**SECTION 904 - NOTICE TO BIDDERS NO. 4888**

**CODE: (SP)**

**DATE: 2/18/2014**

**SUBJECT: Asphalt Tack Coat**

**PROJECT: BWO-5123-35(001) / 502587301,  
BWO-5214-35(001) / 502587302,  
BWO-5067-35(003) / 502587303,  
BWO-5221-35(001) / 502587304, &  
LWO-5035-35(002) / 502587305 -- Kemper County**

Bidders are hereby advised that the costs for Asphalt for Tack Coat are to be absorbed in other items bid.

**MISSISSIPPI DEPARTMENT OF TRANSPORTATION**

**SECTION 904 - NOTICE TO BIDDERS NO. 4932**

**CODE: (SP)**

**DATE: 02/26/2014**

**SUBJECT: Project Number Change**

**PROJECT: BWO-5123-35(001) / 502587301,  
BWO-5214-35(001) / 502587302,  
BWO-5067-35(003) / 502587303,  
BWO-5221-35(001) / 502587304, &  
LWO-5035-35(002) / 502587305 -- Kemper County**

**If anywhere in the plans, proposal, or specifications reference is made to State Project No. BWO-5213-35(001) / 502587301, BWO-5214-35(001) / 502587302, BWO-5067-35(003) / 502587303, BWO-5221-35(001) / 502587304, & LWO-5035-35(002) / 502587305, it is understood that State Project No. BWO-5123-35(001) / 502587301, BWO-5214-35(001) / 502587302, BWO-5067-35(003) / 502587303, BWO-5221-35(001) / 502587304, & LWO-5035-35(002) / 502587305 is the correct project number.**

**MISSISSIPPI DEPARTMENT OF TRANSPORTATION**

**SECTION 904 - NOTICE TO BIDDERS NO.4933**

**CODE: (SP)**

**DATE: 2/25/2014**

**SUBJECT: Solid Sodding**

**PROJECT: BWO-5123-35(001) / 502587301,  
BWO-5214-35(001) / 502587302,  
BWO-5067-35(003) / 502587303,  
BWO-5221-35(001) / 502587304, &  
LWO-5035-35(002) / 502587305 -- Kemper County**

Bidders are hereby advised that the costs for watering of solid sod shall be absorbed in other items bid.

# MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-101-4

CODE: (IS)

DATE: 11/05/2008

SUBJECT: Definitions

Section 101, Definitions and Terms, of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows:

**907-101.02--Definitions.** Replace the following definitions in Subsection 101.02 on pages 3 through 13.

**Contract** - The written agreement between the Mississippi Transportation Commission and the Contractor setting forth the obligations of the parties thereunder, including but not limited to, the performance of the work, the furnishing of labor and materials, and the basis of payment.

The contract includes the invitation for bids, proposal, contract form and contract bonds, specifications, supplemental specifications, interim specifications, general and detailed plans, special provisions, notices to bidders, notice to proceed, and also any agreements that are required to complete the construction of the work in an acceptable manner, including authorized extensions thereof, all of which constitute one instrument.

**Contract Bonds** - The approved form of security, executed by the Contractor and the Contractor's Surety(ies), guaranteeing complete execution of the contract and all supplemental agreements pertaining thereto and the payment of all legal debts pertaining to the construction of the project. This term includes Performance and Payment Bond(s).

**Surety** - A corporate body, qualified under the laws of Mississippi, which is bound with and for the successful bidder by "contract bond(s)" to guarantee acceptable performance of the contract and payment of all legal taxes and debts pertaining to the construction of the project, including payment of State Sales Tax as prescribed by law, and any overpayment made to the Contractor.

Add the following to the list of definitions in Subsection 101.02 on pages 3 through 13.

**Performance Bond** - The approved form of security, executed by the Contractor and issued by the Contractor's Surety(ies), guaranteeing satisfactory completion of the contract and all supplemental agreements pertaining thereto.

**Payment Bond** - The approved form of security, executed by the Contractor and issued by the Contractor's Surety(ies), guaranteeing the payment of all legal debts pertaining to the construction of the project including, but not limited to, the labor and materials of subcontractors and suppliers to the prime contractor.

## MISSISSIPPI DEPARTMENT OF TRANSPORTATION

**SPECIAL PROVISION NO. 907-102-10**

**CODE: (IS)**

**DATE: 05/01/2013**

**SUBJECT: Bidding Requirements and Conditions**

Section 102, Bidding Requirements and Conditions, of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows.

**907-102.06--Preparation of Proposal.** Delete the first paragraph of Subsection 102.06 on page 17, and substitute the following.

The bidder's complete original proposal shall be submitted upon the forms (Certification of Performance, Certification Regarding Non-Collusion, etc.) furnished by the Department and shall include Expedite Bid printed bid sheets along with the bid data on the MDOT-supplied USB Flash Drive. Expedite Bid System (EBS) files shall be downloaded from the Department's website <http://mdot.ms.gov>. In case of discrepancy between a unit price and the extension, the unit price will govern and the extension along with the total amount of the proposal will be corrected.

Delete the fifth, sixth, and seventh paragraphs of Subsection 102.06 on page 18, and substitute the following.

Bid sheets generated by the Department's Electronic Bid System (Transport Expedite Bid) along with a completed proposal package (with all forms completed and signed) will constitute the official bid and shall be signed on the last sheet of the Expedite Bid generated bid sheets and delivered to the Department in accordance with the provisions of Subsection 102.09. Bids submitted using any other form, format or means will result in an irregular bid. The bidder's bid data shall be saved on the MDOT-supplied USB Flash Drive and submitted with the bid. Failure to return the USB Flash Drive with bid data will result in an irregular bid. If a Bidder is submitting bids on multiple proposals, the bid data for all proposals can be included on one flash drive and submitted with any of the bid envelopes.

Bidders are cautioned that using other versions of the Expedite Bid may result in improperly printed bid sheets. The correct version of Expedite Bid can be obtained at no cost from the MDOT Contract Administration Division or at the MDOT website, <http://mdot.ms.gov>. The current version of Expedite Bid is also included on the MDOT-supplied USB Flash Drive.

The Expedite Bid generated bid sheets should be stapled together in order beginning with page 1, signed and included in the bid proposal package in the sealed envelope. Only the Expedite Bid generated sheets will be recognized as the official bid. The MDOT-provided USB Flash Drive containing the information printed on the Expedite Bid generated bid sheets should be placed in the padded envelope included with the bid proposal package and enclosed in the sealed envelope. Bid sheets printed from Expedite Bid should be a representation of the data returned on the flash



drive. To have a true representation of the bid sheets, the Bidder must copy the EBS and EBS amendment files used to prepare the bid sheets to the flash drive. Otherwise, the unit prices bid will not be recorded to the flash drive. Bidders are cautioned that failure to follow proper flash drive handling procedures could result in the Department being unable to process the flash drive. Any modification or manipulation of the data contained on the flash drive, other than entering unit bid prices and completing all required Expedite Bid sections, will not be allowed and will cause the Contractor's bid to be considered irregular.

**907-102.08--Proposal Guaranty.** Delete the first and second paragraphs in Subsection 102.08 on page 20 and substitute the following.

No proposal will be considered unless accompanied by certified check, cashier's check or bid bond, made payable to the State of Mississippi, in an amount of not less than five percent (5%) of the total amount of the proposal offered. The guaranty shall be evidence of good faith that, if awarded the contract, the bidder will execute the contract and give performance and payment contract bond(s) as stipulated in Subsection 907-103.05.1, 907-103.05.2, and as required by law.

If a bid bond is offered as guaranty, the bond must be on a form approved by the Executive Director, made by a Surety acceptable to the Executive Director and signed or countersigned by a Mississippi Agent or Qualified Nonresident Agent and the Bidder. Such bid bond shall also conform to the requirements and conditions stipulated in Subsection 907-103.05.2 as applicable.

## MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-103-8

CODE: (SP)

DATE: 12/15/2009

SUBJECT: Award and Execution of Contract

Section 103, Award and Execution of Contract, of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows:

**907-103.04--Return of Proposal Guaranty.** Delete the second paragraph of Subsection 103.04 on page 23 and substitute the following:

Certified checks or cashier's checks submitted as proposal guaranties, except those of the two lowest bidders, will be returned within 10 days of contract award. The retained proposal guaranty of the unsuccessful of the two lowest bidders will be returned within ten days following the execution of a contract with the successful low bidder. The retained proposal guaranty of the successful bidder will be returned after satisfactory performance and payment bonds have been furnished and the contract has been executed.

In the event all bids are rejected by the Commission, certified checks or cashier's checks submitted as proposal guaranty by all bidders will be returned within 10 days of rejection.

Delete Subsection 103.05 on page 23 and substitute the following:

**907-103.05--Contract Bonds.**

**907-103.05.1--Requirement of Contract Bonds.** Prior to the execution of the contract, the successful bidder shall execute and deliver to the Executive Director a performance and payment bond(s), in a sum equal to the full amount of the contract as a guaranty for complete and full performance of the contract and the protection of the claimants and the Department for materials and equipment and full payment of wages in accordance with Section 65-1-85 Miss. Code Ann. (1972 as amended). In the event of award of a joint bid, each individual, partnership, firm or corporation shall assume jointly the full obligations under the contract and the contract bond(s).

**907-103.05.2--Form of Bonds.** The form of bond(s) shall be that provided by or acceptable to the Department. These bonds shall be executed by a Mississippi agent or qualified nonresident agent and shall be accompanied by a certification as to authorization of the attorney-in-fact to commit the Surety company. A power of attorney exhibiting the Surety's original seal supporting the Mississippi agent or the qualified nonresident agent's signature shall be furnished with each bond. The Surety company shall be currently authorized and licensed in good standing to conduct business in the State of Mississippi with a minimum rating by A.M. Best of (A-) in the latest printing "Best's Key Rating Guide" to write individual bonds up to ten percent of the policy holders' surplus or listed on the current list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as

published by the United States Department of the Treasury, Financial Management Service, Circular 570 (latest revision as published and supplemented on the Financial Management Service Web site and in the Federal Register) within the underwriting limits listed for that Surety. All required signatures on the bond(s) and certifications shall be original signatures, in ink, and not mechanical reproductions or facsimiles. The [Mississippi agent](#) or [qualified nonresident agent](#) shall be in good standing and currently licensed by the Insurance Commissioner of the State of Mississippi to represent the Surety company(ies) executing the bonds.

Surety bonds shall continue to be acceptable to the Commission throughout the life of the Contract and shall not be canceled by the Surety without the consent of the Department. In the event the Surety fails or becomes financially insolvent, the Contractor shall file a new Bond in the amount designated by the Executive Director within thirty (30) days of such failure, insolvency, or bankruptcy. Subsequent to award of Contract, the Commission or the Department may [require additional security for any supplemental agreements executed under the contract or replacement security in the event of the surety\(ies\) loss of the ratings required above](#). Suits concerning bonds shall be filed in the State of Mississippi and adjudicated under its laws without reference to conflict of laws principles.

**907-103.08--Failure to Execute Contract.** In the first sentence of Subsection 103.08 on page 24, change “bond” to “performance and payment bonds”.

**MISSISSIPPI DEPARTMENT OF TRANSPORTATION**

**SPECIAL PROVISION NO. 907-104-5**

**CODE: (IS)**

**DATE: 05/01/2013**

**SUBJECT: Scope of Work**

Section 104, Scope of Work, of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows:

**907-104.05--Removal and Disposal of All Materials From the Project.** Delete the second sentence of the first full paragraph of Subsection 104.05 on page 30 and substitute the following:

The Contractor shall also furnish the Engineer a certified letter stating that the area of disposal is not in a wetland or in Waters of the U.S.

## MISSISSIPPI DEPARTMENT OF TRANSPORTATION

**SPECIAL PROVISION NO. 907-105-7**

**CODE: (IS)**

**DATE: 05/01/2013**

**SUBJECT: Control of Work**

Section 105, Control of Work, of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is modified as follows.

**907-105.05--Cooperation by Contractor.** In the third sentence of the second paragraph of Subsection 105.05 on page 35, change “Notice to Proceed” to “Notice of Award”.

Delete the fourth paragraph of Subsection 105.05 on page 35, and substitute the following.

On projects that include erosion control pay items, the Contractor shall also designate a responsible person whose primary duty shall be to monitor and maintain the effectiveness of the erosion control plan, including NPDES permit requirements. This responsible person must be a Certified Erosion Control Person certified by an organization approved by the Department. Prior to or at the pre-construction conference, the Contractor shall designate in writing the Certified Erosion Control Person to the Project Engineer. The designated Certified Erosion Control Person shall be assigned to only one (1) project. When special conditions exist, such as two (2) adjoining projects or two (2) projects in close proximity, the Contractor may request in writing that the State Construction Engineer approve the use of one (1) Certified Erosion Control Person for both projects. The Contractor may request in writing that the Engineer authorize a substitute Certified Erosion Control Person to act in the absence of the Certified Erosion Control Person. The substitute Certified Erosion Control Person must also be certified by an organization approved by the Department. A copy of the Certified Erosion Control Person's certification must be included in the Contractor's Protection Plan as outlined in Subsection 907-107.22.1. This in no way modifies the requirements regarding the assignment and availability of the superintendent.

**907-105.14--Maintenance During Construction.** Before the first sentence Subsection 105.14 on page 39, add the following.

The Contractor will be responsible for the maintenance of existing roadways within the limits of this project starting on the date of the Notice To Proceed / Beginning of Contract Time. Anytime work is performed in a travel lane, the Contractor shall install portable lane closure signs meeting the requirement of the MDOT Standard Drawing or MUTCD.

## MISSISSIPPI DEPARTMENT OF TRANSPORTATION

| SPECIAL PROVISION NO. 907-107-13

CODE: (IS)

| DATE: 05/01/2013

**SUBJECT: Legal Relations and Responsibility to Public**

Section 107, Legal Relations and Responsibility to Public, of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows.

**907-107.02--Permits, Licenses and Taxes.** Delete in toto Subsection 107.02 on page 49 and substitute the following.

The Contractor or any Subcontractor shall have the duty to determine any and all permits and licenses required and to procure all permits and licenses, pay all charges, fees and taxes and issue all notices necessary and incidental to the due and lawful prosecution of the work. At any time during the life of this contract, the Department may audit the Contractor's or Subcontractor's compliance with the requirements of this section.

The Contractor or any Subcontractor is advised that the "Mississippi Special Fuel Tax Law", Section 27-55-501, et seq. and the Mississippi Use Tax Law, Section 27-67-1, et seq., and their requirements and penalties, apply to any contract or subcontract for construction, reconstruction, maintenance or repairs, for contracts or subcontracts entered into with the State of Mississippi, any political subdivision of the State of Mississippi, or any Department, Agency, Institute of the State of Mississippi or any political subdivision thereof.

The Contractor or any Subcontractor will be subject to one or more audits by the Department during the life of this contract to make certain that all applicable fuel taxes, as outlined in Section 27-55-501, et seq., and any sales and/or use taxes, as outlined in Section 27-67-1, et seq. are being paid in compliance with the law. The Department will notify the Mississippi State Tax Commission of the names and addresses of any Contractors or Subcontractors.

**907-107.14--Damage Claims and Insurance.**

| **907-107.14.2--Liability Insurance.** Delete Subsection 107.14.2 beginning on page 60 and substitute [the following](#).

**907-107.14.2.1--General.** The Contractor shall carry Contractor's liability, including subcontractors and contractual, with limits not less than: \$500,000 each occurrence; \$1,000,000 aggregate; automobile liability - \$500,000 combined single limit - each accident; Workers' Compensation and Employers' Liability - Statutory & \$100,000 each accident; \$100,000 each employee; \$500,000 policy limit. Each policy shall be signed or countersigned by a Mississippi Agent or Qualified Nonresident Agent of the Insurance Company.

The Contractor shall have certificates furnished to the Department from the insurance companies providing the required coverage. The certificates shall be on the form furnished by the Department and will show the types and limits of coverage.

**907-107.14.2.2--Railroad Protective.** The following provisions are applicable to all work performed under a contract on, over or under the rights-of-way of each railroad shown on the plans.

The Contractor shall assume all liability for any and all damages to work, employees, servants, equipment and materials caused by railroad traffic.

Prior to starting any work on railroad property, the Contractor shall furnish satisfactory evidence to the Department that insurance of the forms and amounts set out herein in paragraphs (a) and (b) has been obtained. Also, the Contractor shall furnish similar evidence to the Railroad Company that insurance has been obtained in accordance with the Standard Provisions for General Liability Policies and the Railroad Protective Liability Form as published in the Code of Federal Regulations, 23 CFR 646, Subpart A. Evidence to the Railroad Company shall be in the form of a Certificate of Insurance for coverages required in paragraph (b), and the original policy of the Railroad Protective Liability Insurance for coverage required in paragraph (a).

All insurance herein specified shall be carried until the contract is satisfactorily complete as evidenced by a release of maintenance from the Department.

The Railroad Company shall be given at least 30 days notice prior to cancellation of the Railroad Protective Liability Insurance policy.

For work within the limits set out in Subsection 107.18 and this subsection, the Contractor shall provide insurance for bodily injury liability, property damage liability and physical damage to property with coverages and limits no less than shown in paragraphs (a) and (b). Bodily injury shall mean bodily injury, sickness, or disease, including death at anytime resulting therefrom. Property damage shall mean damages because of physical injury to or destruction of property, including loss of use of any property due to such injury or destruction. Physical damage shall mean direct and accidental loss of or damage to rolling stock and their contents, mechanical construction equipment or motive power equipment.

(a) **Railroad Protective Liability Insurance** shall be purchased on behalf of the Railroad Company with limits of \$2,000,000 each occurrence; \$6,000,000 aggregate applying separately to each annual period for lines without passenger trains. If the line carries passenger train(s), railroad protective liability insurance shall be purchased on behalf of the Railroad Company with limits of \$5,000,000 each occurrence; \$10,000,000 aggregate applying separately to each annual period.

Coverage shall be limited to damage suffered by the railroad on account of occurrences arising out of the work of the Contractor on or about the railroad right-of-way, independent of the railroad's general supervision or control, except as noted in paragraph 4 below.

Coverage shall include:

- (1) death of or bodily injury to passengers of the railroad and employees of the railroad not covered by State workmen's compensation laws,
- (2) personal property owned by or in the care, custody or control of the railroads,
- (3) the Contractor, or any of the Contractor's agents or employees who suffer bodily injury or death as a result of acts of the railroad or its agents, regardless of the negligence of the railroads, and
- (4) negligence of only the following classes of railroad employees:
  - (i) any supervisory employee of the railroad at the job site
  - (ii) any employee of the railroad while operating, attached to, or engaged on, work trains or other railroad equipment at the job site which are assigned exclusively to the Contractor, or
  - (iii) any employee of the railroad not within (i) or (ii) above who is specifically loaned or assigned to the work of the Contractor for prevention of accidents or protection of property, the cost of whose services is borne specifically by the Contractor or Governmental authority.

(b) **Contractor's Liability - Railroad**, including subcontractors, XCU and railroad contractual with limits of \$1,000,000 each occurrence; \$2,000,000 aggregate. **Automobile** with limits of \$1,000,000 combined single limit any one accident; **Workers' Compensation and Employer's Liability** - statutory and \$100,000 each accident; \$100,000 each employee; \$500,000 policy limit. **Excess/Umbrella Liability** \$5,000,000 each occurrence; \$5,000,000 aggregate. All coverage to be issued in the name of the Contractor shall be so written as to furnish protection to the Contractor respecting the Contractor's operations in performing work covered by the contract. Coverage shall include protection from damages arising out of bodily injury or death and damage or destruction of property which may be suffered by persons other than the Contractor's own employees.

In addition, the Contractor shall provide for and on behalf of each subcontractor by means of a separate and individual liability and property damage policy to cover like liability imposed upon the subcontractor as a result of the subcontractor's operations in the same amounts as contained above; or, in the alternative each subcontractor shall provide same.

**907-107.15--Third Party Beneficiary Clause.** In the first sentence of the first paragraph of Subsection 107.15 on page 61, change "create the public" to "create in the public".

**907-107.17--Contractor's Responsibility for Work.** Delete the fifth sentence of the fifth paragraph of Subsection 107.17 on page 63 and substitute the following.

The eligible permanent items shall be limited to traffic signal systems, changeable message signs, roadway signs and sign supports, lighting items, guard rail items, delineators, impact



attenuators, median barriers, bridge railing or pavement markings. The eligible temporary items shall be limited to changeable message signs, guard rail items, or median barriers.

**907-107.18--Contractor's Responsibility for Utility Property and Services.** After the first sentence of Subsection 107.18 on page 63, add the following:

Prior to any excavation on the project, the Contractor shall contact MS 811 and advise them to mark all known utilities in the area of the excavation.

**MISSISSIPPI DEPARTMENT OF TRANSPORTATION**

**SUPPLEMENT TO SPECIAL PROVISION NO. 907-107-14**

**DATE: 10/29/2013**

**SUBJECT: Contractor's Protection Plan**

**907-107.22.1--Contractor's Erosion Control Plan.** Delete the first sentence of the second paragraph of Subsection 907-107.22.1 on page 1, and substitute the following.

The time between the Notice of Award and Notice to Proceed/Beginning of Contract Time in the proposal, has been allowed for the submittal and concurrence of the Contractor's erosion control plan, MDOT's review of the plan, and any revisions that may be necessary.

## MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-107-14

CODE: (IS)

DATE: 05/22/2013

SUBJECT: Contractor's Protection Plan

Section 107, Legal Relations and Responsibility to Public, of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows:

Delete in toto Subsection 107.22.1 on pages 65 and 66, and substitute the following.

**907-107.22.1--Contractor's Erosion Control Plan.** At the preconstruction conference or prior to starting any work on the project, the Contractor shall submit to the Project Engineer for concurrence a comprehensive erosion and siltation control plan. The plan shall utilize temporary measures and permanent erosion control features to provide acceptable controls during all stages of construction. If an early Notice to Proceed is desired, the Contractor's Erosion Control Plan should be submitted to the Engineer as soon as possible after award since an approved erosion control plan is required for an early Notice to Proceed.

Approximately 60 calendar days, the time between the Notice of Award and Notice to Proceed/Beginning of Contract Time in the proposal, has been allowed for the submittal and concurrence of the Contractor's erosion control plan, MDOT's review of the plan, and any revisions that may be necessary. The original contract time shall not be adjusted unless delays are caused solely by the Department for the submission, review, and concurrence of the Contractor's erosion control plan.

As a minimum, the plan shall include the following:

1. Erosion Control Plan (ECP) sheets or the plan profile sheets, 11" x 17" or larger, of all areas within the rights-of-way from the Beginning of the Project (BOP) to the End of the Project (EOP) showing the location of all temporary erosion control devices. Erosion control devices should be identified by exact type, temporary or permanent, configuration, and placement of each item to prevent erosion and siltation. A narrative of the Contractor's temporary erosion control plan shall be submitted in a format similar to the form attached to this special provision, but must include the heading and sub-heading information. As a minimum, the narrative shall include the following:
  - A detailed description, including locations (station numbers) of the Contractor's proposed sequence of operations including, but not limited to, clearing and grubbing, excavation, drainage, and structures.
  - A detailed description, including locations, and best management practices (BMP) that will be used to prevent siltation and erosion from occurring during the Contractor's proposed sequence of operations.

2. A copy of the certification for the Contractor's Certified Erosion Control Person whose primary duty shall be monitoring and maintaining the effectiveness of the erosion control plan, BMPs, and compliance with the NPDES permit requirements.
3. A plan for the disposal of waste materials on the project right-of-way which shall include but not be limited to the following:
  - containment and disposal of materials resulting from the cleaning (washing out) of concrete trucks that are delivering concrete to the project site.
  - containment and disposal of fuel / petroleum materials at staging areas on the project.

The erosion and siltation control plan shall be maintained on the project site at all times, updated as work progresses to show changes due to revisions in the sequences of construction operations, replacement of inadequate BMPs, and the maintenance of BMPs. Work shall not be started until an erosion control plan has been concurred with by the MDOT. The Engineer will have the authority to suspend all work and/or withhold payments for failure of the Contractor to carry out provisions of MDEQ's Storm Water Construction General Permit, the erosion control plan, updates to the erosion control plan, and /or proper maintenance of the BMPs.

**907-107.22.2--Clearing and Grubbing, Haul Roads, Waste Areas, Plant Sites or Other Areas Occupied by the Contractor.** Delete the fourth paragraph of Subsection 107.22.2 on page 66 and substitute the following.

Unless otherwise determined by the Engineer from a study of overall job conditions, the exposed surface area of erodible material at any one time on this project shall not exceed 19 acres without prior approval by the Engineer.

**EXAMPLE**  
**MISSISSIPPI DEPARTMENT OF TRANSPORTATION**  
**Storm Water Pollution Prevention Plan (SWPPP)**  
**Narrative**

General Permit Coverage No: MSR \_\_\_\_\_  
Project Number: \_\_\_\_\_  
County: \_\_\_\_\_  
Route: \_\_\_\_\_

**SITE INFORMATION**

This project consists of grading and installing drainage structures necessary to construct approximately 6 miles of parallel lanes on SR 31 between the Hinds County Line and the Rankin County Line.

**SEDIMENT AND EROSION CONTROLS**

**VEGETATIVE CONTROLS:** Clearing and grubbing areas will be minimized to comply with the buffer zones (minimum of 15 feet along the ROW lines and 5 feet along creeks) as per the contract documents. A combination of temporary and permanent grassing will be used to protect slopes as construction progresses. **Should a disturbed area be left undisturbed for 14 days or more, temporary or permanent vegetation will be placed within 7 calendar days.**

**STRUCTURAL CONTROLS:** Gravel construction entrance/exit will be installed near Stations 145+50, 159+50, 164+50 & 172+50. Riprap ditch checks will be constructed at Stations 144+50, 151+75, 162+00 & 166+25. The Concrete washout area will be at Stations 140+25, 152+00 & 168+50.

**HOUSEKEEPING PRACTICES:** Structural BPM's will be cleaned out when sediment reaches 1/3 to 1/2 of the height of the BMP. Maintenance and repair of equipment will be performed off-site, material wash out will occur either off-site or within designated wash out areas.

**POST-CONSTRUCTION CONTROL MEASURES:** As construction is completed, permanent vegetative growth will be established on disturbed soils to improve soil stability and provide a buffer zone for loose material. Paved ditches and flumes will be placed as specified in the ECP to reduce erosion in concentrated flow areas and rip rap will be placed as specified to dissipate flow energy and reduce flow velocity.

**IMPLEMENTATION SEQUENCE**

Perimeter controls will be installed first. Clearing and grubbing will be performed in 19-acre sections beginning at the BOP and temporary grassing will be installed as needed. Temporary erosion control BMP's will be installed at the drainage structures prior/during construction of the drainage structures. Grading activities will commence at the BOP and proceed towards the EOP, fill slopes will be permanently grassed in stages for fill heights that exceed 5 feet. Base materials will be installed on completed grading sections with the paving to follow.

**MAINTENANCE PLAN**

All erosion and sediment control practices will be checked for stability and operation following every rainfall but in no case less than once every week. Any needed repairs will be made immediately to maintain all practices as designed. Sediment basins will be cleaned out when the level of sediment reaches 2.0 feet below the top of the riser. Sediment will be removed from behind BMP's when it becomes about 1/3 to 1/2 height of BMP.

\_\_\_\_\_  
Prime Contractor's Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Printed Name

\_\_\_\_\_  
Title

## MISSISSIPPI DEPARTMENT OF TRANSPORTATION

| SPECIAL PROVISION NO. 907-108-30

CODE: (IS)

| DATE: 05/22/2013

**SUBJECT: Prosecution and Progress**

Section 108, Prosecution and Progress, of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows.

### **907-108.01--Subletting of Contract.**

**907-108.01.1--General.** At the end of the last paragraph of Subsection 108.01.1 on page 73, add the following.

The Engineer will have the authority to suspend the work wholly or in part and to withhold payments because of the Contractor's failure to make prompt payment within 15 calendar days as required above, or failure to submit the required OCR-484 Form, Certification of Payments to Subcontractors, which is also designed to comply with prompt payment requirements.

**907-108.02--Notice To Proceed.** Delete the second paragraph of Subsection 108.02 on page 75 and substitute the following.

The anticipated date of the Notice to Proceed (NTP) / Beginning of Contract Time (BCT) will be specified in the proposal.

Delete the fourth paragraph of Subsection 108.02 on page 75 and substitute the following.

Upon written request from the Contractor and if circumstances permit, the Notice to Proceed may be issued at an earlier date subject to the conditions stated therein. The Contractor shall not be entitled to any monetary damages or extension of contract time for any delay claim or claim of inefficiency occurring between the early issuance Notice To Proceed date and the Notice to Proceed date stated in the contract.

**907-108.03--Prosecution and Progress.** Delete Subsection 108.03.1 on pages 75 & 76, and substitute the following.

**907-108.03.1--Progress Schedule.** Prior to or at the Pre-Construction Conference, the Contractor shall furnish a progress schedule and be prepared to discuss both its proposed methodologies for fulfilling the scheduling requirements and its sequence of operations. The Engineer will review the schedule and approve the schedule as it relates to compliance with the specifications and logic. The progress schedule must be approved by the Engineer prior to commencing work. The schedule shall be a bar-chart type schedule submitted on 11"x17" paper meeting the below minimum requirements. These activities shall be significantly detailed enough to communicate the Contractor's understanding of the construction sequencing and phasing of the project.

When preparing the progress schedule, the Contractor shall include the following:

- Show a time scale to graphically show the completion of the work within contract time.
- Define and relate activities to the contract pay items.
- Show all activities in the order the work is to be performed including submittals, submittal reviews, fabrication and delivery.
- Show all activities that are controlling factors in the completion of the work.
- Show the time needed to perform each activity and its relationship in time to other activities.

Should the schedule not include the above requirements or becomes unrealistic during construction, the Contractor should immediately submit a revised, more realistic schedule for approval.

**907-108.03.2--Preconstruction Conference.** Delete the first paragraph of Subsection 108.03.2 on page 76 and substitute the following.

Prior to commencement of the work, a preconstruction conference shall be held for the purpose of discussing with the Contractor essential matters pertaining to the prosecution and satisfactory completion of the work. The Contractor will be responsible for scheduling the preconstruction conference. The Contractor will advise the Project Engineer in writing 14 days prior to the requested date that a conference is requested. When the contract requires the Contractor to have a certified erosion control person, the Contractor's certified erosion control person shall be at the preconstruction conference. The Department will arrange for utility representatives and other affected parties to be present.

Delete the third paragraph of Subsection 108.03.2 on page 76.

**907-108.06--Determination and Extension of Contract Time.** Delete Subsections 108.06.1 and 108.06.2 on pages 79 thru 85 and substitute the following.

**907-108.06.1--Blank.**

**907-108.06.2--Based on Calendar Date Completion.**

**907-108.06.2.1--General.** Contract Time will be established on the basis of a Completion Date, as indicated in the contract. The span of time allowed for the completion of the work included in the contract will be indicated in the contract documents and will be known as "Contract Time".

The span of time allowed in the contract as awarded is based on the quantities used for comparison of bids. If satisfactory fulfillment of the contract requires performance of work in greater quantities than those set forth in the proposal, the time allowed for completion shall be increased in Calendar Days in the same ratio that the cost of such added work, exclusive of the cost of work altered by Supplemental Agreement for which a time adjustment is made for such altered work in the Supplemental Agreement, bears to the total value of the original contract unless it can be established that the extra work was of such character that it required more time

than is indicated by the money value.

The Contractor shall provide sufficient materials, equipment and labor to guarantee the completion of the work in the contract in accordance with the plans and specifications within the Contract Time.

**907-108.06.2.2--Contract Time.** The following TABLE OF ANTICIPATED PRODUCTIVE DAYS indicates an average/anticipated number of productive days per month.

**TABLE OF ANTICIPATED PRODUCTIVE DAYS**

Month	Available Productive Days
January	6
February	7
March	11
April	15
May	19
June	20
July	21
August	21
September	20
October	16
November	11
December	5
Calendar Year	172

Allocation of anticipated productive days for a fractional part of the month will be computed as a proportion of the listed anticipated productive days for the applicable month.

Available productive days will start being assessed at the original Notice to Proceed/Beginning of Contract Time date shown in the contract documents, regardless of whether or not the Contractor has been issued an early Notice to Proceed.

Available productive days will be based on soil and weather conditions and other specific conditions cited in the contract. The Engineer will determine on each applicable day the extent to which work in progress could have been productive, regardless of whether the Contractor actually worked.

An available productive day will be assessed as follows:

- (a) any day of the week, Monday through Friday, exclusive of legal holidays recognized by the Department in Subsection 108.04.1, in which the Contractor works or could have worked for more than six (6) consecutive hours on the controlling item(s) of work, as determined by the



Engineer from the Contractor's approved progress schedule. When the Contractor works or could work more than four but less than six consecutive hours, one-half (0.5) of an available work day will be charged for that day. When the Contractor works or could work six or more consecutive hours during the day, one (1.0) available work day will be charged for that day, or

(b) any Saturday, exclusive of legal holidays recognized by the Department in Subsection 108.04.1, in which the Contractor works for more than six (6) consecutive hours on the controlling item(s) of work, as determined by the Engineer from the Contractor's approved progress schedule. When the Contractor works less than four consecutive hours during the day, no time will be charged for that day. When the Contractor works more than four but less than six consecutive hours, one-half (0.5) of an available work day will be charged for that day. When the Contractor works six or more consecutive hours during the day, one (1.0) available work day will be charged for that day.

Should the weather or other conditions be such that four (4) consecutive satisfactory hours are not available prior to noon (for daytime operations) or midnight (for nighttime operations), no time will be assessed for that day regardless of the above conditions. However, if the Contractor elects to work, time will be assessed in accordance with the previous paragraph.

Weather delays will not be considered for Saturdays, Sundays or legal holidays recognized by the Department in Subsection 108.04.1.

Each month the Engineer will complete, and furnish to the Contractor, an "Assessment Report for Available Productive Days" (CSD-765). This report shows the number of available productive days during the estimate period and the cumulative available productive days to date. The Contractor should review the Engineer's report as to the accuracy of the assessment and confer with the Resident or Project Engineer to rectify any differences. Each should make a record of the differences, if any, and conclusions reached. In the event mutual agreement cannot be reached, the Contractor will be allowed a maximum of 15 calendar days following the ending date of the monthly report in question to file a protest Notice of Claim in accordance with the provisions of Subsection 105.17. Otherwise, the Engineer's assessment shall be final unless mathematical errors of assessment are subsequently found to exist, and any claim of the Contractor as to such matter shall be waived.

The Contractor's progress will be determined monthly at the time of each progress estimate and will be based on the percentage of money earned by the Contractor compared to the percentage of elapsed time.

The percentage of money earned will be determined by comparing the total money earned to-date by the Contractor, minus any payment for advancement of materials, to the total dollar amount of the contract. The percentage of time elapsed will be determined by comparing the available productive days assessed to-date on Form CSD-765 to the total available productive days for the contract.

When the "percent complete" lags more than 20 percent behind the "percentage of elapsed time", the Contractor shall immediately submit a written statement and revised progress schedule

indicating any additional equipment, labor, materials, etc. to be assigned to the work to ensure completion within the specified contract time. When the "percent complete" lags more than 40 percent behind the "percentage of elapsed time", the contract may be terminated.

**907-108.06.2.3--Extension of Time.** The Contractor may, prior to the expiration of the Contract Time, make a written request to the Engineer for an extension of time with a valid justification for the request. The Contractor's plea that insufficient time was specified is not a valid reason for extension of time.

No extension of the specified completion date will be granted except as provided herein. An extension of contract time may be granted for unusually severe weather, abnormal delays caused solely by the State or other governmental authorities, or unforeseeable disastrous phenomena of nature of the magnitude of earthquakes, hurricanes, tornadoes, or flooded essential work areas which are deemed to unavoidably prevent prosecuting the work.

Unusually severe weather is defined as when the actual available productive days for the contract time are less than the number of available productive days shown in the Table of Anticipated Productive Days. Any extension of contract time will be based on a calendar days basis, excluding Saturdays, Sundays or legal holidays recognized by the Department in Subsection 108.04.1. Any extension of contract time will be made on or after the specified completion date. No extension of contract time will be made on a monthly basis.

If the **specified completion date** of the project is extended into a season of the year in which completion of certain items of work would be prohibited or delayed because of seasonal or temperature limitations, the Engineer may waive the limitations provided the completion of the work will not result in a reduction in quality. When determined that the completion of the out-of-season items will cause a reduction in the quality of the work, the completion of the project will be further extended so the items may be completed under favorable weather conditions. In either case, the Engineer will notify the Contractor in writing.

Liquidated damages as set forth in Subsection 108.07 under the heading "Daily Charge Per Calendar Day" in the Table titled "Schedule of Deductions for Each Day of Overrun in Contract Time", shall be applicable to each calendar day after the specified completion date, or authorized extension thereof, and until all work under the contract is completed.

**907-108.06.2.4--Cessation of Contract Time.** When the Engineer by written notice schedules a final inspection, time will be suspended until the final inspection is conducted and for an additional 14 calendar days thereafter. If after the end of the 14-day suspension all necessary items of work have not been completed, time charges will resume. If the specified completion date had not been reached at the time the Contractor called for a final inspection, the calendar day difference between the specified completion date and the date the Contractor called for a final inspection will be added after the 14-day period before starting liquidation damages. If a project is on liquidated damages at the time a final inspection is scheduled, liquidated damages will be suspended until the final inspection is conducted and for seven (7) calendar days thereafter. If after the end of the 7-day suspension all necessary items of work have not been completed, liquidated damages will resume. When final inspection has been made by the

Engineer as prescribed in Subsection 105.16 and all items of work have been completed, the daily time charge will cease.

**907-108.07--Failure to Complete the Work on Time.** Delete the Schedule of Deductions table in Subsection 108.07 on page 85, and substitute the following.

**Schedule of Deductions for Each Day of Overrun in Contract Time**

<b>Original Contract Amount</b>		<b>Daily Charge Per Calendar Day</b>
<b>From More Than</b>	<b>To and Including</b>	
\$ 0	100,000	\$ 150
100,000	500,000	360
500,000	1,000,000	540
1,000,000	5,000,000	830
5,000,000	10,000,000	1,200
10,000,000	20,000,000	1,800
20,000,000	-----	3,500

**907-108.10--Termination of Contractor's Responsibility.** In the last sentence of Subsection 108.10 on page 88, change “bond” to “performance and payment bond(s)”.

# MISSISSIPPI DEPARTMENT OF TRANSPORTATION

## SUPPLEMENT TO SPECIAL PROVISION NO. 907-109-6

**DATE:** 12/17/2013

**SUBJECT:** Measurement and Payment

Before the first sentence of Subsection 907-109.04 on page 1, add the following.

Delete the first paragraph under Subsection 109.04 on page 91, and substitute the following.

When extra work results for any reason and is not handled as prescribed elsewhere herein, the Engineer and the Contractor will attempt to agree on equitable prices. When such prices are agreed upon, a Supplemental Agreement will be issued by the Engineer.

When the Supplemental Agreement process is initiated, the Contractor will be required to submit to the Engineer a detailed breakdown for Material, Labor, Equipment, Profit and Overhead. The total allowable markup (which includes Prime Contractor and Subcontractor work, if applicable) for Supplemental Agreement work shall not exceed 20%.

The requirement for detailed cost breakdowns may be waived when a Department's Bid Item History exists for the proposed item(s), and the Contractor's requested price is within 20% of the Department's Bid History cost for that item(s). In any case, the Department reserves the right to request detailed cost breakdowns from the Contractor on any Supplemental Agreement request.

When equitable prices cannot be agreed upon mutually by the Engineer and the Contractor, the Engineer will issue a written order that work will be completed on a force account basis to be compensated in the following manner:

After the last paragraph of Subsection 907-109.07 on page 2, add the following.

Delete the last paragraph of Subsection 109.07 on pages 97 & 98, and substitute the following.

Adjustments herein provided shall not apply to fuels consumed or materials incorporated into the work during any monthly estimate period falling wholly after the expiration of contract time as defined in Subsection 101.02 of the applicable Mississippi Standard Specifications for Road and Bridge Construction, and as determined by checked final quantities..

# MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-109-6

CODE: (IS)

DATE: 05/01/2013

SUBJECT: Measurement and Payment

Section 109, Measurement and Payment, of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows.

**907-109.01--Measurement of Quantities.** Delete the third full paragraph of Subsection 109.01 on page 90 and substitute the following.

When requested by the Contractor, material specified to be measured by the cubic yard or ton may be converted to the other measure as appropriate. Factors for this conversion will be determined by the District Materials Engineer and agreed to by the Contractor. The conversion of the materials along with the conversion factor will be incorporated into the contract by supplemental agreement. The supplemental agreement must be executed before such method of measurement is used.

After the second sentence of the fourth full paragraph of Subsection 109.01 on page 90, add the following.

Where loose vehicle measurement (LVM) is used, the capacity will be computed to the nearest one-tenth cubic yard and paid to the whole cubic yard. Measurements greater than or equal to nine-tenths of a cubic yard will be rounded to the next highest number. Measurements less than nine-tenths of a cubic yard will not be rounded to the next highest number. Example: A vehicle measurement of 9.9 cubic yards will be classified as a 10-cubic yard vehicle. A vehicle measurement of 9.8 cubic yards will be classified as a 9-cubic yard vehicle.

**907-109.04--Extra and Force Account Work.** In the last sentence of subparagraph (b) in Subsection 109.04 on page 91, change “bond” to “bond(s)”.

Delete the first sentence of the second paragraph of subparagraph (d) in Subsection 109.04 on page 92 and substitute the following.

In the event an agreement cannot be reached for a particular piece of equipment, the book entitled "Rental Rate Blue Book For Construction Equipment" as published by EquipmentWatch® and is current at the time the force account work is authorized will be used to determine equipment ownership and operating expense rates.

**907-109.06--Partial Payment.**

**907-109.06.1--General.** Delete the fourth and fifth sentences of the third paragraph of Subsection 109.06.1 on page 94, and substitute the following.

In the event mutual agreement cannot be reached, the Contractor will be allowed a maximum of

25 calendar days following the Contractor's receipt of the monthly estimate in question to file in writing, a protest Notice of Claim in accordance with the provisions Subsection 105.17. Otherwise, the Engineer's estimated quantities shall be considered acceptable pending any changes made during the checking of final quantities.

**907-109.07--Changes in Material Costs.** Delete the third full paragraph of Subsection 109.07 on page 96 and substitute the following.

A link to the established base prices for bituminous products and fuels will be included in the contract documents under a Notice to Bidders entitled "Petroleum Products Base Prices."

**MISSISSIPPI DEPARTMENT OF TRANSPORTATION**

**SPECIAL PROVISION NO. 907-216-1**

**CODE: (IS)**

**DATE: 05/22/2013**

**SUBJECT: Solid Sodding**

Section 216, Solid Sodding, of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows.

**907-216.04--Method of Measurement.** Delete the third and fourth paragraphs of Subsection 216.04 on page 144.

**907-216.05--Basis of Payment.** Delete the first paragraph of Subsection 216.05 on pages 144 and 145, and substitute the following.

Solid sodding will be paid for at the contract unit price per square yard, which price shall be full compensation for all labor, equipment, materials, tools, ground preparation, fertilization, and all incidentals necessary to complete the work.

Add the "907" prefix to the pay items listed on page 145.

# MISSISSIPPI DEPARTMENT OF TRANSPORTATION

**SPECIAL PROVISION NO. 907-225-3**

**CODE: (IS)**

**DATE: 02/23/2012**

**SUBJECT: Grassing**

Section 907-225, Grassing, of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows:

Delete in toto Section 225 on pages 158 thru 163, and substitute the following.

## **SECTION 907-225--GRASSING**

**907-225-01--Description.** This work consists of furnishing, transporting, placing, plant establishment, and all work, including ground preparation, fertilizing, seeding, and mulching, necessary to produce a satisfactory and acceptable growth of grass.

At the Contractor's option, seeds and mulch may be incorporated using a hydraulically applied method under certain limitations. Under no circumstances shall fertilizer be incorporated hydraulically.

### **907-225.02--Materials.**

**907-225.02.1--Fertilizers.** Fertilizers for purposes of this specification shall be understood to include standard manufactured products consisting of single or combination ingredients and agricultural limestone.

All fertilizer shall comply with the State fertilizer laws, Subsection 715.02, and the requirements of this specification.

**907-225.02.2--Seeds.** Seeds shall meet the requirements of Subsection 715.03, subject to the provisions of this subsection. The Contractor shall acquire seed from persons registered with the Mississippi Department of Agriculture and Commerce.

Except for the germination requirements, bags of seeds properly labeled or tagged according to law and indicating characteristics meeting or exceeding the requirements of Subsection 715.03 will be acceptable for planting.

The Contractor should provide adequate dry storage facilities for seeds, and shall furnish access to the storage for sampling stored seed.

### **907-225.02.3--Mulch.**

**907-225.02.3.1--Vegetative Mulch.** The vegetative materials for mulch shall meet the



requirements of Subsection 215.02.

**907-225.02.3.2--Hydraulically Applied Mulch (Hydromulch).** Fibers for hydromulch shall be produced from wood, straw, cellulose, natural fibers, or recycled fibers which are free of non-biodegradable substances. The fiber shall disperse into a uniform slurry when mixed with water. Fibers shall be colored green, or other approved contrasting color, and shall not stain concrete or other surfaces. The use of tackifiers or activators will be allowed.

Hydromulch shall be listed on the Department's "Approved Sources of Materials".

**907-225.02.3.2.1--Wood Fiber Mulch.** Wood fiber mulch shall be made from wood chip particles manufactured particularly for discharging uniformly on the ground surface when dispersed by a hydraulic water sprayer. It shall remain in uniform suspension in water under agitation and blend with grass seed and fertilizer to form a homogeneous slurry. The fibers shall intertwine physically to form a strong moisture-holding mat on the ground surface and allow rainfall to percolate the underlying soil. The fiber material shall be heat processed so as to contain no germination or growth-inhibiting factors. The mulch shall be dyed an appropriate color to facilitate the application of material using non-toxic dye.

**907-225.02.3.2.2--Cellulose Fiber Mulch.** Cellulose fiber mulch consist of recycled paper stock products which are shredded into small pieces particular for application by hydraulic seeding equipment. It shall mix readily and uniformly under agitation with water and blend with grass seed and fertilizer to form a homogeneous slurry. When applied to the ground surface, the material shall form a strong moisture-holding mat, allow rainfall to percolate the underlying soil, and remain in place until the grass root system is established. The material shall contain no growth inhibiting characteristic or organisms. The mulch shall be dyed an appropriate color to facilitate the application of material using non-toxic dye.

**907-225.02.3.2.3--Wood/Cellulose Fiber Mulch.** Wood/cellulose fiber mix hydroseeding mulch shall consist of a combination of the above wood and cellulose fibers at a ratio recommended by the manufacturer of the products.

**907-225.02.3.2.4--Straw Mulch.** Straw mulch shall consist of a natural straw fiber. This material shall be a minimum 90% straw and essentially free from plastic materials or other non-bio degradable substances. The material shall be disperse into a uniform mulch slurry when mixed with water.

**907-225.02.3.2.5--Tackifier.** The tackifier will serve the purpose of an adhesive to form a bond between the soil, fiber, and seed particles. It will also allow the soil to retain moisture. The tackifier shall be of the organic or synthetic variety.

**907-225.03--Construction Requirements.**

**907-225.03.1--Ground Preparation.** Ground preparation, light or standard, consists of plowing, loosening, and pulverizing the soil to form suitable beds for erosion control items in reasonably close conformity with the established lines and grades without appreciable humps or depressions.

When grassing an area that has been previously planted with temporary grassing, a standard ground preparation will be required. The previously planted grasses shall be disked, tilled, plowed, etc. to assure that the existing temporary grasses are thoroughly mixed into the soil.

Any equipment used for ground preparation shall be approved units suitable to perform the work and subject to the requirements of Subsection 108.05.

The Contractor shall take full advantage of weather and soil conditions, and no attempt shall be made to prepare soil when it is wet or in a condition which will not allow the soil to be properly tilled.

Light ground preparation should be used on areas where seeding is required to improve the coverage of partially vegetated areas.

Standard ground preparation should be used on areas designated to be solid sodded and unvegetated areas designated to be seeded.

Aerating, moistening, or otherwise bringing the soil to a suitable condition for ground preparation shall be considered as incidental to the work and will not be measured for separate payment.

**907-225.03.1.1--Light Ground Preparation.** Light ground preparation consists of scratching the surface with a close-tooth harrow, disk-harrow, or similar equipment. The depth of scratching should be at least three-quarters inch but not deep enough to damage existing grasses of the type being planted.

**907-225.03.1.2--Standard Ground Preparation.** Standard ground preparation consists of plowing or disk-harrowing and thoroughly pulverizing the areas immediately before the application of erosion control (vegetative) items. Unless otherwise specified, the pulverized and prepared seedbed should be at least four inches deep and shall be reasonably free of large clods, earthballs, boulders, stumps, roots and other objectionable matter. Incorporation of fertilizer and ground preparation may be performed simultaneously.

**907-225.03.2--Fertilizing.** Fertilizing consists of furnishing, transporting, spreading, and incorporating fertilizers. The Contractor shall furnish all equipment necessary to properly handle, store, uniformly spread, and incorporate the specified application of fertilizer.

Unless otherwise specified in the contract, the Contractor shall incorporate bag fertilizer at a rate of 1000 pounds per acre of 13-13-13 commercial fertilizer. The equivalent rate of other type fertilizers will be allowed if the equivalent percentages of Nitrogen, Phosphorus and Potassium are obtained. The Contractor shall incorporate agricultural limestone at a rate of 5000 pounds per acre. Fertilization shall be applied uniformly on the areas to be planted or seeded and uniformly incorporated into the soil.

Fertilizers should be applied on individual areas of not more than three acres.

All fertilizer should be incorporated within 24 hours following spreading.

**907-225.03.3--Seeding.** Seeding consists of furnishing and planting seeds in a prepared seedbed, covering the seeds, and providing plant establishment on all areas seeded.

Prior to planting the seeds, ground preparation and fertilizing shall be satisfactorily performed.

The required type of seeds, minimum rates of application, and planting dates of seeds are shown in the vegetation schedule in the plans.

When a vegetation schedule is not shown in the plans, the following types of seed and application rates shall be used, unless otherwise approved by the Engineer.

Bermudagrass -----	20 pounds per acre
Bahiagrass -----	25 pounds per acre
Tall Fescue -----	15 pounds per acre
Crimson Clover -----	20 pounds per acre

It is the Contractor's responsibility to apply an ample amount of each type of seed to produce a satisfactory growth of grass and of the seed type required. At the completion of the project, a satisfactory growth of grass will be required. Reference Section 210 for satisfactory growth and coverage of dormant seed.

Seeding should not be done during windy weather or when the ground is frozen, extremely wet, or in a condition which will not allow the soil to be properly tilled.

**907-225.03.3.1--Conventional Application.** Legume seeds should be treated in accordance with Subsection 715.03.4 immediately before sowing. Seeds should be uniformly sown over the entire area with mechanical seeders. Seeds of different sizes may necessitate separate sowing. When legume seeds become dry, they should be re-inoculated.

All seeds should be covered lightly with soil by raking, rolling, or other approved methods, and the area compacted with a cultipacker.

Mulching should be performed as soon as practicable after seeding.

**907-225.03.3.2--Hydroseeding Application.** Seeds may be applied using the hydroseeding method except during the months of June, July, August, and September. During these months, the seeding shall be incorporated in accordance with the above Conventional Application method.

The seed(s) shall be combined into a distribution tank with all required ingredients on the project site. The application of the seed(s) and all ingredients shall be performed in one operation.

Mulching should be performed simultaneously with or as soon as practicable after seeding.

**907-225.03.3.3--Plant Establishment.** The Contractor should provide plant establishment on all areas seeded until release of maintenance. At the completion of the project, a satisfactory growth of grass will be required. The Contractor should reference Subsection 210 for satisfactory growth and coverage of dormant seed.

Plant establishment should be provided for a minimum period of 45 calendar days after completion of seeding. In the event satisfactory growth and coverage has not been attained by the end of the 45-day period, plant establishment should be continued until a satisfactory growth and coverage is provided for at least one kind of plant as referenced in Section 210. The Contractor shall perform plant establishment on all areas of temporary seeding until the Engineer determines that the temporary seeding has served its purpose.

Plant establishment shall consist of preserving, protecting, watering, reseeding, mowing, and other work necessary to keep the seeded areas in satisfactory condition.

Areas requiring reseeding should be prepared and seeded and all other work performed as if the reseeding was the initial seeding. The types and application rates of fertilizer will be at the discretion of the Contractor.

**907-225.03.3.4--Growth and Coverage.** It shall be the Contractor's responsibility to provide satisfactory growth and coverage of grasses, legumes, or combination produced from the specified seeding.

Growth and coverage on seeded areas will be considered to be in reasonably close conformity with the intent of the contract when the type of vegetation specified, exclusive of that from seeds not expected to have germinated and shows growth at that time, has reached a point of maturity where stems or runners overlap adjacent similar growth in each direction over the entire area.

**907-225.03.4--Mulching.** Mulching consists of furnishing, transporting, and placing mulch on slopes, shoulders, medians, and other designated areas. Unless otherwise noted in the contract or directed by the Engineer, the Contractor has the option to place mulch by the conventional method or by the hydraulic method.

**907-225.03.4.1--Vegetative Mulch.**

**907-225.03.4.1.1--Equipment.** Mulching equipment should be capable of maintaining a constant air stream which will blow or eject controlled quantities of mulch in a uniform pattern.

Mulch stabilizers should consist of dull blades or disks without camber and approximately 20 inches in diameter. The disks should be notched, should be spaced at approximately 8-inch intervals, and should be equipped with scrapers. The stabilizer should weigh approximately 1000 to 1200 pounds, should have a working width of no more than eight feet, and should be equipped with a ballast compartment, so that weight can be increased.

**907-225.03.4.1.2--Placement of Vegetative Mulch.** Mulching should be placed uniformly on designated areas within 24 hours following seeding unless weather conditions are such that

mulching cannot be performed. Placement should begin on the windward side of areas and from tops of slopes. In its final position, the mulch should be loose enough to allow air to circulate but compact enough to partially shade the ground and reduce erosion.

The baled material should be loosened and broken thoroughly before it is fed into the machine to avoid placement of unbroken clumps.

**907-225.03.4.1.3--Anchoring Mulch.** The mulch should be anchored by using a mulch stabilizer when not hydraulically applied. If a mulch stabilizer is used, the mulch should be punched into the soil for a minimum depth of one inch.

When mulch stabilizers are used, anchoring the mulch should be performed along the contour of the ground surface.

**907-225.03.4.2--Hydromulch.** Hydromulch shall be applied in accordance with the installation instructions and recommendations of the manufacturer. Hydromulch shall be uniformly applied at the manufacturer's recommended application rate. In no case shall the application rate be less than one (1) ton per acre.

**907-225.03.4.3--Protection and Maintenance.** The Contractor should maintain and protect mulched areas until the Release of Maintenance of the project. The Contractor should take every precaution to prevent unnecessary foot and vehicular traffic.

The Contractor should mow, remove or destroy any undesirable growth on all areas mulched as soon as any undesirable growth appears. This will prevent competition with the desired plants and to prevent reseeding of undesirable growth.

**907-225.03.5--Hydro Equipment.** The equipment for hydraulically applying seed and mulch shall have a built-in agitation system with an operating capacity sufficient to agitate, suspend, and homogeneously mix slurry of the specified amount of fiber, seed, and water. The slurry distribution lines shall be large enough to prevent stoppage. The discharge line shall be equipped with a set of hydraulic spray nozzles, which will provide even distribution of the slurry on the various areas to be seeded.

The mixture shall all be combined into the slurry tank for distribution of all ingredients in one operation as specified herein. The materials shall be combined in a manner recommended by the manufacturer. The slurry mixture shall be so regulated that the amounts and rates of application shall result in a uniform application of all materials at rates not less than the amounts specified. Using the color of the mulch as a guide, the equipment operator shall spray the prepared seedbed with a uniform visible coat. The slurry shall be applied in a sweeping motion, in an arched stream, so as to fall like rain, allowing the mulch to build upon each other until an even coat is achieved.

**907-225.04--Method of Measurement.** Grassing will be measured by the acre. Acceptance will be based on a satisfactory growth and coverage of seeds planted.

Acceptable quantities of agricultural limestone will be measured by the ton.

Acceptable quantities for mulch will be measured by the ton. For vegetative mulch, the weight for measurement will be the product of the number of bales acceptably placed and the average weight per bale as determined on approved scales provided by the Contractor. Anchoring of vegetative mulch will not be measured for separate payment. The cost of anchoring shall be absorbed in the prices bid for other items of work. For hydromulch, the weight for measurement will be the dry weight of the packaged fibers used in the mixture. No payment will be allowed for water, additives, tackifier, or other liquids used in the mixture.

**907-225.05--Basis of Payment.** Grassing, measured as prescribed above, will be paid for at the contract unit price per acre, which will be full compensation for all required materials, equipment, labor, testing and all work necessary to establish a satisfactory growth of grass.

Hard rock agricultural limestone will be paid for at the contract unit price per ton. Hard rock agricultural limestone with a relative neutralizing value (RNV), determined in accordance with Subsection 907-715-02.2.1.3, of between 60.0% and 62.9% will be paid for at half (1/2) the contract unit price per ton. No payment will be made for hard rock agricultural limestone with an RNV less than 60.0%.

Mulch, measured as prescribed above, will be paid for at the contract unit price per ton, which price shall be full compensation for all materials, equipment, labor, and incidentals necessary to complete the work.

Payment will be made under:

907-225-A:	Grassing	- per acre
907-225-B:	Agricultural Limestone	- per ton
907-225-C:	Mulch, Vegetative Mulch	- per ton
907-225-D:	Mulch, Hydromulch	- per ton

## MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-226-2

CODE: (IS)

DATE: 05/13/2011

SUBJECT: Temporary Grassing

Section 907-226, Temporary Grassing, is hereby added to and made part of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction as follows:

### SECTION 907-226 -- TEMPORARY GRASSING

**907-226.01--Description.** This work consists of furnishing, transporting, placing, plant establishment and all work necessary to produce rapid-growing grasses, grains or legumes to provide an initial, temporary cover of grass. This work includes ground preparation, fertilizing, seeding and mulching necessary to establish a satisfactory growth of temporary grass. The Contractor may elect to place temporary grassing using the hydroseeding method as set out in Special Provision No. 907-227, as modified by this special provision.

The Engineer or the plans will designate areas to be temporarily grassed. Any other areas the Contractor desires to grass will be measured for payment only if agreed upon by the Engineer.

### **907-226.02--Materials.**

**907-226.02.1--Fertilizers.** Fertilizers for purposes of these specifications shall be understood to include standard manufactured products consisting of a combination of ingredients.

All fertilizer shall comply with the State fertilizer laws and Subsection 715.02.

Agricultural limestone will not be requirement for temporary grassing.

**907-226.02.2--Seeds.** Seeds shall meet the requirements of Subsection 715.03, subject to the provisions of this subsection. The Contractor shall acquire seed from persons registered with the Mississippi Department of Agriculture and Commerce.

Except for the germination requirements, bags of seeds properly labeled or tagged according to law and indicating characteristics meeting or exceeding the requirements of Subsection 715.03 will be acceptable for planting.

The Contractor should provide adequate dry storage facilities for seeds, and shall furnish access to the storage for sampling stored seed.

**907-226.02.3--Mulching.** The vegetative materials for mulch shall meet the requirements of Subsection 715.05.

When used, bituminous material for mulch shall be Emulsified Asphalt, Grade SS-1, meeting the requirement of Subsection 702.07.

**907-226.03--Construction Requirements.** The rates of application shall not exceed the rates shown on the temporary vegetation schedule, unless otherwise approved by the Engineer. Any unauthorized overage due to increased application rates will not be measured for payment.

**907-226.03.1--Ground Preparation.** Any equipment used for ground preparation shall be approved units suitable to perform the work and subject to the requirements of Subsection 108.05.

Light ground preparation should be used on areas where seeding is required.

Light ground preparation consists of scratching the surface with a close-tooth harrow, disk-harrow, or similar equipment. The depth of scratching should be at least three-quarters inch but not deep enough to damage existing grasses of the type being planted.

Aerating, moistening, or otherwise bringing the soil to a suitable condition for ground preparation shall be considered as incidental to the work and will not be measured for separate payment.

**907-226.03.2--Fertilizing.** The Contractor shall furnish all equipment necessary to properly handle, store, uniformly spread, and incorporate the specified application of fertilizer.

The Contractor shall incorporate fertilizer at a rate of 500 pounds per acre of 13-13-13 commercial fertilizer. The equivalent rate of other type fertilizers will be allowed if the equivalent percentages of Nitrogen, Phosphorus and Potassium are obtained. Fertilization shall be applied uniformly on the areas to be seeded and uniformly incorporated into the soil.

Fertilizer should be applied on individual areas of not more than three acres.

All fertilizer should be incorporated within 24 hours following spreading.

**907-226.03.3--Seeding.**

**907-226.03.3.1--General.** Prior to planting the seeds, ground preparation and fertilizing should have been satisfactorily performed.

The required type of seeds, recommended rates of application and recommended planting dates of seeds are shown in the vegetation schedule in the plans.

When a temporary vegetation schedule is not shown in the plans, the following types of seed and application rates should be used.



Spring & Summer

Browntop Millet ----- 20 pounds per acre - April 1 to August 31

Fall & Winter

Rye Grass ----- 25 pounds per acre - September 1 to March 31

Oats ----- 90 pounds per acre - September 1 to December 15

It is the Contractor's responsibility to apply an ample amount of each type of seed to produce a satisfactory growth of grass and of the seed type required.

Legume seeds should be treated in accordance with Subsection 715.03.4 immediately before sowing. Seeds should be uniformly sown over the entire area with mechanical seeders. Seeds of different sizes may necessitate separate sowing. When legume seeds become dry, they should be reinoculated.

Seeding should not be done during windy weather or when the ground is frozen, extremely wet, or in an untillable condition.

All seeds should be covered lightly with soil by raking, rolling, or other approved methods, and the area compacted with a cultipacker.

**907-226.03.3.2--Plant Establishment.** Plant establishment shall consist of preserving, protecting, watering, reseeding, and other work necessary to keep the seeded areas in satisfactory condition.

Areas requiring reseeding should be prepared and seeded and all other work performed as if the reseeding was the initial seeding. The types and application rates of fertilizer will be at the discretion of the Contractor. **No additional measurement and payment will be made for re-seeding when payment was made for the initial seeding.**

**907-226.03.3.3--Growth and Coverage.** It shall be the Contractor's responsibility to provide satisfactory growth and coverage of grasses, legumes, or combination produced from the specified seeding.

Growth and coverage on seeded areas will be considered to be in reasonably close conformity with the intent of the contract when the type of vegetation specified, exclusive of that from seeds not expected to have germinated and shows growth at that time, has reached a point of maturity where stems or runners overlap adjacent similar growth in each direction over the entire area.

**907-226.03.4--Mulching.**

**907-226.03.4.1--Equipment.** Mulching equipment should be capable of maintaining a constant air stream which will blow or eject controlled quantities of mulch in a uniform pattern. If asphalt is used, a jet or spray nozzle for applying uniform, controlled amounts of asphalt to the vegetative material as it is ejected should be located at or near the discharge spout.

Mulch stabilizers should consist of dull blades or disks without camber and approximately 20 inches in diameter. The disks should be notched, should be spaced at approximately 8-inch intervals, and should be equipped with scrapers. The stabilizer should weigh approximately 1000 to 1200 pounds, should have a working width of no more than eight feet, and should be equipped with a ballast compartment, so that weight can be increased.

**907-226.03.4.2--Placement of Vegetative Mulch.** If required, mulching should be placed uniformly on designated areas within 24 hours following seeding unless weather conditions are such that mulching cannot be performed. Placement should begin on the windward side of areas and from tops of slopes. In its final position, the mulch should be loose enough to allow air to circulate but compact enough to partially shade the ground and reduce erosion.

The baled material should be loosened and broken thoroughly before it is fed into the machine to avoid placement of unbroken clumps.

**907-226.03.4.3--Rates of Application and Anchoring Mulch.** The recommended rate of application of vegetative mulch shall be as shown in the vegetation schedule in the plans. The mulch should be anchored by either the use of a mulch stabilizer or by tacking with bituminous material. If a mulch stabilizer is used, the mulch should be punched into the soil for a minimum depth of one inch. If bituminous material is used, the rate of application should be 150 gallons per acre.

Where steep slopes or other conditions are such that anchoring cannot be performed satisfactory with a mulch stabilizer, the Contractor may elect to use bituminous material applied at the time or immediately following the mulch placement.

When mulch stabilizers are used, anchoring the mulch should be performed along the contour of the ground surface.

**907-226.03.4.4--Protection and Maintenance.** The Contractor should take every precaution to prevent unnecessary foot and vehicular traffic.

**907-226.04--Method of Measurement.** Temporary grassing will be measured by the acre. Acceptance will be based on a satisfactory growth and coverage of seeds planted.

**907-226.05--Basis of Payment.** Temporary grassing, measured as prescribed above, will be paid for at the contract unit price per acre, which will be full compensation for all required materials, equipment, labor, testing and all work necessary to establish a satisfactory growth of grass.

Payment will be made under:

907-226-A: Temporary Grassing - per acre

## MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-227-10

CODE: (IS)

DATE: 01/25/2012

SUBJECT: Hydroseeding

Section 907-227, Hydroseeding, is hereby added to and made part of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction as follows:

### **SECTION 907-227--HYDROSEEDING**

**907-227.01--Description.** This work consists of furnishing, transporting, placing, plant establishment and all work necessary to produce a satisfactory and acceptable growth of grass. The seeds, fertilizers, tackifier, and mulch shall be incorporated using the hydroseeding process. These items shall be combined into a mixture and force-applied to the areas to be grassed.

**907-227.02--Materials.** The Contractor shall, prior to application, furnish the Engineer with invoices of all materials used in the grassing operation.

**907-227.02.1--Fertilizers.** Fertilizers for purposes of these specifications shall be understood to include standard manufactured products consisting of single or combination ingredients.

All fertilizers shall comply with the State fertilizer laws and Subsection 715.02.

**907-227.02.2--Seeds.** Seeds shall meet the requirements of Subsection 715.03, subject to the provisions of this subsection. The Contractor shall acquire seed from persons registered with the Mississippi Department of Agriculture and Commerce.

Except for the germination requirements, bags of seeds properly labeled or tagged according to law and indicating characteristics meeting or exceeding the requirements of Subsection 715.03 will be acceptable for planting.

The Contractor should provide adequate dry storage facilities for seeds, and shall furnish access to the storage for sampling stored seed.

**907-227.02.3--Mulching.** The rate of application of fiber mulch shall be as recommended by the manufacture of the fibers mulch.

**907-227.02.3.1--Wood Fiber Mulch.** Wood fiber mulch shall be made from wood chip particles manufactured particularly for discharging uniformly on the ground surface when dispersed by a hydraulic water sprayer. It shall remain in uniform suspension in water under agitation and blend with grass seed and fertilizer to form a homogeneous slurry. The fibers shall intertwine physically to form a strong moisture-holding mat on the ground surface and allow rainfall to percolate the underlying soil. The fiber material shall be heat processed so as to

contain no germination or growth-inhibiting factors. The mulch shall be dyed an appropriate color to facilitate the application of material using non-toxic dye.

**907-227.02.3.2--Cellulose Fiber Mulch.** Cellulose fiber mulch consist of recycled paper stock products which are shredded into small pieces particular for application by hydraulic seeding equipment. It shall mix readily and uniformly under agitation with water and blend with grass seed and fertilizer to form a homogeneous slurry. When applied to the ground surface, the material shall form a strong moisture-holding mat, allow rainfall to percolate the underlying soil, and remain in place until the grass root system is established. The material shall contain no growth inhibiting characteristic or organisms. The mulch shall be dyed an appropriate color to facilitate the application of material using non-toxic dye.

**907-227.02.3.3--Wood/Cellulose Fiber Mulch.** Wood/cellulose fiber mix hydroseeding mulch shall consist of a combination of the above wood and cellulose fibers at a ratio recommended by the manufacturer of the products.

**907-227.02.3.4--Straw Mulch.** Straw mulch shall consist of a natural straw fiber. This material shall be a minimum 90% straw and essentially free from plastic materials or other non-bio degradable substances. The material shall be disperse into a uniform mulch slurry when mixed with water.

**907-227.02.3.5--Tackifier.** The tackifier will serve the purpose of an adhesive to form a bond between the soil, fiber, and seed particles. It will also allow the soil to retain moisture.

The tackifier shall be of the organic or synthetic variety.

### **907-227.03--Construction Requirements.**

**907-227.03.1--Ground Preparation.** Light ground preparation consists of plowing, loosening, and pulverizing the soil to form suitable beds for seeding items in reasonably close conformity with the established lines and grades without appreciable humps or depressions. Unless otherwise specified, the pulverized and prepared seedbed should be at least four inches deep and shall be reasonably free of large clods, earth balls, boulders, stumps, roots and other objectionable matter. The Engineer may eliminate or alter the requirements for ground preparation due to site conditions.

**907-227.03.2--Fertilizing.** The Contractor shall furnish all equipment necessary to properly handle, store, uniformly spread, and incorporate the specified application of fertilizer.

The Contractor shall incorporate bag fertilizer at a rate of 1000 pounds per acre of 13-13-13 commercial fertilizer. The equivalent rate of other type fertilizers will be allowed if the equivalent percentages of Nitrogen, Phosphorus and Potassium are obtained. Any changes in the type or rate of application of the fertilizers shall be approved by the Engineer prior to being incorporated.

Agricultural limestone will be incorporated into the area and paid for in accordance with Section 213 of the Standard Specifications.

**907-227.03.3--Seeding.**

**907-227.03.3.1--General.** The Contractor shall use the vegetation schedule in the plan for the correct types of seed and application rates, unless otherwise noted or approved by the Engineer.

When a vegetation schedule for permanent grass is not shown in the plans, the following types of seed and application rates shall be used, unless otherwise approved by the Engineer.

Bermudagrass -----	20 pounds per acre
Bahiagrass -----	25 pounds per acre
Tall Fescue -----	15 pounds per acre
Crimson Clover -----	20 pounds per acre

At the completion of the project, a satisfactory growth of grass will be required. The Contractor should reference Subsection 210 for satisfactory growth and coverage of dormant seed.

**907-227.03.3.2--Plant Establishment.** The Contractor should provide plant establishment on all areas seeded until release of maintenance. Plant establishment shall consist of preserving, protecting, watering, reseeding, mowing, and other work necessary to keep the seeded areas in satisfactory condition.

Plant establishment should be provided for a minimum period of 45 calendar days after completion of seeding. In the event satisfactory growth and coverage has not been attained by the end of the 45-day period, plant establishment should be continued until a satisfactory growth and coverage is provided for at least one kind of plant. The Contractor should reference Section 210 of the Standard Specifications for more information.

**907-227.03.3.3--Growth and Coverage.** It shall be the Contractor's responsibility to provide satisfactory growth and coverage of grasses, legumes, or combination produced from the specified seeding.

Growth and coverage on seeded areas will be considered to be in reasonably close conformity with the intent of the contract when the type of vegetation specified, exclusive of that from seeds not expected to have germinated and shows growth at that time, has reached a point of maturity where stems or runners overlap adjacent similar growth in each direction over the entire area.

Final acceptance of the project will not be made until a satisfactory growth of grass has been acknowledged by the Engineer.

**907-227.03.4--Mulching.** At the Contractor's option, mulch may be wood fiber, cellulose fiber, a mixture of wood and cellulose fibers, or straw fiber. The mulch shall be applied at the rate recommended by the manufacturer in a mixture of water, seed and fertilizer. Any changes in the rate of application of the mulch shall be approved by the Engineer prior to its use.

**907-227.03.5--Equipment.** Hydraulic equipment shall be used for the application of fertilizers, seeds and slurry of the prepared mulch. This equipment shall have a built-in agitation system with an operating capacity sufficient to agitate, suspend, and homogeneously mix slurry of the specified amount of fiber, fertilizer, seed and water. The slurry distribution lines shall be large enough to prevent stoppage. The discharge line shall be equipped with a set of hydraulic spray nozzles, which will provide even distribution of the slurry on the various areas to be seeded.

The seed, fertilizer, mulch and water shall all be combined into the slurry tank for distribution of all ingredients in one operation as specified herein. The materials shall be combined in a manner recommended by the manufacturer. The slurry mixture shall be so regulated that the amounts and rates of application shall result in a uniform application of all materials at rates not less than the amounts specified. Using the color of the mulch as a guide, the equipment operator shall spray the prepared seedbed with a uniform visible coat. The slurry shall be applied in a sweeping motion, in an arched stream, so as to fall like rain, allowing the mulch to build upon each other until an even coat is achieved.

**907-227.03.6--Protection and Maintenance.** The Contractor should maintain and protect seeded areas until release of maintenance of the project. The Contractor should take every precaution to prevent unnecessary foot and vehicular traffic.

The Contractor should mow or otherwise remove or destroy any undesirable growth on all areas mulched to prevent competition with the desired plants and to prevent reseeding of undesirable growth.

**907-227.04--Method of Measurement.** Hydroseeding, complete and accepted, will be measured by the acre. No separate payment will be made for ground preparation, seeds, fertilizers, or mulch. Acceptance will be based on a satisfactory growth and coverage of seeds planted.

Agricultural limestone shall be measured and paid for under Section 213 of the Standard Specifications.

**907-227.05--Basis of Payment.** Hydroseeding, measured as prescribed above, will be paid for at the contract unit price per acre, which will be full compensation for all required materials, equipment, labor, testing and all work necessary to establish a satisfactory growth of grass.

Payment will be made under:

907-227-A: Hydroseeding - per acre

## MISSISSIPPI DEPARTMENT OF TRANSPORTATION

| SPECIAL PROVISION NO. 907-237-4

CODE: (SP)

| DATE: 03/13/2012

SUBJECT: Wattles

Section 907-237, Wattles, is hereby added to and made a part of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction as follows.

### SECTION 907-237 - WATTLES

**907-237.01--Description.** This work consists of furnishing, constructing and maintaining wattles for the retention of soil around inlets, swale areas, small ditches, sediment basins and other areas as necessary. Also, the work includes removing and disposing of the wattles and silt accumulations.

Measurement and payment for wattles will be made only when a pay item is included in the bid schedule of the proposal. The quantity is estimated for bidding purposes only and will be dependent upon actual conditions which occur during construction of the project.

| **907-237.02--Materials.** Wattles used around inlets shall have a diameter of twelve inches (12") and a length adequate to meet field conditions. Wattles used at other locations shall have a diameter of twenty inches (20") and a length adequate to meet field conditions. **The minimum diameter for the above wattle sizes shall be one inch (1") less than the specified diameter.**

The stakes used in securing the wattles in place shall be placed approximately three feet (3') apart throughout the length of the wattle. Stakes shall be wooden and of adequate size to stabilize the wattles to the satisfaction of the Engineer.

In addition to the requirements of this specifications, wattles shall be listed on the Department's "Approved Sources of Materials".

### **907-237.03--Construction Requirements.**

**907-237.03.1--General.** The wattles shall be constructed at the locations and according to the requirements shown on the erosion control plan.

**907-237.03.2--Maintenance and Removal.** The Contractor shall maintain the wattles and remove and dispose of silt accumulations.

When the wattles are no longer needed, they shall be removed and the Contractor shall dispose of silt accumulations and treat the disturbed areas in accordance with the contract requirements.

**907-237.04--Method of Measurement.** Wattles of the size specified will be measured per linear foot.

**907-237.05--Basis of Payment.** Wattles, measured as prescribed above, will be paid for at the contract unit price per linear foot, which price shall be full compensation for installation, maintaining and removal of the wattles, the removal and disposal of silt accumulations and any required restoration of the disturbed areas.

Payment will be made under:

907-237-A: Wattles, Size - per linear foot



**MISSISSIPPI DEPARTMENT OF TRANSPORTATION**

**SPECIAL PROVISION NO. 907-242-33**

**CODE: (SP)**

**DATE: 02/04/2014**

**SUBJECT: Site Improvement**

**PROJECT: BWO-5123-35(001) / 502587301,  
BWO-5214-35(001) / 502587302,  
BWO-5067-35(003) / 502587303,  
BWO-5221-35(001) / 502587304, &  
LWO-5035-35(002) / 502587305 -- Kemper County**

Section 907-242, Site Improvements, is hereby added to and made part of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction as follows:

**SECTION 907-242-- SITE IMPROVEMENTS**

The following specification is to be used **ONLY** for the Construction of the Site Improvements at MDOT Maintenance Area Headquarters and Support Buildings at DeKalb. Measurement and payments will be made under pay item 907-242.

The 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction shall be used for all other items of work in the contract.

SECTION 00 01 10 TABLE OF CONTENTS

PROJECT: MAINTENANCE AREA HEADQUARTERS AND SUPPORT BUILDINGS AT DEKALB, KEMPER COUNTY, MISSISSIPPI

PROJECT NUMBERS: BWO-5213-35(001) 502587  
 BWO-5214-35(001) 502587  
 BWO-5067-35(003) 502587  
 BWO-5221-35(001) 502587  
 LWO-5035-35(002) 502587

DATE: 1-27-14

DESCRIPTION "A": This Work shall consist of minor site work and all construction work necessary in constructing a Maintenance Area Headquarters for District Five at DeKalb, Kemper County, Mississippi, Project No. BWO-5213-35(001) 502587, in accordance with these Specifications and conforming to the Drawings.

DESCRIPTION "B": This Work shall consist of minor site work and all construction work necessary in constructing an Equipment Shed with Enclosed Bay for District Five at DeKalb, Kemper County, Mississippi, Project No. BWO-5214-35(001) 502587 in accordance with these Specifications and conforming to the Drawings.

DESCRIPTION "C": This Work shall consist of minor site work and all construction work necessary to relocate an Existing Equipment Shed for District Five at DeKalb, Kemper County, Mississippi, Project No. BWO-5067-35(003) 502587 in accordance with these Specifications and conforming to the Drawings.

DESCRIPTION "D": This Work shall consist of minor site work and all construction work necessary in constructing a Storage Bins (Covered) for District Five at DeKalb, Kemper County, Mississippi, Project No. BWO-5221-35(001) 502587 in accordance with these Specifications and conforming to the Drawings.

Site Improvements at MDOT Maintenance Area Headquarters and Support Buildings at DeKalb, Kemper County, Mississippi are under Project No. LWO-5035-35(002) 502587 and shall be in accordance with the Pay Items / Special Provisions listed on Summary of Quantity sheets and conforming to the related Drawings.

It is the intention of these Specifications to provide the necessary items and instruction for complete buildings including all code compliance. Omission of items or instruction necessary or considered standard good practice for the proper installation and construction of the buildings shall not relieve the Contractor of furnishing and installing such items and conforming to the building codes having jurisdiction.

SECTION NUMBER	SECTION TITLE	NO. OF PAGES
	<b>DIVISION 00 PROCUREMENT AND CONTRACTING REQUIREMENTS</b>	

<b>INTRODUCTORY INFORMATION</b>		
00 01 10	TABLE OF CONTENTS	6
00 01 15	LIST OF DRAWING SHEETS	3
<b>BIDDING REQUIREMENTS</b>		
00 21 13	INSTRUCTION TO BIDDERS	6
00 22 13	SUPPLEMENTARY INSTRUCTIONS TO BIDDERS	2
<b>CONTRACTING REQUIREMENTS</b>		
00 72 00	GENERAL CONDITIONS	1
	AIA DOCUMENT A201™ - 2007 AMENDED	42
00 91 13	ADDENDA	1
<b>DIVISION 01 – GENERAL REQUIREMENTS</b>		
01 10 00	SUMMARY	6
01 25 00	SUBSTITUTION PROCEDURES	5
01 26 00	CONTRACT MODIFICATION PROCEDURES	2
01 29 00	PAYMENT PROCEDURES	4
01 31 00	PROJECT MANAGEMENT AND COORDINATION	9
01 32 00	CONSTRUCTION PROGRESS DOCUMENTATION	3
01 32 33	PHOTOGRAPHIC DOCUMENTATION	2
01 33 00	SUBMITTAL PROCEDURES	11
01 40 00	QUALITY REQUIREMENTS	9
01 42 00	REFERENCES	13
01 45 23	TESTING AND INSPECTION SERVICES - CONTRACTOR	3
01 45 29	TESTING LABORATORY SERVICES - MDOT	2
01 50 00	TEMPORARY FACILITIES AND CONTROLS	8
01 60 00	PRODUCT REQUIREMENTS	5
01 73 00	EXECUTION	8
01 74 19	CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL	3
01 77 00	CLOSEOUT PROCEDURES	5
01 78 23	OPERATION AND MAINTENANCE DATA	7
01 78 39	PROJECT RECORD DOCUMENTS	3
01 79 00	DEMONSTRATION AND TRAINING	4
<b>DIVISION 02 - EXISTING CONDITIONS (Not Used)</b>		
<b>DIVISION 03 - CONCRETE</b>		
03 10 00	CONCRETE FORMING AND ACCESSORIES	2
03 20 00	CONCRETE REINFORCING	3
03 30 00	CAST-IN-PLACE CONCRETE	6

	<b>DIVISION 04 - MASONRY</b>	
04 20 00	UNITS MASONRY	11
	<b>DIVISION 05 - METALS</b>	
05 12 00	STRUCTURAL STEEL FRAMING	6
05 50 00	METAL FABRICATIONS	6
	<b>DIVISION 06 – WOOD AND PLASTIC</b>	
06 10 00	ROUGH CARPENTRY	8
06 17 33	WOOD I-JOISTS	3
06 40 00	ARCHITECTURAL WOODWORK	6
	<b>DIVISION 07 - THERMAL AND MOISTURE PROTECTION</b>	
07 21 28	CELLULOSE SPRAY-ON INSULATION	3
07 26 00	VAPOR RETARDERS	3
07 27 26	FLUID-APPLIED MEMBRANE AIR BARRIERS	8
07 65 26	SELF ADHERING SHEET FLASHING	3
07 84 00	FIRESTOPPING	6
07 92 00	JOINT SEALANTS	7
	<b>DIVISION 08 – OPENINGS</b>	
08 11 13	HOLLOW METAL DOORS AND FRAMES	11
08 14 29	PREFINISHED WOOD DOORS	5
08 31 13	ACCESS DOORS AND FRAMES	4
08 33 23	OVERHEAD COILING DOORS	5
08 51 14	ALUMINUM WINDOWS-HOPPER	6
08 71 00	DOOR HARDWARE	9
08 80 00	GLAZING	7
08 91 19	FIXED LOUVERS	5
	<b>DIVISION 09 - FINISHES</b>	
09 05 15	COLOR DESIGN	3
09 29 00	GYPSUM BOARD	5
09 31 13	THIN-SET CERAMIC TILING	5
09 65 00	RESILIENT FLOORING	5
09 90 00	PAINTING AND COATING	16

	<b>DIVISION 10 - SPECIALTIES</b>	
10 11 00	VISUAL DISPLAY SURFACES	3
10 14 00	SIGNAGE	6
10 21 15	SOLID PLASTIC TOILET COMPARTMENTS	4
10 28 13	TOILET ACCESSORIES	3
10 43 15	DEFIBRILLATORS AND CABINETS	2
10 44 16	FIRE EXTINGUISHERS	2
10 51 13	METAL LOCKERS	3
10 56 13	METAL STORAGE SHELVING	2
10 57 13	HAT AND COAT RACKS	2
10 73 16	CANOPIES	3
10 75 00	FLAGPOLES	3
	<b>DIVISION 11 - EQUIPMENT</b>	
11 31 15	RESIDENTIAL APPLIANCES & EQUIPMENT	3
	<b>DIVISION 12 - FURNISHINGS</b>	
12 21 14	HORIZONTAL LOUVER BLINDS-METAL	3
12 48 43	FLOOR MATS	2
	<b>DIVISION 13 - SPECIAL CONSTRUCTION</b>	
13 34 18	METAL BUILDING SHED	13
13 34 19	METAL BUILDING SYSTEMS	14
	<b>DIVISION 14 - CONVEYING SYSTEMS</b>	
14 45 00	VEHICLE LIFTS	4
	<b>DIVISIONS 15 – 21 (NOT USED)</b>	
	<b>DIVISION 22 – PLUMBING</b>	
22 05 18	ESCUTCHEONS FOR PLUMBING PIPING	2
22 05 23	GENERAL-DUTY VALVES FOR PLUMBING PIPING	6
22 05 29	HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT	8
22 05 53	IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT	4
22 07 19	PLUMBING PIPING INSULATION	20
22 11 16	DOMESTIC WATER AND COMPRESSED AIR PIPING	9

22 11 19	DOMESTIC WATER PIPING SPECIALTIES	5
22 13 16	SANITARY WASTE AND VENT PIPING	8
22 13 19	SANITARY WASTE PIPING SPECIALTIES	7
22 33 00	ELECTRIC, DOMESTIC-WATER HEATERS	5
	<b>DIVISION 23 HEATING, VENTILATING, AND AIR-CONDITIONING</b>	
23 05 13	COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT	3
23 05 17	SLEEVES FOR HVAC PIPING	2
23 05 18	ESCUTCHEONS FOR HVAC PIPING	2
23 05 29	HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT	9
23 05 48	VIBRATION AND CONTROLS FOR HVAC PIPING & EQUIPMENT	4
23 05 53	IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT	5
23 05 93	TESTING, ADJUSTING AND BALANCING FOR HVAC	12
23 07 13	DUCT INSULATION	15
23 07 19	HVAC PIPING INSULATION	16
23 11 23	FACILITY NATURAL-GAS PIPING	18
23 23 00	REFRIGERANT PIPING	7
23 31 13	METAL DUCTS	11
23 33 00	AIR DUCT ACCESSORIES	7
23 34 23	HVAC POWER VENTILATORS	6
23 37 13	DIFFUSERS, REGISTERS, AND GRILLES	5
23 51 00	BREECHINGS, CHIMNEYS, AND STACKS	3
23 54 00	FURNACES, CONDENSING UNITS, ACCESSORIES	7
23 55 23	LOW-INTENSITY, GAS-FIRED, RADIANT HEATERS	5
	<b>DIVISIONS 24 – 25 (NOT USED)</b>	
	<b>DIVISION 26 - ELECTRICAL</b>	
26 05 00	COMMON WORK RESULTS FOR ELECTRICAL	9
26 05 19	LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES	4
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	9
26 05 43	UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS	5
26 05 44	SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING	4
26 05 53	IDENTIFICATION FOR ELECTRICAL SYSTEMS	6
26 27 26	WIRING DEVICES	5
26 28 16	ENCLOSED SWITCHES AND CIRCUIT BREAKERS	4
26 32 13	ENGINE GENERATORS	13
26 36 00	TRANSFER SWITCHES	7

26 51 00	INTERIOR LIGHTING	6
	<b>DIVISION 27 COMMUNICATIONS (Not Used)</b>	
	<b>DIVISION 28 ELECTRONIC SAFETY AND SECURITY</b>	
28 05 13	CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY	6
28 05 28	PATHWAYS FOR ELECTRONIC SAFETY AND SECURITY	6
28 05 44	SLEEVES AND SLEEVE SEALS FOR ELECTRONIC SAFETY AND SECURITY PATHWAYS AND CABLING	2
28 23 00	SECURITY CCTV VIDEO SURVEILLANCE	15
28 31 11	DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM	12
	<b>DIVISIONS 29 – 30 (NOT USED)</b>	
	<b>DIVISION 31 EARTHWORK</b>	
31 23 11	EXCAVATION, FILL AND GRADING FOR BUILDINGS	8
31 31 16	TERMITE CONTROL	4
	<b>DIVISIONS 32-49 (Not Used)</b>	

(REVISIONS TO THE ABOVE WILL BE INDICATED ON THE SECOND SHEET OF SECTION 905 AS ADDENDA)

END OF TABLE OF CONTENTS

## SECTION 00 01 15 LIST OF DRAWING SHEETS

## PART 1 - GENERAL

## 1.01 LIST OF DRAWINGS

- A. List of Drawings: Drawings consist of the following Contract Drawings and other drawings of type indicated:

<b>WORKING NUMBER</b>	<b>SHEET NUMBER</b>	<b>DESCRIPTION</b>
----	1	TITLE SHEET
DI-1	2	DETAILED INDEX
GN-1	3	GENERAL NOTES
SQ-1	4	SUMMARY OF QUANTITIES
SQ-2	5	SUMMARY OF QUANTITIES
SQ-3	6	SUMMARY OF QUANTITIES
C-1	7	SITE PLAN
C-2	8	GRADING AND PAVING SOUTH PLAN
C-2A	9	DETAILED SOUTH GRADING PLAN
C-3	10	GRADING AND PAVING NORTH PLAN
C-4	11	UTILITIES PLAN
C-4A	12	TEMP MDOT OFFICE LOCATION
C-5	13	TYPICAL SECTIONS
C-6	14	PAVEMENT MARKING AND SIGNING DETAILS
C-7	15	CONCRETE DETAILS
C-8	16	WATER AND SEWER DETAILS
VS-1	17	VEGETATION SCHEDULE
A1.1	18	ABBREVIATIONS, SYMBOLS AND CODE DATA
A1.2	19	MAINTENANCE AREA HEADQUARTERS FLOOR PLAN
A1.3	20	MEZZANINE FRAMING PLAN AND FLOOR FINISH PLAN
A2.1	21	BUILDING ELEVATIONS, SOUTH AND EAST
A2.2	22	BUILDING ELEVATIONS, NORTH AND WEST
A2.3	23	ROOM ELEVATIONS
A2.4	24	ROOM ELEVATIONS
A3.1	25	BUILDING SECTIONS AND DETAILS
A4.1	26	SECTIONS AND DETAILS
A5.1	27	DOOR FRAME DETAILS
A5.2	28	WINDOW AND LOUVER DETAILS
A6.1	29	FINISH, DOOR AND LOUVER SCHEDULES
S1.1	30	FOUNDATION PLAN AND
S5.1	31	FOUNDATION DETAILS



ES1.1	32	EQUIPMENT SHED PLAN AND ELEVATIONS
ES1.2	33	EQUIPMENT SHED ENCLOSED BAY DETAILS
ES1.3	34	EQUIPMENT SHED SECTIONS AND DETAILS
ES1.4	35	EQUIPMENT SHED DETAILS
SB1.1	36	STORAGE BINS (COVERED)
SB1.2	37	STORAGE BINS, DETAILS AND ROOF FRAMING
P1.0	38	PLUMBING SCHEDULES, LEGEND AND GENERAL NOTES
P2.1	39	MAINTENANCE BUILDING FLOOR PLAN – PLUMBING
P2.2	40	MAINTENANCE BUILDING, MEZZANINE PLAN – PLUMBING
P3.1	41	EQUIPMENT SHED PLAN – PLUMBING
P5.1	42	PLUMBING DETAILS
M0.1	43	HVAC LEGEND, ABBREVIATIONS, AND GENERAL NOTES
M2.1	44	FLOOR PLAN – HVAC
M2.2	45	MAINTENANCE BUILDING, MEZZANINE PLAN – PLUMBING
M3.1	46	EQUIPMENT SHED PLAN – PLUMBING
M5.1	47	MECHANICAL DETAILS
M6.1	48	MECHANICAL SCHEDULES
E0.1	49	ELECTRICAL SYMBOLS, LEGEND, GENERAL NOTES AND SCHEDULES
E1.1	50	SITE PLAN – ELECTRICAL
E2.1	51	MAINTENANCE BUILDING FLOOR PLAN – LIGHTING
E2.2	52	MAINTENANCE BUILDING, MEZZANINE FLOOR PLAN – ELECTRICAL
E2.3	53	MAINTENANCE BUILDING FLOOR PLAN – POWER
E2.4	54	MAINTENANCE BUILDING FLOOR PLAN – SYSTEMS
E3.1	55	EQUIPMENT SHED PLAN – LIGHTING
E3.2	56	EQUIPMENT SHED PLAN – POWER
E5.1	57	ELECTRICAL DETAILS
E6.1	58	ELECTRICAL SINGLE LINE DIAGRAM AND PANEL SCHEDULES
E6.2	59	FIRE ALARM RISER DIAGRAM
ECD-1	60	TYPICAL TEMPORARY EROSION / SEDEMENT CONTROL APPLICATION
ECD-2	61	DETAILS OF SEDIMENT BARRIER APPLICATIONS
ECD-3	62	DETAILS OF SILT FENCE INSTALLATION
ECD-4	63	DITCH CHECK STRUCTURES, TYPICAL APPLICATIONS AND DETAILS
ECD-5	64	TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES, SILT FENCE AND HAY BALE DITCH CHECKS
ECD-6	65	DETAILS OF EROSION CONTROL WATTLE DITCH CHECK
ECD-15	66	STABILIZED CONSTRUCTION ENTRANCE
DT-1A	93	DITCH TREATMENT INSTALLATION DETAIL FOR SOIL REINFORCING MAT
EC-1	6140	EROSION CONTROL
TEC-1	6142	TYPICAL TEMPORARY EROSION CONTROL MEASURES

DT-1	6145	DETAILS OF TYPICAL DITCH TREATMENTS
CL-1	6162	FENCE: CHAIN LINK, CLASS 1
CLG-1	6168	FENCE: CHAIN LINK GATE
SN-3	6222	STANDARD ROADSIDE SIGNS
SN-3A	6223	STANDARD ROADSIDE SIGNS
SN-4	6225	STANDARD ROADSIDE SIGNS, ASSEMBLY AND INSTALLATION
SN-4A	6226	STANDARD ROADSIDE SIGNS, ASSEMBLY AND INSTALLATION
PI-1	6300	PIPE CULVERT INSTALLATION
FE-1	6328	FLARED END SECTION FOR CONCRETE PIPE

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION

SECTION 00 21 13

INSTRUCTIONS TO BIDDERS

PART 1 - GENERAL

1.01 QUESTIONS

- A. Questions Regarding Bidding: Refer to Section 904 – Notice to Bidders No. 3980.

1.02 BIDDER'S QUALIFICATIONS

- A. Prequalification of Bidders: Refer to Mississippi Standard Specifications for Road and Bridge Construction 2004 Edition Section 102 – Bidding Requirements and Conditions, Subsection – Prequalification of Bidders.

1.03 NON-RESIDENT BIDDER

- A. Consideration of Proposals: Refer to Mississippi Standard Specifications for Road and Bridge Construction 2004 Edition Section 103 – Award and Execution of Contract, Article 103.01 – Consideration of Proposal.

1.04 CONDITIONS OF WORK

- A. Each Bidder must fully inform themselves of all conditions relating to the construction of the Project and employment of labor thereon. Failure to do so will not relieve a successful Bidder of obligations to furnish all material and labor necessary to carry out the provisions of the Contract. Insofar as possible, the Bidder must employ methods, or means, which will not cause interruption of, or interference with, the work of any other Bidder or Contractor.

1.05 EXAMINATION OF PROPOSAL AND SITE

- A. Examination of proposal and Site: Refer to Mississippi Standard Specifications for Road and Bridge Construction 2004 Edition Section 102 – Bidding Requirements and Conditions, Article 102.05 – Examination of Plans, Specifications, Special Provisions, Notice to Bidders and Site Work.

1.06 LAWS AND REGULATIONS

- A. Laws and Regulations: Refer to Mississippi Standard Specifications for Road and Bridge Construction 2004 Edition Section 107 – Legal Relations and Responsibility to Public, Article 107.01 – Laws to be Observed.

1.07 BID DOCUMENT

- A. The amount for Bid Document (Proposal) is indicated in the advertisement for Bids. Selected plan rooms will be issued one set of documents without charge.

## 1.08 METHOD OF BIDDING

- A. Lump sum, single bids received on a general contract will include general, mechanical and electrical construction (including Pay Items) and all work shown on Drawings or specified in the Project Manual (Proposal).

## 1.09 PROPOSAL FORMS

- A. Preparation of Proposal: Refer to Mississippi Standard Specifications for Road and Bridge Construction 2004 Edition Section 102 – Bidding Requirements and Conditions, Article 907-102.06 – Preparation of Proposal (as amended).

## 1.10 TIME OF COMPLETION

- A. The Bidder shall agree to commence work on a date specified in a written *NOTICE TO PROCEED* and fully complete the Project within the Contract Time indicated on the Proposal Form.

## 1.11 SUBSTITUTIONS

- A. No substitutions, qualifications or redefining of the Specification requirements are allowed to be marked on the Proposal, unless specifically required by the Bid Documents. Refer to Section 01 25 00 entitled Substitution procedures which covers procedures after the award of Contract.

## 1.12 ADDENDA

- A. Addenda to the Drawings or Project Manual issued before or during the time of bidding shall be included in the proposal and become a part of the Contract.
- B. If the Proposal, Section 905, does not contain acknowledgement of receipt and addition to the Proposal and Contract Documents of all addenda issued prior to opening of bids will be considered irregular and may be rejected.

## 1.13 BIDDER IDENTIFICATION

- A. Signature: The Proposal Form shall be signed, by any individual authorized to enter into a binding agreement for the Business making the bid proposal.
- B. Name of Business: The name appearing on the Proposal Form should be complete spelling of bidder's name and address – exact as recorded at the Secretary of State <http://www.sos.state.ms.us/busserv/corp/soskb/csearch.asp> which should be the same as you applied for at the Mississippi Board of Contractors <http://www.msdoc.us/search2.CFM>.
- C. Legal Address: The address appearing on the Proposal Form should be the same address exact as recorded at the Secretary of State <http://www.sos.state.ms.us/busserv/corp/soskb/csearch.asp> which should be the same as you applied for at the Mississippi Board of Contractors <http://www.msdoc.us/search2.CFM>.

- D. Certificate of Responsibility Number(s): The Certificate of Responsibility Number(s) appearing on the Proposal Form should be the same number appearing in the current Mississippi State Board of Contractors Roster.
  
- 1.14 BID SECURITY
  - A. Proposal Guaranty: Refer to Mississippi Standard Specifications for Road and Bridge Construction 2004 Edition Section 102 – Bidding Requirements and Conditions, Article 907-102.08 – Proposal Guaranty (as amended).
  
- 1.15 POWER OF ATTORNEY
  - A. Power of Attorney: Refer to Mississippi Standard Specifications for Road and Bridge Construction 2004 Edition Section 103 – Award and Execution of Contract, Article 103.05 – Requirement of Contract Bond.
  
- 1.16 SUBMITTAL
  - A. Delivery of Proposals: Refer to Mississippi Standard Specifications for Road and Bridge Construction 2004 Edition Section 102 – Bidding Requirements and Conditions, Article 102.09 – Delivery of Proposal.
  
- 1.17 MODIFICATION TO BID
  - A. A Bidder may NOT MODIFY the bid prior to the scheduled closing time indicated in the Advertisement for Bids in the following manner:
    - 1. Notification on Envelope: A modification may NOT be written on the outside of the sealed envelope containing the bid.
    - 2. Facsimile: A facsimile (fax) will NOT be acceptable.
  
- 1.18 OPENING OF BIDS
  - A. Public Opening of Proposal: Refer to Mississippi Standard Specifications for Road and Bridge Construction 2004 Edition Section 102 – Bidding Requirements and Conditions, Article 102.12 – Public Opening of Proposal.
  
- 1.19 IRREGULARITIES
  - A. Irregular Proposals: Refer to Mississippi Standard Specifications for Road and Bridge Construction 2004 Edition Section 102 – Bidding Requirements and Conditions, Article 102.07 – Irregular Proposal.
  
- 1.20 PROTEST
  - A. Any protest must be delivered in writing to the Owner prior to the Award Date.
  
- 1.21 ERRORS
  - A. Any claim of error and request for release from bid must be delivered in writing to the Owner within twenty-four (24) hours after the bid opening. The Bidder shall provide sufficient documentation with the written request clearly proving an error was made.

## 1.22 AWARD OF CONTRACT

- A. Award of Contract: Refer to Mississippi Standard Specifications for Road and Bridge Construction 2004 Edition Section 103 – Award and Execution of Contract, Article 103.02 – Award of Contract..
- B. Consideration of Proposal: Refer to Mississippi Standard Specifications for Road and Bridge Construction 2004 Edition Section 103 – Award and Execution of Contract, Article 907-103.01 – Consideration of Proposal (as amended).

## 1.23 FAILURE TO ENTER INTO A CONTRACT

- A. Failure to Execute Contract: Refer to Mississippi Standard Specifications for Road and Bridge Construction 2004 Edition Section 103 – Award and Execution of Contract, Article 103.08 – Failure to Execute Contract.

## 1.24 SECURITY FOR FAITHFUL PERFORMANCE

- A. Requirements of Contract Bonds: Refer to Mississippi Standard Specifications for Road and Bridge Construction 2004 Edition Section 103 – Award and Execution of Contract, Article 103.05 – Requirement of Contract Bond.

## 1.25 BIDDER'S CHECKLIST

## A. Proposal Form

1. Base Bid:  
 Fill-in the amount of the base bid in numbers. The written word shall govern.
2. Alternates:  
 Fill-in each alternates amount in words and numbers.
3. Certification Form (State Non-Collusion Certificate)  
 Certification (regarding Non-Collusion, Debarment and Suspension, etc). Form has been executed in duplicate.
4. Acceptance:  
 Proposal is signed by authorized person.  
 Name of Business. - complete spelling of bidder's name and address – exact as recorded at the Secretary of State <http://www.sos.state.ms.us/busserv/corp/soskb/csearch.asp> which should be the same as you applied for at the Mississippi Board of Contractors <http://www.msdoc.us/search2.CFM>.  
 Legal address of the business listed above (at SOS and Contractor's Board).  
 Correct Certificate of Responsibility Number(s) as it appears in the current Mississippi State Board of Contractors Roster.
5. Certificate of Responsibility Number(s):  
 Base Bid is under \$50,000 and no number is required.  
 Base Bid is under \$50,000 and the statement "bid does not exceed \$50,000" is on the outside of the sealed envelope.  
 Base Bid is equal to or over \$50,000 and number is required.  
 Joint Venture and *joint venture* number is required.  
Or  
 Joint Venture participants' numbers are required.

B. Bid Security

1. Bid Bond:  
 Included Bid Bond payable to the STATE OF MISSISSIPPI with Project number identified thereon,  
Or  
 Included Certified Check payable to the STATE OF MISSISSIPPI with Project number identified thereon.
2. Power of Attorney:  
 Included Power of Attorney.

C. Non-Resident Bidder

1. Preference Law:  
 Attached a Copy of Non-Resident Bidder's Preference Law.  
Or  
 Attached a Statement.

D. Subcontractors' Name

1. Subcontractor:  
 List Mechanical, Plumbing, and/or Electrical Subcontractor regardless of cost.  
\* List name even for under \$50,000.  
\* Fire Protection Sprinkler Contractors do not have to be listed.  
\* If there is a separate HVAC/Plumbing Sub-Contractor, so notate as mentioned herein.  
\* If Mechanical, Plumbing, and/or Electrical Subcontractor is performed by the General Contractor, be sure the General has COR for said discipline.  
\* If there is no Mechanical, Plumbing, and/or Electrical Sub-Contractor listed, then use of Sub-Contractor to perform such scope will not be permitted.

E. Subcontractors' COR Number

1. Certificate of Responsibility  
 List certificate of responsibility Number for all listed Sub-Contractors over \$50,000.  
\* If under \$50,000 – so notate on the COR line “under \$50,000” (or can still show COR Number)

1.26 BIDDER'S CONTACT LIST

A. Proposal and Contract Documents: If the Bidder has any questions pertaining to the following specific areas of the Documents, please direct them to the following individuals:

1. Additional Proposals: Emma Taylor – Contract Administration (601) 359-7744
2. Additional Prints: Clint Wells – MDOT Plans Print Shop (601) 359-7460
3. Bid Forms: Billy Owen – Contract Admin. Engineer (601) 359-7730
4. Specifications Earl Glenn – Assist Construction Engr. (601) 359-7301
5. Drawings Earl Glenn – Assist Construction Engr. (601) 359-7301
6. Bidder's List & Specimen Proposals are available online at:  
<http://www.gomdot.com/Applications/BidSystem/Home.aspx>

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION



SECTION 00 22 13

SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

PART 1 - GENERAL

1.01 INSTRUCTIONS TO BIDDERS

- A. Instructions to Bidders for Project consist of the following:

1.02 WORK IN PROXIMITY OF HIGH VOLTAGE POWER LINES

- A. Contractor's Responsibility for Utility Property and Services: Refer to Mississippi Standard Specifications for Road and Bridge Construction 2004 Edition Section 107 – Legal Relations and Responsibility to Public, Article 107.18 – Contractor's Responsibility for Utility Property and services.

1.03 PLANT PEST QUARANTINES INFORMATION

- A. Quarantine Information: Refer to Mississippi Standard Specifications for Road and Bridge Construction 2004 Edition Section 107 – Legal Relations and Responsibility to Public, Article 107.22.7 – Quarantine Information.

1.04 PROMPT PAYMENT

- A. General: Refer to Mississippi Standard Specifications for Road and Bridge Construction 2004 Edition Section 108 – Prosecution and Progress, Article 108.01.1 – General.

1.05 ALTERATIONS IN BIDDING PROCESS

- A. Preparation of Proposal: Refer to Mississippi Standard Specifications for Road and Bridge Construction 2004 Edition Section 102 – Bidding Requirements and Conditions, Article 907-102.06 – Preparation of Proposal (as amended).

1.06 CONTRACT TIME

- A. Refer to Section 904 – Notice to Bidders (Contract Time) for completion of Contract. Construction Schedule: Refer to Mississippi Standard Specifications for Road and Bridge Construction 2004 Edition Section 105 – Control of Work, Article 907-105.05 – Cooperation by Contractor (as amended).

1.07 SUBCONTRACTING

- A. The Bidder is specifically advised that any person, firm or other party to whom it proposes to award a subcontract must be acceptable to the Owner. The total allowable

subcontract amount shall not exceed **sixty percent (60%) of the Contract Sum**, excluding the value of any "Specialty Items" listed below:

- a. Termite Treatment
- b. Masonry Items
- c. Metal Roofing
- d. Metal Building System
- e. Plumbing Items
- f. Heating, Ventilating and Air Conditioning Items
- g. Electrical Items

These items are not to be confused with Division 10 – Specialties of the Specifications.

END OF SECTION

SECTION 00 72 00

GENERAL CONDITIONS

PART 1 - GENERAL

1.01 DESCRIPTION.

- A. The American Institute of Architects AIA DOCUMENT A201-2007, "General Conditions of the Contract for Construction", 2007, Sixteenth Edition, Articles 1 through 15 inclusive, except as may be added to or modified herein, is hereby made a part of the Contract Documents. For brevity, AIA DOCUMENT A201-2007 is also referred to in the Contract documents as the "General Conditions".
- B. All persons intending to provide goods or services in connection with this Work are required to read and understand the referenced document prior to proceeding.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION



# AIA<sup>®</sup> Document A201<sup>™</sup> – 2007

## General Conditions of the Contract for Construction

for the following PROJECT:

*(Name and location or address)*

MAINTENANCE AREA HEADQUARTERS AND SUPPORT BUILDINGS AT  
DEKALB, KEMPER COUNTY, MISSISSIPPI

BWO-5213-35(001) 502587

BWO-5214-35(001) 502587

BWO-5067-35(003) 502587

BWO-5221-35(001) 502587

LWO-5035-35(002) 502587

**THE OWNER:**

*(Name, legal status and address)*

MISSISSIPPI TRANSPORTATION COMMISSION  
P O BOX 1850  
JACKSON, MISSISSIPPI 39215-1850

**THE ARCHITECT:**

*(Name, legal status and address)*

**TABLE OF ARTICLES**

- 1 GENERAL PROVISIONS
- 2 OWNER
- 3 CONTRACTOR
- 4 ARCHITECT
- 5 SUBCONTRACTORS
- 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS
- 7 CHANGES IN THE WORK
- 8 TIME
- 9 PAYMENTS AND COMPLETION
- 10 PROTECTION OF PERSONS AND PROPERTY
- 11 INSURANCE AND BONDS
- 12 UNCOVERING AND CORRECTION OF WORK

**ADDITIONS AND DELETIONS:**

The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

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User Notes:

- 13 MISCELLANEOUS PROVISIONS
- 14 TERMINATION OR SUSPENSION OF THE CONTRACT
- 15 CLAIMS AND DISPUTES



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User Notes:

## INDEX

(Topics and numbers in bold are section headings.)

### Acceptance of Nonconforming Work

9.6.6, 9.9.3, **12.3**

### Acceptance of Work

9.6.6, 9.8.2, 9.9.3, 9.10.1, 9.10.3, **12.3**

### Access to Work

**3.16**, 6.2.1, 12.1

### Accident Prevention

10

### Acts and Omissions

3.2, 3.3.2, 3.12.8, 3.18, 4.2.3, 8.3.1, 9.5.1, 10.2.5, 10.2.8, 13.4.2, 13.7, 14.1, 15.2

### Addenda

1.1.1, 3.11.1

### Additional Costs, Claims for

3.7.4, 3.7.5, 6.1.1, 7.3.7.5, 10.3, 15.1.4

### Additional Inspections and Testing

9.4.2, 9.8.3, 12.2.1, **13.5**

### Additional Insured

11.1.4

### Additional Time, Claims for

3.2.4, 3.7.4, 3.7.5, 3.10.2, 8.3.2, **15.1.5**

### Administration of the Contract

3.1.3, **4.2**, 9.4, 9.5

### Advertisement or Invitation to Bid

1.1.1

### Aesthetic Effect

4.2.13

### Allowances

**3.8**, 7.3.8

### All-risk Insurance

11.3.1, 11.3.1.1

### Applications for Payment

4.2.5, 7.3.9, 9.2, **9.3**, 9.4, 9.5.1, 9.6.3, 9.7, 9.10, 11.1.3

### Approvals

2.1.1, 2.2.2, 2.4, 3.1.3, 3.10.2, 3.12.8, 3.12.9, 3.12.10, 4.2.7, 9.3.2, 13.5.1

### Arbitration

8.3.1, 11.3.10, 13.1.1, 15.3.2, **15.4**

## ARCHITECT

**4**

### Architect, Definition of

**4.1.1**

### Architect, Extent of Authority

2.4.1, 3.12.7, 4.1, 4.2, 5.2, 6.3, 7.1.2, 7.3.7, 7.4, 9.2, 9.3.1, 9.4, 9.5, 9.6.3, 9.8, 9.10.1, 9.10.3, 12.1, 12.2.1, 13.5.1, 13.5.2, 14.2.2, 14.2.4, 15.1.3, 15.2.1

### Architect, Limitations of Authority and Responsibility

2.1.1, 3.12.4, 3.12.8, 3.12.10, 4.1.2, 4.2.1, 4.2.2, 4.2.3, 4.2.6, 4.2.7, 4.2.10, 4.2.12, 4.2.13, 5.2.1, 7.4, 9.4.2, 9.5.3, 9.6.4, 15.1.3, 15.2

### Architect's Additional Services and Expenses

2.4.1, 11.3.1.1, 12.2.1, 13.5.2, 13.5.3, 14.2.4

### Architect's Administration of the Contract

3.1.3, 4.2, 3.7.4, 15.2, 9.4.1, 9.5

### Architect's Approvals

2.4.1, 3.1.3, 3.5, 3.10.2, 4.2.7

### Architect's Authority to Reject Work

3.5, 4.2.6, 12.1.2, 12.2.1

### Architect's Copyright

1.1.7, 1.5

### Architect's Decisions

3.7.4, 4.2.6, 4.2.7, 4.2.11, 4.2.12, 4.2.13, 4.2.14, 6.3, 7.3.7, 7.3.9, 8.1.3, 8.3.1, 9.2, 9.4.1, 9.5, 9.8.4, 9.9.1, 13.5.2, 15.2, 15.3

### Architect's Inspections

3.7.4, 4.2.2, 4.2.9, 9.4.2, 9.8.3, 9.9.2, 9.10.1, 13.5

### Architect's Instructions

3.2.4, 3.3.1, 4.2.6, 4.2.7, 13.5.2

### Architect's Interpretations

4.2.11, 4.2.12

### Architect's Project Representative

4.2.10

### Architect's Relationship with Contractor

1.1.2, 1.5, 3.1.3, 3.2.2, 3.2.3, 3.2.4, 3.3.1, 3.4.2, 3.5, 3.7.4, 3.7.5, 3.9.2, 3.9.3, 3.10, 3.11, 3.12, 3.16, 3.18, 4.1.2, 4.1.3, 4.2, 5.2, 6.2.2, 7, 8.3.1, 9.2, 9.3, 9.4, 9.5, 9.7, 9.8, 9.9, 10.2.6, 10.3, 11.3.7, 12, 13.4.2, 13.5, 15.2

### Architect's Relationship with Subcontractors

1.1.2, 4.2.3, 4.2.4, 4.2.6, 9.6.3, 9.6.4, 11.3.7

### Architect's Representations

9.4.2, 9.5.1, 9.10.1

### Architect's Site Visits

3.7.4, 4.2.2, 4.2.9, 9.4.2, 9.5.1, 9.9.2, 9.10.1, 13.5

### Asbestos

10.3.1

### Attorneys' Fees

3.18.1, 9.10.2, 10.3.3

### Award of Separate Contracts

6.1.1, 6.1.2

### Award of Subcontracts and Other Contracts for Portions of the Work

**5.2**

## Basic Definitions

**1.1**

### Bidding Requirements

1.1.1, 5.2.1, 11.4.1

### Binding Dispute Resolution

9.7, 11.3.9, 11.3.10, 13.1.1, 15.2.5, 15.2.6.1, 15.3.1, 15.3.2, 15.4.1

### Boiler and Machinery Insurance

**11.3.2**

### Bonds, Lien

7.3.7.4, 9.10.2, 9.10.3

### Bonds, Performance, and Payment

7.3.7.4, 9.6.7, 9.10.3, 11.3.9, **11.4**

### Building Permit

3.7.1

Init.

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User Notes:

**Capitalization**

**1.3**

Certificate of Substantial Completion  
9.8.3, 9.8.4, 9.8.5

**Certificates for Payment**

4.2.1, 4.2.5, 4.2.9, 9.3.3, 9.4, 9.5, 9.6.1, 9.6.6, 9.7,  
9.10.1, 9.10.3, 14.1.1.3, 14.2.4, 15.1.3

Certificates of Inspection, Testing or Approval  
13.5.4

**Certificates of Insurance**

9.10.2, 11.1.3

**Change Orders**

1.1.1, 2.4.1, 3.4.2, 3.7.4, 3.8.2.3, 3.11.1, 3.12.8, 4.2.8,  
5.2.3, 7.1.2, 7.1.3, 7.2, 7.3.2, 7.3.6, 7.3.9, 7.3.10, 8.3.1,  
9.3.1.1, 9.10.3, 10.3.2, 11.3.1.2, 11.3.4, 11.3.9, 12.1.2,  
15.1.3

**Change Orders, Definition of**

7.2.1

**CHANGES IN THE WORK**

2.2.1, 3.11, 4.2.8, 7, 7.2.1, 7.3.1, 7.4, 8.3.1, 9.3.1.1,  
11.3.9

**Claims, Definition of**

15.1.1

**CLAIMS AND DISPUTES**

3.2.4, 6.1.1, 6.3, 7.3.9, 9.3.3, 9.10.4, 10.3.3, 15, 15.4

Claims and Timely Assertion of Claims

15.4.1

**Claims for Additional Cost**

3.2.4, 3.7.4, 6.1.1, 7.3.9, 10.3.2, 15.1.4

**Claims for Additional Time**

3.2.4, 3.7.4.6.1.1, 8.3.2, 10.3.2, 15.1.5

**Concealed or Unknown Conditions, Claims for**

3.7.4

Claims for Damages

3.2.4, 3.18, 6.1.1, 8.3.3, 9.5.1, 9.6.7, 10.3.3, 11.1.1,

11.3.5, 11.3.7, 14.1.3, 14.2.4, 15.1.6

Claims Subject to Arbitration

15.3.1, 15.4.1

**Cleaning Up**

3.15, 6.3

Commencement of the Work, Conditions Relating to

2.2.1, 3.2.2, 3.4.1, 3.7.1, 3.10.1, 3.12.6, 5.2.1, 5.2.3,

6.2.2, 8.1.2, 8.2.2, 8.3.1, 11.1, 11.3.1, 11.3.6, 11.4.1,

15.1.4

**Commencement of the Work, Definition of**

8.1.2

**Communications Facilitating Contract**

**Administration**

3.9.1, 4.2.4

Completion, Conditions Relating to

3.4.1, 3.11, 3.15, 4.2.2, 4.2.9, 8.2, 9.4.2, 9.8, 9.9.1,

9.10, 12.2, 13.7, 14.1.2

**COMPLETION, PAYMENTS AND**

**9**

Completion, Substantial

4.2.9, 8.1.1, 8.1.3, 8.2.3, 9.4.2, 9.8, 9.9.1, 9.10.3, 12.2,

13.7

**Compliance with Laws**

1.6.1, 3.2.3, 3.6, 3.7, 3.12.10, 3.13, 4.1.1, 9.6.4, 10.2.2,

11.1, 11.3, 13.1, 13.4, 13.5.1, 13.5.2, 13.6, 14.1.1,

14.2.1.3, 15.2.8, 15.4.2, 15.4.3

Concealed or Unknown Conditions

3.7.4, 4.2.8, 8.3.1, 10.3

Conditions of the Contract

1.1.1, 6.1.1, 6.1.4

Consent, Written

3.4.2, 3.7.4, 3.12.8, 3.14.2, 4.1.2, 9.3.2, 9.8.5, 9.9.1,

9.10.2, 9.10.3, 11.3.1, 13.2, 13.4.2, 15.4.4.2

**Consolidation or Joinder**

15.4.4

**CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS**

1.1.4, 6

Construction Change Directive, Definition of

7.3.1

Construction Change Directives

1.1.1, 3.4.2, 3.12.8, 4.2.8, 7.1.1, 7.1.2, 7.1.3, 7.3,

9.3.1.1

Construction Schedules, Contractor's

3.10, 3.12.1, 3.12.2, 6.1.3, 15.1.5.2

Contingent Assignment of Subcontracts

5.4, 14.2.2.2

**Continuing Contract Performance**

15.1.3

Contract, Definition of

1.1.2

**CONTRACT, TERMINATION OR SUSPENSION OF THE**

5.4.1.1, 11.3.9, 14

Contract Administration

3.1.3, 4, 9.4, 9.5

Contract Award and Execution, Conditions Relating

to

3.7.1, 3.10, 5.2, 6.1, 11.1.3, 11.3.6, 11.4.1

Contract Documents, Copies Furnished and Use of

1.5.2, 2.2.5, 5.3

Contract Documents, Definition of

1.1.1

Contract Sum

3.7.4, 3.8, 5.2.3, 7.2, 7.3, 7.4, 9.1, 9.4.2, 9.5.1.4, 9.6.7,

9.7, 10.3.2, 11.3.1, 14.2.4, 14.3.2, 15.1.4, 15.2.5

Contract Sum, Definition of

9.1

Contract Time

3.7.4, 3.7.5, 3.10.2, 5.2.3, 7.2.1.3, 7.3.1, 7.3.5, 7.4,

8.1.1, 8.2.1, 8.3.1, 9.5.1, 9.7, 10.3.2, 12.1.1, 14.3.2,

15.1.5.1, 15.2.5

Contract Time, Definition of

8.1.1

**CONTRACTOR**

**3**

Contractor, Definition of  
3.1, 6.1.2

Init.

## **Contractor's Construction Schedules**

3.10, 3.12.1, 3.12.2, 6.1.3, 15.1.5.2

### **Contractor's Employees**

3.3.2, 3.4.3, 3.8.1, 3.9, 3.18.2, 4.2.3, 4.2.6, 10.2, 10.3, 11.1.1, 11.3.7, 14.1, 14.2.1.1

### **Contractor's Liability Insurance**

#### **11.1**

#### **Contractor's Relationship with Separate Contractors and Owner's Forces**

3.12.5, 3.14.2, 4.2.4, 6, 11.3.7, 12.1.2, 12.2.4

#### **Contractor's Relationship with Subcontractors**

1.2.2, 3.3.2, 3.18.1, 3.18.2, 5, 9.6.2, 9.6.7, 9.10.2, 11.3.1.2, 11.3.7, 11.3.8

#### **Contractor's Relationship with the Architect**

1.1.2, 1.5, 3.1.3, 3.2.2, 3.2.3, 3.2.4, 3.3.1, 3.4.2, 3.5, 3.7.4, 3.10, 3.11, 3.12, 3.16, 3.18, 4.1.3, 4.2, 5.2, 6.2.2, 7, 8.3.1, 9.2, 9.3, 9.4, 9.5, 9.7, 9.8, 9.9, 10.2.6, 10.3, 11.3.7, 12, 13.5, 15.1.2, 15.2.1

#### **Contractor's Representations**

3.2.1, 3.2.2, 3.5, 3.12.6, 6.2.2, 8.2.1, 9.3.3, 9.8.2

#### **Contractor's Responsibility for Those Performing the Work**

3.3.2, 3.18, 5.3.1, 6.1.3, 6.2, 9.5.1, 10.2.8

#### **Contractor's Review of Contract Documents**

3.2

#### **Contractor's Right to Stop the Work**

9.7

#### **Contractor's Right to Terminate the Contract**

14.1, 15.1.6

#### **Contractor's Submittals**

3.10, 3.11, 3.12.4, 4.2.7, 5.2.1, 5.2.3, 9.2, 9.3, 9.8.2, 9.8.3, 9.9.1, 9.10.2, 9.10.3, 11.1.3, 11.4.2

#### **Contractor's Superintendent**

3.9, 10.2.6

#### **Contractor's Supervision and Construction**

##### **Procedures**

1.2.2, 3.3, 3.4, 3.12.10, 4.2.2, 4.2.7, 6.1.3, 6.2.4, 7.1.3, 7.3.5, 7.3.7, 8.2, 10, 12, 14, 15.1.3

##### **Contractual Liability Insurance**

11.1.1.8, 11.2

##### **Coordination and Correlation**

1.2, 3.2.1, 3.3.1, 3.10, 3.12.6, 6.1.3, 6.2.1

##### **Copies Furnished of Drawings and Specifications**

1.5, 2.2.5, 3.11

##### **Copyrights**

1.5, 3.17

##### **Correction of Work**

2.3, 2.4, 3.7.3, 9.4.2, 9.8.2, 9.8.3, 9.9.1, 12.1.2, 12.2

##### **Correlation and Intent of the Contract Documents**

1.2

##### **Cost, Definition of**

7.3.7

##### **Costs**

2.4.1, 3.2.4, 3.7.3, 3.8.2, 3.15.2, 5.4.2, 6.1.1, 6.2.3, 7.3.3.3, 7.3.7, 7.3.8, 7.3.9, 9.10.2, 10.3.2, 10.3.6, 11.3, 12.1.2, 12.2.1, 12.2.4, 13.5, 14

## **Cutting and Patching**

3.14, 6.2.5

### **Damage to Construction of Owner or Separate Contractors**

3.14.2, 6.2.4, 10.2.1.2, 10.2.5, 10.4, 11.1.1, 11.3, 12.2.4

### **Damage to the Work**

3.14.2, 9.9.1, 10.2.1.2, 10.2.5, 10.4.1, 11.3.1, 12.2.4

### **Damages, Claims for**

3.2.4, 3.18, 6.1.1, 8.3.3, 9.5.1, 9.6.7, 10.3.3, 11.1.1, 11.3.5, 11.3.7, 14.1.3, 14.2.4, 15.1.6

### **Damages for Delay**

6.1.1, 8.3.3, 9.5.1.6, 9.7, 10.3.2

### **Date of Commencement of the Work, Definition of**

8.1.2

### **Date of Substantial Completion, Definition of**

8.1.3

### **Day, Definition of**

8.1.4

### **Decisions of the Architect**

3.7.4, 4.2.6, 4.2.7, 4.2.11, 4.2.12, 4.2.13, 15.2, 6.3, 7.3.7, 7.3.9, 8.1.3, 8.3.1, 9.2, 9.4, 9.5.1, 9.8.4, 9.9.1, 13.5.2, 14.2.2, 14.2.4, 15.1, 15.2

### **Decisions to Withhold Certification**

9.4.1, 9.5, 9.7, 14.1.1.3

### **Defective or Nonconforming Work, Acceptance, Rejection and Correction of**

2.3.1, 2.4.1, 3.5, 4.2.6, 6.2.5, 9.5.1, 9.5.2, 9.6.6, 9.8.2, 9.9.3, 9.10.4, 12.2.1

### **Definitions**

1.1, 2.1.1, 3.1.1, 3.5, 3.12.1, 3.12.2, 3.12.3, 4.1.1, 15.1.1, 5.1, 6.1.2, 7.2.1, 7.3.1, 8.1, 9.1, 9.8.1

### **Delays and Extensions of Time**

3.2, 3.7.4, 5.2.3, 7.2.1, 7.3.1, 7.4, 8.3, 9.5.1, 9.7, 10.3.2, 10.4.1, 14.3.2, 15.1.5, 15.2.5

### **Disputes**

6.3, 7.3.9, 15.1, 15.2

### **Documents and Samples at the Site**

3.11

### **Drawings, Definition of**

1.1.5

### **Drawings and Specifications, Use and Ownership of**

3.11

### **Effective Date of Insurance**

8.2.2, 11.1.2

### **Emergencies**

10.4, 14.1.1.2, 15.1.4

### **Employees, Contractor's**

3.3.2, 3.4.3, 3.8.1, 3.9, 3.18.2, 4.2.3, 4.2.6, 10.2, 10.3.3, 11.1.1, 11.3.7, 14.1, 14.2.1.1

### **Equipment, Labor, Materials or**

1.1.3, 1.1.6, 3.4, 3.5, 3.8.2, 3.8.3, 3.12, 3.13.1, 3.15.1, 4.2.6, 4.2.7, 5.2.1, 6.2.1, 7.3.7, 9.3.2, 9.3.3, 9.5.1.3, 9.10.2, 10.2.1, 10.2.4, 14.2.1.1, 14.2.1.2



Execution and Progress of the Work  
 1.1.3, 1.2.1, 1.2.2, 2.2.3, 2.2.5, 3.1, 3.3.1, 3.4.1, 3.5,  
 3.7.1, 3.10.1, 3.12, 3.14, 4.2, 6.2.2, 7.1.3, 7.3.5, 8.2,  
 9.5.1, 9.9.1, 10.2, 10.3, 12.2, 14.2, 14.3.1, 15.1.3  
 Extensions of Time  
 3.2.4, 3.7.4, 5.2.3, 7.2.1, 7.3, 7.4, 9.5.1, 9.7, 10.3.2,  
 10.4.1, 14.3, 15.1.5, 15.2.5  
**Failure of Payment**  
 9.5.1.3, 9.7, 9.10.2, 13.6, 14.1.1.3, 14.2.1.2  
 Faulty Work  
 (See Defective or Nonconforming Work)  
**Final Completion and Final Payment**  
 4.2.1, 4.2.9, 9.8.2, 9.10, 11.1.2, 11.1.3, 11.3.1, 11.3.5,  
 12.3.1, 14.2.4, 14.4.3  
 Financial Arrangements, Owner's  
 2.2.1, 13.2.2, 14.1.1.4  
 Fire and Extended Coverage Insurance  
 11.3.1.1  
**GENERAL PROVISIONS**  
**1**  
**Governing Law**  
**13.1**  
 Guarantees (See Warranty)  
**Hazardous Materials**  
 10.2.4, 10.3  
 Identification of Subcontractors and Suppliers  
 5.2.1  
**Indemnification**  
 3.17, 3.18, 9.10.2, 10.3.3, 10.3.5, 10.3.6, 11.3.1.2,  
 11.3.7  
**Information and Services Required of the Owner**  
 2.1.2, 2.2, 3.2.2, 3.12.4, 3.12.10, 6.1.3, 6.1.4, 6.2.5,  
 9.6.1, 9.6.4, 9.9.2, 9.10.3, 10.3.3, 11.2, 11.4, 13.5.1,  
 13.5.2, 14.1.1.4, 14.1.4, 15.1.3  
**Initial Decision**  
**15.2**  
**Initial Decision Maker, Definition of**  
 1.1.8  
 Initial Decision Maker, Decisions  
 14.2.2, 14.2.4, 15.2.1, 15.2.2, 15.2.3, 15.2.4, 15.2.5  
 Initial Decision Maker, Extent of Authority  
 14.2.2, 14.2.4, 15.1.3, 15.2.1, 15.2.2, 15.2.3, 15.2.4,  
 15.2.5  
**Injury or Damage to Person or Property**  
**10.2.8, 10.4.1**  
 Inspections  
 3.1.3, 3.3.3, 3.7.1, 4.2.2, 4.2.6, 4.2.9, 9.4.2, 9.8.3,  
 9.9.2, 9.10.1, 12.2.1, 13.5  
 Instructions to Bidders  
 1.1.1  
 Instructions to the Contractor  
 3.2.4, 3.3.1, 3.8.1, 5.2.1, 7, 8.2.2, 12, 13.5.2  
**Instruments of Service, Definition of**  
**1.1.7**  
 Insurance  
 3.18.1, 6.1.1, 7.3.7, 9.3.2, 9.8.4, 9.9.1, 9.10.2, 11

**Insurance, Boiler and Machinery**  
**11.3.2**  
**Insurance, Contractor's Liability**  
**11.1**  
 Insurance, Effective Date of  
 8.2.2, 11.1.2  
**Insurance, Loss of Use**  
**11.3.3**  
**Insurance, Owner's Liability**  
**11.2**  
**Insurance, Property**  
 10.2.5, 11.3  
 Insurance, Stored Materials  
 9.3.2  
**INSURANCE AND BONDS**  
**11**  
 Insurance Companies, Consent to Partial Occupancy  
 9.9.1  
 Intent of the Contract Documents  
 1.2.1, 4.2.7, 4.2.12, 4.2.13, 7.4  
**Interest**  
**13.6**  
**Interpretation**  
 1.2.3, 1.4, 4.1.1, 5.1, 6.1.2, 15.1.1  
 Interpretations, Written  
 4.2.11, 4.2.12, 15.1.4  
 Judgment on Final Award  
 15.4.2  
**Labor and Materials, Equipment**  
 1.1.3, 1.1.6, 3.4, 3.5, 3.8.2, 3.8.3, 3.12, 3.13, 3.15.1,  
 4.2.6, 4.2.7, 5.2.1, 6.2.1, 7.3.7, 9.3.2, 9.3.3, 9.5.1.3,  
 9.10.2, 10.2.1, 10.2.4, 14.2.1.1, 14.2.1.2  
 Labor Disputes  
 8.3.1  
 Laws and Regulations  
 1.5, 3.2.3, 3.6, 3.7, 3.12.10, 3.13.1, 4.1.1, 9.6.4, 9.9.1,  
 10.2.2, 11.1.1, 11.3, 13.1.1, 13.4, 13.5.1, 13.5.2,  
 13.6.1, 14, 15.2.8, 15.4  
 Liens  
 2.1.2, 9.3.3, 9.10.2, 9.10.4, 15.2.8  
 Limitations, Statutes of  
 12.2.5, 13.7, 15.4.1.1  
 Limitations of Liability  
 2.3.1, 3.2.2, 3.5, 3.12.10, 3.17, 3.18.1, 4.2.6, 4.2.7,  
 4.2.12, 6.2.2, 9.4.2, 9.6.4, 9.6.7, 10.2.5, 10.3.3, 11.1.2,  
 11.2, 11.3.7, 12.2.5, 13.4.2  
 Limitations of Time  
 2.1.2, 2.2, 2.4, 3.2.2, 3.10, 3.11, 3.12.5, 3.15.1, 4.2.7,  
 5.2, 5.3.1, 5.4.1, 6.2.4, 7.3, 7.4, 8.2, 9.2, 9.3.1, 9.3.3,  
 9.4.1, 9.5, 9.6, 9.7, 9.8, 9.9, 9.10, 11.1.3, 11.3.1.5,  
 11.3.6, 11.3.10, 12.2, 13.5, 13.7, 14, 15  
**Loss of Use Insurance**  
**11.3.3**  
 Material Suppliers  
 1.5, 3.12.1, 4.2.4, 4.2.6, 5.2.1, 9.3, 9.4.2, 9.6, 9.10.5  
**Materials, Hazardous**  
 10.2.4, 10.3

Init.

Materials, Labor, Equipment and  
 1.1.3, 1.1.6, 1.5.1, 3.4.1, 3.5, 3.8.2, 3.8.3, 3.12, 3.13.1,  
 3.15.1, 4.2.6, 4.2.7, 5.2.1, 6.2.1, 7.3.7, 9.3.2, 9.3.3,  
 9.5.1.3, 9.10.2, 10.2.1.2, 10.2.4, 14.2.1.1, 14.2.1.2

Means, Methods, Techniques, Sequences and  
 Procedures of Construction  
 3.3.1, 3.12.10, 4.2.2, 4.2.7, 9.4.2

Mechanic's Lien  
 2.1.2, 15.2.8

**Mediation**  
 8.3.1, 10.3.5, 10.3.6, 15.2.1, 15.2.5, 15.2.6, **15.3**,  
 15.4.1

**Minor Changes in the Work**  
 1.1.1, 3.12.8, 4.2.8, 7.1, 7.4

**MISCELLANEOUS PROVISIONS**  
**13**

**Modifications, Definition of**  
**1.1.1**  
 Modifications to the Contract  
 1.1.1, 1.1.2, 3.11, 4.1.2, 4.2.1, 5.2.3, 7, 8.3.1, 9.7,  
 10.3.2, 11.3.1

**Mutual Responsibility**  
**6.2**

**Nonconforming Work, Acceptance of**  
 9.6.6, 9.9.3, **12.3**  
 Nonconforming Work, Rejection and Correction of  
 2.3.1, 2.4.1, 3.5, 4.2.6, 6.2.4, 9.5.1, 9.8.2, 9.9.3, 9.10.4,  
 12.2.1

Notice  
 2.2.1, 2.3.1, 2.4.1, 3.2.4, 3.3.1, 3.7.2, 3.12.9, 5.2.1, 9.7,  
 9.10, 10.2.2, 11.1.3, 12.2.2.1, 13.3, 13.5.1, 13.5.2,  
 14.1, 14.2, 15.2.8, 15.4.1

**Notice, Written**  
 2.3.1, 2.4.1, 3.3.1, 3.9.2, 3.12.9, 3.12.10, 5.2.1, 9.7,  
 9.10, 10.2.2, 10.3, 11.1.3, 11.3.6, 12.2.2.1, **13.3**, 14,  
 15.2.8, 15.4.1

**Notice of Claims**  
 3.7.4, 10.2.8, **15.1.2**, 15.4

Notice of Testing and Inspections  
 13.5.1, 13.5.2

Observations, Contractor's  
 3.2, 3.7.4

Occupancy  
 2.2.2, 9.6.6, 9.8, 11.3.1.5

Orders, Written  
 1.1.1, 2.3, 3.9.2, 7, 8.2.2, 11.3.9, 12.1, 12.2.2.1, 13.5.2,  
 14.3.1

**OWNER**  
**2**

**Owner, Definition of**  
**2.1.1**

**Owner, Information and Services Required of the**  
 2.1.2, **2.2**, 3.2.2, 3.12.10, 6.1.3, 6.1.4, 6.2.5, 9.3.2,  
 9.6.1, 9.6.4, 9.9.2, 9.10.3, 10.3.3, 11.2, 11.3, 13.5.1,  
 13.5.2, 14.1.1.4, 14.1.4, 15.1.3

**Owner's Authority**  
 1.5, 2.1.1, 2.3.1, 2.4.1, 3.4.2, 3.8.1, 3.12.10, 3.14.2,  
 4.1.2, 4.1.3, 4.2.4, 4.2.9, 5.2.1, 5.2.4, 5.4.1, 6.1, 6.3,  
 7.2.1, 7.3.1, 8.2.2, 8.3.1, 9.3.1, 9.3.2, 9.5.1, 9.6.4,  
 9.9.1, 9.10.2, 10.3.2, 11.1.3, 11.3.3, 11.3.10, 12.2.2,  
 12.3.1, 13.2.2, 14.3, 14.4, 15.2.7

**Owner's Financial Capability**  
 2.2.1, 13.2.2, 14.1.1.4

**Owner's Liability Insurance**  
**11.2**  
 Owner's Relationship with Subcontractors  
 1.1.2, 5.2, 5.3, 5.4, 9.6.4, 9.10.2, 14.2.2

**Owner's Right to Carry Out the Work**  
 2.4, 14.2.2

**Owner's Right to Clean Up**  
**6.3**

**Owner's Right to Perform Construction and to Award Separate Contracts**  
**6.1**

**Owner's Right to Stop the Work**  
**2.3**  
 Owner's Right to Suspend the Work  
 14.3

Owner's Right to Terminate the Contract  
 14.2

**Ownership and Use of Drawings, Specifications and Other Instruments of Service**  
 1.1.1, 1.1.6, 1.1.7, **1.5**, 2.2.5, 3.2.2, 3.11.1, 3.17,  
 4.2.12, 5.3.1

**Partial Occupancy or Use**  
 9.6.6, **9.9**, 11.3.1.5

**Patching, Cutting and**  
**3.14**, 6.2.5

Patents  
 3.17

**Payment, Applications for**  
 4.2.5, 7.3.9, 9.2, **9.3**, 9.4, 9.5, 9.6.3, 9.7, 9.8.5, 9.10.1,  
 14.2.3, 14.2.4, 14.4.3

**Payment, Certificates for**  
 4.2.5, 4.2.9, 9.3.3, **9.4**, 9.5, 9.6.1, 9.6.6, 9.7, 9.10.1,  
 9.10.3, 13.7, 14.1.1.3, 14.2.4

**Payment, Failure of**  
 9.5.1.3, 9.7, 9.10.2, 13.6, 14.1.1.3, 14.2.1.2

Payment, Final  
 4.2.1, 4.2.9, 9.8.2, 9.10, 11.1.2, 11.1.3, 11.4.1, 12.3.1,  
 13.7, 14.2.4, 14.4.3

**Payment Bond, Performance Bond and**  
 7.3.7.4, 9.6.7, 9.10.3, **11.4**

**Payments, Progress**  
 9.3, **9.6**, 9.8.5, 9.10.3, 13.6, 14.2.3, 15.1.3

**PAYMENTS AND COMPLETION**  
**9**  
 Payments to Subcontractors  
 5.4.2, 9.5.1.3, 9.6.2, 9.6.3, 9.6.4, 9.6.7, 14.2.1.2

PCB  
 10.3.1

**Performance Bond and Payment Bond**

7.3.7.4, 9.6.7, 9.10.3, 11.4

**Permits, Fees, Notices and Compliance with Laws**

2.2.2, 3.7, 3.13, 7.3.7.4, 10.2.2

**PERSONS AND PROPERTY, PROTECTION OF**  
**10**

Polychlorinated Biphenyl

10.3.1

**Product Data**, Definition of

**3.12.2**

**Product Data and Samples, Shop Drawings**

3.11, 3.12, 4.2.7

**Progress and Completion**

4.2.2, 8.2, 9.8, 9.9.1, 14.1.4, 15.1.3

**Progress Payments**

9.3, 9.6, 9.8.5, 9.10.3, 13.6, 14.2.3, 15.1.3

**Project**, Definition of

**1.1.4**

Project Representatives

4.2.10

**Property Insurance**

10.2.5, 11.3

**PROTECTION OF PERSONS AND PROPERTY**  
**10**

Regulations and Laws

1.5, 3.2.3, 3.6, 3.7, 3.12.10, 3.13, 4.1.1, 9.6.4, 9.9.1, 10.2.2, 11.1, 11.4, 13.1, 13.4, 13.5.1, 13.5.2, 13.6, 14, 15.2.8, 15.4

Rejection of Work

3.5, 4.2.6, 12.2.1

Releases and Waivers of Liens

9.10.2

Representations

3.2.1, 3.5, 3.12.6, 6.2.2, 8.2.1, 9.3.3, 9.4.2, 9.5.1, 9.8.2, 9.10.1

Representatives

2.1.1, 3.1.1, 3.9, 4.1.1, 4.2.1, 4.2.2, 4.2.10, 5.1.1, 5.1.2, 13.2.1

Responsibility for Those Performing the Work

3.3.2, 3.18, 4.2.3, 5.3.1, 6.1.3, 6.2, 6.3, 9.5.1, 10

Retainage

9.3.1, 9.6.2, 9.8.5, 9.9.1, 9.10.2, 9.10.3

**Review of Contract Documents and Field**

**Conditions by Contractor**

**3.2**, 3.12.7, 6.1.3

Review of Contractor's Submittals by Owner and Architect

3.10.1, 3.10.2, 3.11, 3.12, 4.2, 5.2, 6.1.3, 9.2, 9.8.2

Review of Shop Drawings, Product Data and Samples by Contractor

3.12

**Rights and Remedies**

1.1.2, 2.3, 2.4, 3.5, 3.7.4, 3.15.2, 4.2.6, 5.3, 5.4, 6.1, 6.3, 7.3.1, 8.3, 9.5.1, 9.7, 10.2.5, 10.3, 12.2.2, 12.2.4, 13.4, 14, 15.4

**Royalties, Patents and Copyrights**

**3.17**

Rules and Notices for Arbitration

15.4.1

**Safety of Persons and Property**

**10.2**, 10.4

**Safety Precautions and Programs**

3.3.1, 4.2.2, 4.2.7, 5.3.1, 10.1, 10.2, 10.4

**Samples**, Definition of

**3.12.3**

**Samples, Shop Drawings, Product Data and**

**3.11**, 3.12, 4.2.7

**Samples at the Site, Documents and**

**3.11**

**Schedule of Values**

**9.2**, 9.3.1

Schedules, Construction

3.10, 3.12.1, 3.12.2, 6.1.3, 15.1.5.2

Separate Contracts and Contractors

1.1.4, 3.12.5, 3.14.2, 4.2.4, 4.2.7, 6, 8.3.1, 12.1.2

**Shop Drawings**, Definition of

**3.12.1**

**Shop Drawings, Product Data and Samples**

3.11, 3.12, 4.2.7

**Site**, Use of

**3.13**, 6.1.1, 6.2.1

Site Inspections

3.2.2, 3.3.3, 3.7.1, 3.7.4, 4.2, 9.4.2, 9.10.1, 13.5

Site Visits, Architect's

3.7.4, 4.2.2, 4.2.9, 9.4.2, 9.5.1, 9.9.2, 9.10.1, 13.5

Special Inspections and Testing

4.2.6, 12.2.1, 13.5

**Specifications**, Definition of

**1.1.6**

**Specifications**

1.1.1, 1.1.6, 1.2.2, 1.5, 3.11, 3.12.10, 3.17, 4.2.14

Statute of Limitations

13.7, 15.4.1.1

Stopping the Work

2.3, 9.7, 10.3, 14.1

Stored Materials

6.2.1, 9.3.2, 10.2.1.2, 10.2.4

**Subcontractor**, Definition of

**5.1.1**

**SUBCONTRACTORS**

**5**

Subcontractors, Work by

1.2.2, 3.3.2, 3.12.1, 4.2.3, 5.2.3, 5.3, 5.4, 9.3.1.2, 9.6.7

**Subcontractual Relations**

**5.3**, 5.4, 9.3.1.2, 9.6, 9.10, 10.2.1, 14.1, 14.2.1

Submittals

3.10, 3.11, 3.12, 4.2.7, 5.2.1, 5.2.3, 7.3.7, 9.2, 9.3, 9.8, 9.9.1, 9.10.2, 9.10.3, 11.1.3

Submittal Schedule

3.10.2, 3.12.5, 4.2.7

**Subrogation, Waivers of**

6.1.1, 11.3.7

Init.

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**Substantial Completion**

4.2.9, 8.1.1, 8.1.3, 8.2.3, 9.4.2, 9.8, 9.9.1, 9.10.3, 12.2, 13.7

**Substantial Completion, Definition of 9.8.1**Substitution of Subcontractors  
5.2.3, 5.2.4Substitution of Architect  
4.1.3Substitutions of Materials  
3.4.2, 3.5, 7.3.8**Sub-subcontractor, Definition of 5.1.2**Subsurface Conditions  
3.7.4**Successors and Assigns 13.2****Superintendent 3.9, 10.2.6****Supervision and Construction Procedures 1.2.2, 3.3, 3.4, 3.12.10, 4.2.2, 4.2.7, 6.1.3, 6.2.4, 7.1.3, 7.3.7, 8.2, 8.3.1, 9.4.2, 10, 12, 14, 15.1.3**Surety  
5.4.1.2, 9.8.5, 9.10.2, 9.10.3, 14.2.2, 15.2.7Surety, Consent of  
9.10.2, 9.10.3Surveys  
2.2.3**Suspension by the Owner for Convenience 14.3**Suspension of the Work  
5.4.2, 14.3Suspension or Termination of the Contract  
5.4.1.1, 14**Taxes 3.6, 3.8.2.1, 7.3.7.4****Termination by the Contractor 14.1, 15.1.6****Termination by the Owner for Cause 5.4.1.1, 14.2, 15.1.6****Termination by the Owner for Convenience 14.4**Termination of the Architect  
4.1.3Termination of the Contractor  
14.2.2**TERMINATION OR SUSPENSION OF THE CONTRACT 14****Tests and Inspections**

3.1.3, 3.3.3, 4.2.2, 4.2.6, 4.2.9, 9.4.2, 9.8.3, 9.9.2, 9.10.1, 10.3.2, 11.4.1.1, 12.2.1, 13.5

**TIME 8****Time, Delays and Extensions of 3.2.4, 3.7.4, 5.2.3, 7.2.1, 7.3.1, 7.4, 8.3, 9.5.1, 9.7, 10.3.2, 10.4.1, 14.3.2, 15.1.5, 15.2.5****Time Limits**

2.1.2, 2.2, 2.4, 3.2.2, 3.10, 3.11, 3.12.5, 3.15.1, 4.2, 5.2, 5.3, 5.4, 6.2.4, 7.3, 7.4, 8.2, 9.2, 9.3.1, 9.3.3, 9.4.1, 9.5, 9.6, 9.7, 9.8, 9.9, 9.10, 11.1.3, 12.2, 13.5, 13.7, 14, 15.1.2, 15.4

**Time Limits on Claims 3.7.4, 10.2.8, 13.7, 15.1.2**Title to Work  
9.3.2, 9.3.3**Transmission of Data in Digital Form 1.6****UNCOVERING AND CORRECTION OF WORK 12****Uncovering of Work 12.1**Unforeseen Conditions, Concealed or Unknown  
3.7.4, 8.3.1, 10.3Unit Prices  
7.3.3.2, 7.3.4Use of Documents  
1.1.1, 1.5, 2.2.5, 3.12.6, 5.3**Use of Site 3.13, 6.1.1, 6.2.1****Values, Schedule of 9.2, 9.3.1**Waiver of Claims by the Architect  
13.4.2Waiver of Claims by the Contractor  
9.10.5, 13.4.2, 15.1.6Waiver of Claims by the Owner  
9.9.3, 9.10.3, 9.10.4, 12.2.2.1, 13.4.2, 14.2.4, 15.1.6Waiver of Consequential Damages  
14.2.4, 15.1.6Waiver of Liens  
9.10.2, 9.10.4**Waivers of Subrogation 6.1.1, 11.3.7****Warranty 3.5, 4.2.9, 9.3.3, 9.8.4, 9.9.1, 9.10.4, 12.2.2, 13.7**Weather Delays  
15.1.5.2**Work, Definition of 1.1.3**Written Consent  
1.5.2, 3.4.2, 3.7.4, 3.12.8, 3.14.2, 4.1.2, 9.3.2, 9.8.5, 9.9.1, 9.10.2, 9.10.3, 11.4.1, 13.2, 13.4.2, 15.4.4.2Written Interpretations  
4.2.11, 4.2.12Written Notice  
2.3, 2.4, 3.3.1, 3.9, 3.12.9, 3.12.10, 5.2.1, 8.2.2, 9.7, 9.10, 10.2.2, 10.3, 11.1.3, 12.2.2, 12.2.4, 13.3, 14, 15.4.1Written Orders  
1.1.1, 2.3, 3.9, 7, 8.2.2, 12.1, 12.2, 13.5.2, 14.3.1, 15.1.2

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## ARTICLE 1 GENERAL PROVISIONS

### § 1.1 BASIC DEFINITIONS

#### § 1.1.1 THE CONTRACT DOCUMENTS

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive or (4) a written order for a minor change in the Work issued by the Architect. . The Contract Documents include the Advertisement for Bids, Instructions to Bidders, Notice to Bidders, Proposal Form, sample forms and all portions of addenda issued prior to execution of the Contract.

#### § 1.1.2 THE CONTRACT

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

#### § 1.1.3 THE WORK

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

#### § 1.1.4 THE PROJECT

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by separate contractors.

#### § 1.1.5 THE DRAWINGS

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules and diagrams.

#### § 1.1.6 THE SPECIFICATIONS

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

#### § 1.1.7 INSTRUMENTS OF SERVICE

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials. The Project Manual is a volume assembled for the Work which may include the bidding requirements, sample forms, Conditions of the Contract and Specifications

#### § 1.1.8 INITIAL DECISION MAKER

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2 and certify termination of the Agreement under Section 14.2.2.

### § 1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results. In the event of a conflict between or among the Contract Documents, Contractor shall perform Work and obligations of the higher quality, larger quantity, greater expense, tighter schedule and more stringent requirements, unless otherwise

directed in writing by the Owner.

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

### § 1.3 CAPITALIZATION

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles or (3) the titles of other documents published by the American Institute of Architects.

### § 1.4 INTERPRETATION

In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

### § 1.5 OWNERSHIP AND USE OF DRAWINGS, SPECIFICATIONS AND OTHER INSTRUMENTS OF SERVICE

§ 1.5.1 The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and will retain all common law, statutory and other reserved rights, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and material or equipment suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with this Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights. This Paragraph in no way supersedes the Owner's document rights set forth in the "Engineering Services Contract" Agreement Between the Owner and the Professional.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors and material or equipment suppliers are authorized to use and reproduce the Instruments of Service provided to them solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and material or equipment suppliers may not use the Instruments of Service on other projects or for additions to this Project outside the scope of the Work without the specific written consent of the Owner, Architect and the Architect's consultants.

### § 1.6 TRANSMISSION OF DATA IN DIGITAL FORM

If the parties intend to transmit Instruments of Service or any other information or documentation in digital form, they shall endeavor to establish necessary protocols governing such transmissions, unless otherwise already provided in the Agreement or the Contract Documents.

### § 1.7 EXECUTION OF THE WORK

Sections of Division 01 General Requirements govern the execution of the Work of all Sections in Divisions 02-49 of the Specifications.

## ARTICLE 2 OWNER

### § 2.1 GENERAL

§ 2.1.1 The Owner, as used in these Documents, refers to the Mississippi Transportation Commission, a body Corporate of the State of Mississippi, acting by and through the duly authorized Executive Director of the Mississippi Department of Transportation for the benefit of the Department for which the Work under this Contract is being performed. The Owner is the entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner's representative, who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization, is the individual who signed the Construction Contract for the Owner. The term "Owner" means the Owner or the Owner's authorized representative.

§ 2.1.2 The Owner shall furnish to the Contractor within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of or enforce mechanic's lien rights. Such

information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.

## § 2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER

§ 2.2.1 Prior to commencement of the Work, the Contractor may request in writing that the Owner provide reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. Thereafter, the Contractor may only request such evidence if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) a change in the Work materially changes the Contract Sum; or (3) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due. The Owner shall furnish such evidence as a condition precedent to commencement or continuation of the Work or the portion of the Work affected by a material change. After the Owner furnishes the evidence, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

§ 2.2.2 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

§ 2.2.3 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

§ 2.2.4 The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services.

§ 2.2.5 After the Contract is executed by the Executive Director, the Contractor will receive free of charge two bound copies of the Project Manual (Proposal and Contract Documents) (one executed and one blank), and five full-scale copies of the Drawings and two half-scale copies. The Contractor shall have available on the Project Site at all times one copy each of the Contract Drawings and the Project Manual (Proposal).

## § 2.3 OWNER'S RIGHT TO STOP THE WORK

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

## § 2.4 OWNER'S RIGHT TO CARRY OUT THE WORK

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of written notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such deficiencies. In such case an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect or failure. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

## ARTICLE 3 CONTRACTOR

### § 3.1 GENERAL

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express

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authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 The Contractor shall not be relieved of obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

### § 3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed and correlated personal observations with requirements of the Contract Documents.

§ 3.2.2 Because the Contract Documents are complementary and any Work or material called for by either shall be provided as if called for by both, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.2.3, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

§ 3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require.

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall make Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

### § 3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract, unless the Contract Documents give other specific instructions concerning these matters. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences or procedures, the Contractor shall evaluate the jobsite safety thereof and, except as stated below, shall be fully and solely responsible for the jobsite safety of such means, methods, techniques, sequences or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely written notice to the Owner and Architect and shall not proceed with that portion of the Work without further written instructions from the Architect. If the Contractor is then instructed to proceed with the required means, methods, techniques, sequences or procedures without acceptance of changes proposed by the Contractor, the Owner and Professional shall be responsible for any resulting loss or damage.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.



§ 3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

#### § 3.4 LABOR AND MATERIALS

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work. The Owner will furnish utilities for construction (electricity and water). Contractor must use "as-is" or pay for any necessary modifications.

§ 3.4.2 Except in the case of minor changes in the Work authorized by the Architect in accordance with Sections 3.12.8 or 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive.

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

§ 3.4.4 All Work as described or required shall be executed in a neat, skillful manner, in accordance with the best-recognized trade practice. Only competent workmen (including the superintendent), who work and perform their duties satisfactorily shall be employed on the Project. When requested by the Project Engineer, the Contractor shall discharge and shall not re-employ on the Project, any person who commits trespass or who is, in the opinion of the Project Engineer, dangerous, disorderly, insubordinate, incompetent, or otherwise objectionable.

§ 3.4.5 All materials and each part or detail of the Work are subject to inspection by the Project Engineer. Work performed or materials used by the Contractor without supervision, inspection, or written approval by an authorized Department representative may be ordered removed and replaced, at Contractor's expense, if found to be defective or noncompliant with the Contract Documents. No Work shall be performed on Legal Holidays, Sundays or after 5:00 P.M. on week days without prior written approval from the Project Engineer.

#### § 3.5 WARRANTY

The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

#### § 3.6 TAXES

The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

#### § 3.7 PERMITS, FEES, NOTICES AND COMPLIANCE WITH LAWS

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.7.4 **Concealed or Unknown Conditions.** If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature, that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 21 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend an equitable adjustment in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor in writing, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may proceed as provided in Article 15.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

#### § 3.8 ALLOWANCES

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents,

- .1 Allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- .2 Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and
- .3 Whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Supplemental Agreement (Change Order). The amount of the Supplemental Agreement (Change Order) shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

#### § 3.9 SUPERINTENDENT

§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner through the Architect the name and qualifications of a proposed superintendent. The Architect may reply within 14 days to the Contractor in writing stating (1) whether the Owner or the Architect has reasonable objection to the proposed superintendent or (2) that the Architect requires additional time to review. Failure of the Architect to reply within the 14 day period shall constitute notice of no reasonable objection.

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

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### § 3.10 CONTRACTOR'S CONSTRUCTION SCHEDULES

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall prepare and submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall not exceed time limits current under the Contract Documents, shall be revised at appropriate intervals as required by the conditions of the Work and Project, shall be related to the entire Project to the extent required by the Contract Documents, and shall provide for expeditious and practicable execution of the Work.

§ 3.10.2 The Contractor shall prepare a submittal schedule, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, and shall submit the schedule(s) for the Architect's approval. The Architect's approval shall not unreasonably be delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

### § 3.11 DOCUMENTS AND SAMPLES AT THE SITE

The Contractor shall maintain at the site for the Owner one copy of the Drawings, Specifications, Addenda, Change Orders and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and one copy of approved Shop Drawings, Product Data, Samples and similar required submittals. These shall be available to the Architect and shall be delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

### § 3.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier or distributor to illustrate some portion of the Work.

§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

§ 3.12.3 Samples are physical examples that illustrate materials, equipment or workmanship and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples and similar submittals are not Contract Documents. Their purpose is to demonstrate the way by which the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve and submit to the Architect Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of separate contractors.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples or similar submittals until the respective submittal has been approved by the Architect.

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§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples or similar submittals unless the Contractor has specifically informed the Architect in writing of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples or similar submittals by the Architect's approval thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such written notice, the Architect's approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. The Contractor shall not be required to provide professional services in violation of applicable law. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall cause such services or certifications to be provided by a properly licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor all performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review, approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Contractor shall not be responsible for the adequacy of the performance and design criteria specified in the Contract Documents.

### § 3.13 USE OF SITE

The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities and the Contract Documents and shall not unreasonably encumber the site with materials or equipment. The Contractor shall not allow tradesman, technicians and laborers to enter other portions of existing facilities except as predetermined and approved by the Project Engineer. Existing utilities shall not be interrupted unless pre-approved by the Project Engineer. Parking for construction vehicles shall be in areas designated by the Owner at the Pre-construction Conference.

### § 3.14 CUTTING AND PATCHING

§ 3.14.1 The Contractor shall be responsible for cutting, fitting or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting and patching shall be restored to the condition existing prior to the cutting, fitting and patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or separate contractors by cutting, patching or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter such construction by the Owner or a separate contractor except with written consent of the Owner and of such separate contractor; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the Owner or a separate contractor the Contractor's consent to cutting or otherwise altering the Work.

### § 3.15 CLEANING UP

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials or rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery and surplus materials from and about the Project.

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§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and Owner shall be entitled to reimbursement from the Contractor.

#### § 3.16 ACCESS TO WORK

The Contractor shall provide the Owner and Architect access to the Work in preparation and progress wherever located.

#### § 3.17 ROYALTIES, PATENTS AND COPYRIGHTS

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for such defense or loss when a particular design, process or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications or other documents prepared by the Owner or Architect. However, if the Contractor has reason to believe that the required design, process or product is an infringement of a copyright or a patent, the Contractor shall be responsible for such loss unless such information is promptly furnished to the Architect.

#### § 3.18 INDEMNIFICATION

§ 3.18.1 To the fullest extent permitted by law the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18. The Contractor agrees to defend, hold harmless and indemnify the Owner against all claims or demands caused by the Contractor's acts or omissions.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts or other employee benefit acts.

### ARTICLE 4 ARCHITECT

#### § 4.1 GENERAL

§ 4.1.1 The Owner shall retain an architect lawfully licensed to practice architecture or an entity lawfully practicing architecture in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

§ 4.1.2 Duties, responsibilities and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified or extended without written consent of the Owner, Contractor and Architect. Consent shall not be unreasonably withheld.

§ 4.1.3 If the employment of the Architect is terminated, the Owner shall employ a successor architect as to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect.

§ 4.1.4 The term "Architect," "Engineer," "Professional", or "Consultant" as used in these Documents refers to the Professional firm who has been directed by the Owner to design, provide Construction Documents and Construction Administration for this Project. These Consultants are advisors to the Project Engineer and MDOT Architect.

§ 4.1.5 The term "Project Engineer" as used in these Documents refers to the Mississippi Department of Transportation Executive Director's authorized representative. The Project Engineer shall be the Initial Decision Maker referenced in Article 15. The term "MDOT Architect" is the representative for the MDOT Architectural Services Unit and is an advisor to the Project Engineer.

## § 4.2 ADMINISTRATION OF THE CONTRACT

§ 4.2.1 The Architect will provide assistance to the Project Engineer and MDOT Architect for administration of the Contract as described in the Contract Documents and will be the Project Engineer's representative during construction until the date the Project Engineer issues the final Certificate for Payment. The Architect will have authority to act on behalf of the Project Engineer only to the extent provided in the Contract Documents.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Project Engineer, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for, the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents, except as provided in Section 3.3.1.

§ 4.2.3 On the basis of the site visits, the Architect will keep the Project Engineer reasonably informed about the progress and quality of the portion of the Work completed, and report to the Project Engineer (1) known deviations from the Contract Documents and from the most recent construction schedule submitted by the Contractor, and (2) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of and will not be responsible for acts or omissions of the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

## § 4.2.4 COMMUNICATIONS FACILITATING CONTRACT ADMINISTRATION

Except as otherwise provided in the Contract Documents or when direct communications have been specially authorized, the Architect and Contractor shall endeavor to communicate with each other through the Project Engineer about matters arising out of or relating to the Contract. Communications by and with the Architect's consultants shall be through the Architect to the MDOT Architect and Project Engineer. Communications by and with Subcontractors and material suppliers shall be through the Contractor. Communications by and with separate contractors shall be through the Project Engineer.

§ 4.2.5 Based on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and the Project Engineer will prepare State Estimates for Payment in such amounts.

§ 4.2.6 The Architect shall advise the Project Engineer to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will advise the Project Engineer to require inspection or testing of the Work in accordance with Sections 13.5.2 and 13.5.3, whether or not such Work is fabricated, installed or completed. However, neither this recommendation of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, material and equipment suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5 and 3.12. The Architect's review shall not constitute approval of safety precautions or, unless otherwise specifically stated by the Architect, of any construction means, methods, techniques, sequences or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

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§ 4.2.8 The Project Engineer, with recommendations from the Architect, will prepare Supplemental Agreements (Change Orders) and Advanced Authority (Construction Change Directives), and may authorize minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.9 The Project Engineer, MDOT Architect, and Architect will conduct inspections to determine the date or dates of Completion; determine Final Acceptance; receive and forward to the Project Engineer, for review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 If the Project Engineer and Architect agree, the Architect will provide one or more project representatives to assist in carrying out the Architect's responsibilities at the site. The duties, responsibilities and limitations of authority of such project representatives shall be as set forth in an exhibit to be incorporated in the Contract Documents.

§ 4.2.11 The Architect will interpret and recommend matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either and will not be liable for results of interpretations or decisions rendered in good faith.

§ 4.2.13 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

## ARTICLE 5 SUBCONTRACTORS

### § 5.1 DEFINITIONS

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a separate contractor or subcontractors of a separate contractor.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

### § 5.2 AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK

§ 5.2.1 Unless otherwise stated in the Contract Documents or the bidding requirements, the Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner through the Architect the names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for each principal portion of the Work. The Architect may reply within 14 days to the Contractor in writing stating (1) whether the Owner or the Architect has reasonable objection to any such proposed person or entity or (2) that the Architect requires additional time for review. Failure of the Owner or Architect to reply within the 14-day period shall constitute notice of no reasonable objection.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person or entity previously selected if the Owner or Architect makes reasonable objection to such substitution.

### § 5.3 SUBCONTRACTUAL RELATIONS

By appropriate agreement, written where legally required for validity, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work, which the Contractor, by these Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

### § 5.4 CONTINGENT ASSIGNMENT OF SUBCONTRACTS

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

- .1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor in writing; and
- .2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

§ 5.4.3 Upon such assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

## ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

### § 6.1 OWNER'S RIGHT TO PERFORM CONSTRUCTION AND TO AWARD SEPARATE CONTRACTS

§ 6.1.1 The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces and to award separate Contracts either in connection with other portions of the Project or other construction or operation on the site. In such event, the Contractor shall coordinate its activities with those of the Owner and of other Contractors so as to facilitate the general progress of all work being performed by all parties. Cooperation will be required in the arrangement for the storage of materials, and in the detailed execution of the work.

§ 6.1.2 The Contractor, including his subcontractors, shall keep informed of the progress and the detailed work of the Owner or other Contractors and shall immediately notify the Project Engineer and Architect of lack of progress or

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delays by other Contractors which are affecting Contractor's Work. Failure of Contractor to keep informed of the progress of the work of the Owner or other Contractors and / or failure of Contractor to give notice of lack of progress or delays by the Owner or other Contractors shall be deemed to be acceptance by Contractor of the status of progress by other Contractors for the proper coordination and completion of Contractor's Work. If, through acts or neglect on the part of the Contractor, the Owner or any other Contractor or subcontractor shall suffer loss or damage or assert any claims of whatever nature against the Owner, the Contractor shall defend, indemnify and hold harmless the Owner from any such claims or alleged damages, and the Contractor shall resolve such alleged damages or claims directly with the other Contractors or subcontractors.

§ 6.1.3 The Owner shall provide for coordination of the activities of the separate contractors with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with other separate contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to the construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, separate contractors and the Owner until subsequently revised.

*(Paragraph deleted)*

#### § 6.2 MUTUAL RESPONSIBILITY

§ 6.2.1 The Contractor shall afford the Owner and separate contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a separate contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly report to the Architect apparent discrepancies or defects in such other construction that would render it unsuitable for such proper execution and results. Failure of the Contractor so to report shall constitute an acknowledgment that the Owner's or separate contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work, except as to defects not then reasonably discoverable.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a separate contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a separate contractor's delays, improperly timed activities, damage to the Work or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or separate contractors as provided in Section 10.2.5.

§ 6.2.5 The Owner and each separate contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

#### § 6.3 OWNER'S RIGHT TO CLEAN UP

If a dispute arises among the Contractor, separate contractors and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

### ARTICLE 7 CHANGES IN THE WORK

#### § 7.1 GENERAL

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Supplemental Agreement (Change Order), Advance Authority (Construction Change Directive) or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Supplemental Agreement (Change Order) shall be based upon agreement among the Owner, Contractor and Architect; a Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor; an order for a minor change in the Work may be issued by the Project Engineer.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents, and the Contractor shall proceed promptly, unless otherwise provided in the Supplemental Agreement (Change Order), Advance Authority (Construction Change Directive) or order for a minor change in the Work.

**§ 7.2 SUPPLEMENTAL AGREEMENT (CHANGE ORDERS)**

§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor and Architect stating their agreement upon all of the following:

- .1 The change in the Work;
- .2 The amount of the adjustment, if any, in the Contract Sum; and
- .3 The extent of the adjustment, if any, in the Contract Time.

§ 7.2.2 The maximum cost included in a Supplemental Agreement (Change Order) for profit and overhead is limited to twenty percent (20%) of the total of the actual cost for materials, labor and subcontracts. Profit and overhead include: all taxes, fees, permits, insurance, bond, job superintendent, job and home office expense. All Subcontractors shall comply passively without protest to the same requirements when participating in a Supplemental Agreement (Change Order).

**§ 7.3 ADVANCE AUTHORITY (CONSTRUCTION CHANGE DIRECTIVES)**

§ 7.3.1 Advance Authority (Construction Change Directive) is a written order prepared and signed by the Project Engineer, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Project Engineer may by Advance Authority (Construction Change Directive), without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used as Advanced Authority on changes to the Work where agreement has been reached prior to preparation of Supplemental Agreement (Change Order).

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

- .1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- .2 Unit prices stated in the Contract Documents or subsequently agreed upon;
- .3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
- .4 As provided in Section 7.3.7.

§ 7.3.4 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed in a proposed Change Order or Construction Change Directive so that application of such unit prices to quantities of Work proposed will cause substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 7.3.5 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.6 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.7 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the method and the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.7 shall be limited to the following:

- .1 Costs of labor, including social security, old age and unemployment insurance, fringe benefits required by agreement or custom, and workers' compensation insurance;
- .2 Costs of materials, supplies and equipment, including cost of transportation, whether incorporated or consumed;
- .3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;
- .4 Costs of premiums for all bonds and insurance, permit fees, and sales, use or similar taxes related to the Work; and
- .5 Additional costs of supervision and field office personnel directly attributable to the change.

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

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Project Engineer will prepare a Supplemental Agreement (Change Order). Supplemental Agreements (Change Orders) shall be issued for all or any part of an Advance Authority (Construction Change Directive).

#### § 7.4 MINOR CHANGES IN THE WORK

The Architect has authority to order minor changes in the Work not involving adjustment in the Contract Sum or extension of the Contract Time and not inconsistent with the intent of the Contract Documents. Such changes will be effected by written order signed by the Architect and shall be binding on the Owner and Contractor.

### ARTICLE 8 TIME

#### § 8.1 DEFINITIONS

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Completion is the date certified by the Project Engineer and approved by the Owner in accordance with Section 9.8.

§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

#### § 8.2 PROGRESS AND COMPLETION

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, prematurely commence operations on the site or elsewhere prior to the effective date of insurance required by Article 11 to be furnished by the Contractor and Owner. The date of commencement of the Work shall not be changed by the effective date of such insurance.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

**§ 8.3 DELAYS AND EXTENSIONS OF TIME**

**§ 8.3.1** If the Contractor is delayed at any time in the commencement or progress of the Work by any act of neglect of the Owner or Project Engineer, or by any employee or either, or by changes ordered in the Work, or by labor disputes, fire, unusual delay in deliveries, unavoidable casualties or any causes beyond the Contractor's control, or by any other causes which the Project Engineer determines may justify the delay, then the Contract time may be extended by Change Order for such reasonable time as the Project Engineer may determine, subject to the Owner's approval. The Contractor's sole and exclusive right and remedy for delay by any cause whatsoever is an extension of the Contract Time but no increase in the Contract Sum. Any claim for loss or any delay occasioned by any separate Contractor, or Subcontractor, shall be settled between the Contractor and such other separate Contractor, or Subcontractors.

**§ 8.3.2** No delay, interference, hindrance or disruption, from whatever source or cause, in the progress of the Contractor's Work shall be a basis for an extension of time unless the delay, interference hindrance or disruption is (1) without the fault and not the responsibility of the Contractor, its subcontractors and suppliers and (2) directly affects the overall completion of the Work as reflected on the critical path of the updated Construction Schedule. The contractor expressly agrees that the Owner shall have the benefit of any float in the construction schedule and delay in construction activities which do not affect the overall completion of the work does not entitle the Contractor to any extension in the Contract Time. **§ 8.3.3** This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

*(Paragraph deleted)*

**§ 8.3.4** This provision specifies the procedure for the determination of time extensions for unusually severe weather. In order for the Owner and Architect to award a time extension under this clause, the following conditions must be satisfied:

1. The weather experienced at the project site during the contract period must be found to be unusually severe, that is, more severe than the adverse weather anticipated for the project location during any given month.
2. The unusually severe weather must actually cause a delay in the completion of the project. The delay must be beyond the control and without the fault or negligence of the Contractor.

**§ 8.3.5** The following schedule of monthly anticipated adverse weather delays is based on National Oceanic and Atmospheric Administration (NOAA) or similar data for the project location and will constitute the base line for monthly weather time evaluations. The Contractor's activity durations for inclusion in the progress schedule must reflect these anticipated adverse weather delays in all weather dependent activities.

1. Adverse Weather Evaluation: The table below defines the monthly anticipated adverse weather in days for the project:

Adverse Weather Table

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
10	9	9	8	9	8	10	9	7	6	8	9

**§ 8.3.6** Monthly anticipated adverse weather delay work days based on five (5) day work week.

**§ 8.3.7** Upon acknowledgement of the Notice to Proceed (NTP) and continuing throughout the contract, the Contractor shall record on the daily report, the occurrence of adverse weather and resultant impact to normally scheduled work. Actual adverse weather delay days must prevent work on the overall projects' critical activities for 50 percent or more of the contractor's scheduled workday. The number of actual adverse weather days shall include days impacted by actually adverse weather (even if adverse weather occurred in previous month), be calculated chronologically from the first to the last day of each month and be recorded as full days. If the number of actual adverse weather delay days exceeds the number of days anticipated in paragraph 8.3.5 above, the Owner and the Architect will convert any qualifying delays to calendar days giving full consideration for equivalent fair weather work days, and issue a modification in accordance with the contract.

## ARTICLE 9 PAYMENTS AND COMPLETION

### § 9.1 CONTRACT SUM

The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

### § 9.2 SCHEDULE OF VALUES

Where the Contract is based on a stipulated sum, the Contractor shall submit to the Architect, before the first Application for Payment, a schedule of values allocating the entire Contract Sum to the various portions of the Work and prepared in such form and supported by such data to substantiate its accuracy as the Architect may require. This schedule, unless objected to by the Architect, MDOT Architect, or Project Engineer, shall be used as a basis for reviewing the Contractor's Applications for Payment.

### § 9.3 APPLICATIONS FOR PAYMENT

§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. Such application shall be notarized, if required, and supported by such data substantiating the Contractor's right to payment as the Owner or Architect may require, such as copies of requisitions from Subcontractors and material suppliers, and shall reflect retainage if provided for in the Contract Documents. The form of Application for Payment will be AIA Document G702, Application and Certification for Payment, supported by AIA Document G703, Continuation Sheet, or a computer generated form containing similar data.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or material supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.1.3 The Owner will retain five percent (5%) until the Work is at least fifty percent (50%) complete, on schedule, and satisfactory in the Project Engineer's opinion, at which time fifty percent (50%) of the retainage held to date shall be returned to the Contractor for distribution to the appropriate Sub-Contractors and Suppliers. Future retainage shall be withheld at the rate of two and one half percent (2-1/2%) of the amount due the Contractor on account of progress payments.

§ 9.3.1.4 The Contractor must submit each month with this Application for Payment a separate letter stating that he is requesting an extension of time or that he had no need for an extension for that period of time. No payment on a monthly application will be made until the letter is received. Complete justification such as weather reports or other pertinent correspondence must be included for each day's request for extension. A Contractor's letter, or statement, will not be considered as adequate justification. The receipt of this request and data by the Owner will not be considered as Owner approval in any way.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage and transportation to the site for such materials and equipment stored off the site.

§ 9.3.2.1 Payment on materials stored at some location other than the building site, may be approved by the Project Engineer and the Owner after the Contractor has submitted the following items:

- .1 An acceptable Lease Agreement between the General Contractor and the owner of the land, or building, where the materials are located.
- .2 Consent of Surety, or other acceptable Bond, to cover the materials stored off-site.
- .3 All Perils Insurance coverage for the full value of the materials stored off-site.

- .4 A Bill of Sale from the Manufacturer to the General Contractor for the stored materials.
- .5 A complete list and inventory of materials manufactured, stored and delivered to the storage site and of materials removed from the storage site and delivered to the job site.
- .6 A review by the Project Engineer of the materials stored off-site prior to release of payment.
- .7 Guarantee no storage costs, additional delivery fees, or subsequent costs to the Owner.
- .8 List of stored items shall be sent to the Chief Engineer for his approval prior to payment of stored materials.

§ 9.3.2.2 Payment for materials stored at the building site, may be approved by the Project Engineer and the Owner after the Contractor has submitted the following items:

- .1 A Bill of Sale from the Manufacturer to the General Contractor for the stored materials.
- .2 List of stored items shall be sent to the Chief Engineer for his approval prior to payment of stored materials.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information and belief, be free and clear of liens, claims, security interests or encumbrances in favor of the Contractor, Subcontractors, material suppliers, or other persons or entities making a claim by reason of having provided labor, materials and equipment relating to the Work.

#### § 9.4 CERTIFICATES FOR PAYMENT

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either recommend acceptance or state what portions should be modified to the Project Engineer for such amount as the Architect determines is properly due, or notify the Contractor and Project Engineer in writing of the Architect's reasons for modifications in whole or in part as provided in Section 9.5.1.

§ 9.4.2 The recommendations for Payment will constitute a representation by the Architect to the Project Engineer, based on the Architect's evaluation of the Work and the data comprising the Application for Payment, that, to the best of the Architect's knowledge, information and belief, the Work has progressed to the point indicated and that the quality of the Work is in accordance with the Contract Documents. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Date of Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion and to specific qualifications expressed by the Architect. The recommendations for Payment will further constitute a representation that the Contractor is entitled to payment in the amount recommended. However, the recommendations for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work, (2) reviewed construction means, methods, techniques, sequences or procedures, (3) reviewed copies of requisitions received from Subcontractors and material suppliers and other data requested by the Owner to substantiate the Contractor's right to payment, or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

#### § 9.5 DECISIONS TO WITHHOLD CERTIFICATION

§ 9.5.1 The Architect may recommend to withhold Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to recommend payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly make recommendation for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also make recommendations to withhold Payment or, because of subsequently discovered evidence, may make recommendations to nullify the whole or a part of a Payment previously made, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

- .1 defective Work not remedied;
- .2 third party claims filed or reasonable evidence indicating probable filing of such claims unless security acceptable to the Owner is provided by the Contractor;
- .3 failure of the Contractor to make payments properly to Subcontractors or for labor, materials or equipment;



- .4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- .5 damage to the Owner or a separate contractor;
- .6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
- .7 repeated failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When the above reasons for recommendations to withhold Payment are removed, recommendations will be made for amounts previously withheld.

*(Paragraph deleted)*

#### § 9.6 PROGRESS PAYMENTS

§ 9.6.1 After the Architect has reviewed the Application for Payment and made recommendations to the Project Engineer, the Project Engineer shall make payment in the manner and within the time provided in the Contract Documents.

§ 9.6.2 The Contractor shall pay each Subcontractor no later than seven days after receipt of payment from the Owner the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and material and equipment suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay or to see to the payment of money to a Subcontractor, except as may otherwise be required by law.

§ 9.6.5 Contractor payments to material and equipment suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors and suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, shall create any fiduciary liability or tort liability on the part of the Contractor for breach of trust or shall entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.6.8 The amount retained by the Contractor from each payment to each Subcontractor and material supplier will not exceed the percentage retained by the Owner from the Contractor

#### § 9.7 FAILURE OF PAYMENT

The Contractor and the Owner shall be subject to the remedies as prescribed in Section 31-5-25 of the Mississippi Code 1972, Annotated.

#### 9.8 SUBSTANTIAL COMPLETION

*(Paragraph deleted)*

§ 9.8.1 Substantial Completion shall not be recognized under this Contract. The Project Engineer shall determine when the building or designated portion is complete to the point it can be used for its intended purpose and occupied. This date shall be the Date of Completion. All Warranties and Extended Warranties shall use this date as the starting date of Warranty Period.

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§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion, shall establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance, and shall fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in such Certificate. Upon such acceptance and consent of surety, if any, the Owner shall make payment of retainage applying to such Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

#### § 9.9 PARTIAL OCCUPANCY OR USE

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer as required under Section 11.3.1.5 and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

#### § 9.10 FINAL COMPLETION AND FINAL PAYMENT

§ 9.10.1 Upon receipt of the Contractor's written notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection and, when the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with terms and conditions of the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.



§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner, (3) a written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment and (5), if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien. If such lien remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees.

§ 9.10.3 If, after Date of Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and agreement by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to agreement of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

- .1 liens, Claims, security interests or encumbrances arising out of the Contract and unsettled;
- .2 failure of the Work to comply with the requirements of the Contract Documents; or
- .3 terms of special warranties required by the Contract Documents.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor or material supplier shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

**§ 9.11 LIQUIDATED DAMAGES**

§ 9.11.1 Time being of the essence and a matter of material consideration thereof, a reasonable estimate in advance is established to cover losses incurred by the Owner if the project is not substantially complete on the date set forth in the Contract Documents. The Contractor and his Surety will be liable for and will pay the Owner liquidated damages for each calendar day of delay until the work is substantially complete as follows:

For More Than	To and Including	Per Calendar Day
\$ 0	\$ 100,000	\$ 140
100,000	500,000	200
500,000	1,000,000	300
1,000,000	2,000,000	400
2,000,000	5,000,000	650
5,000,000	10,000,000	750
10,000,000	-----	1,400

**ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY**

**§ 10.1 SAFETY PRECAUTIONS AND PROGRAMS**

The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the Contract.

**§ 10.2 SAFETY OF PERSONS AND PROPERTY**

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury or loss to

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- .1 employees on the Work and other persons who may be affected thereby;
- .2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody or control of the Contractor or the Contractor's Subcontractors or Sub-subcontractors; and
- .3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

§ 10.2.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities bearing on safety of persons or property or their protection from damage, injury or loss.

§ 10.2.3 The Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent sites and utilities.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3, except damage or loss attributable to acts or omissions of the Owner or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, or the Project Engineer and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

**§ 10.2.8 INJURY OR DAMAGE TO PERSON OR PROPERTY**

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, written notice of such injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

**§ 10.3 HAZARDOUS MATERIALS**

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and report the condition to the Owner and Architect in writing.

*(Paragraphs deleted)*

**§ 10.4 EMERGENCIES**

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 15 and Article 7.

**ARTICLE 11 INSURANCE AND BONDS**

**§ 11.1 CONTRACTOR'S LIABILITY INSURANCE**

§ 11.1.1 The Contractor shall purchase from and maintain in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located such insurance as will protect the Contractor from claims set forth below which may arise out of or result from the Contractor's operations and completed operations under the Contract and for which the Contractor may be legally liable, whether such operations be by the Contractor or by a Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

- .1 Claims under workers' compensation, disability benefit and other similar employee benefit acts that are applicable to the Work to be performed;
- .2 Claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor's employees;
- .3 Claims for damages because of bodily injury, sickness or disease, or death of any person other than the Contractor's employees;
- .4 Claims for damages insured by usual personal injury liability coverage;
- .5 Claims for damages, other than to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom;
- .6 Claims for damages because of bodily injury, death of a person or property damage arising out of ownership, maintenance or use of a motor vehicle;
- .7 Claims for bodily injury or property damage arising out of completed operations; and
- .8 Claims involving contractual liability insurance applicable to the Contractor's obligations under Section 3.18.

§ 11.1.2 The insurance required by Section 11.1.1 shall be written for not less than limits of liability specified in the Contract Documents or required by law, whichever coverage is greater. Coverages, whether written on an occurrence or claims-made basis, shall be maintained without interruption from the date of commencement of the Work until the date of final payment and termination of any coverage required to be maintained after final payment, and, with respect to the Contractor's completed operations coverage, until the expiration of the period for correction of Work or for such other period for maintenance of completed operations coverage as specified in the Contract Documents.

§ 11.1.3 Certificates of insurance acceptable to the Owner shall be filed with the Owner prior to commencement of the Work and thereafter upon renewal or replacement of each required policy of insurance. These certificates and the insurance policies required by this Section 11.1 shall contain a provision that coverages afforded under the policies will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner. An additional certificate evidencing continuation of liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment as required by Section 9.10.2 and thereafter upon renewal or replacement of such coverage until the expiration of the time required by Section 11.1.2. Information concerning reduction of coverage on account of revised limits or claims paid under the General Aggregate, or both, shall be furnished by the Contractor with reasonable promptness.

§ 11.1.4 The Contractor shall cause the commercial liability coverage required by the Contract Documents to include (1) the Owner, the Architect and the Architect's consultants as additional insureds for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's operations; and (2) the Owner as an additional insured for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's completed operations.

§ 11.1.5 The Contractor's limits of liability shall be written for not less than the following:

.1 <b>GENERAL LIABILITY:</b>		
Commercial General Liability		
(Including XCU)		
General Aggregate.....	\$ 1,000,000.00	Aggregate
Products & Completed Operations.....	\$ 1,000,000.00	Aggregate
Personal & Advertising Injury.....	\$ 500,000.00	Per Occurrence
Bodily Injury & Property Damage.....	\$ 500,000.00	Per Occurrence
Fire Damage Liability.....	\$ 50,000.00	Per Fire
Medical Expense.....	\$ 5,000.00	Per Person

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- .2 **OWNERS & CONTRACTORS PROTECTIVE LIABILITY:**  
 Bodily Injury & Property Damage.....\$ 1,000,000.00 Aggregate  
 Bodily Injury & Property Damage.....\$ 500,000.00 Per Occurrence
- .3 **AUTOMOBILE LIABILITY:**  
 (Owned, Non-owned & Hired Vehicle  
 Contractor Insurance Option Number 1:  
 Bodily Injury & Property Damage.....\$ 500,000.00 Per Occurrence  
 (Combined Single Limit)  
 Contractor Insurance Option Number 2:  
 Bodily Injury.....\$ 250,000.00 Per Person  
 Bodily Injury.....\$ 500,000.00 Per Accident  
 Property Damage.....\$ 100,000.00 Per Occurrence
- .4 **EXCESS LIABILITY:**  
 (Umbrella on projects over \$500,000)  
 Bodily Injury & Property Damage .....\$ 1,000,000.00 Aggregate  
 (Combined Single Limit)
- .5 **WORKERS' COMPENSATION:**  
 (As required by Statute)  
**EMPLOYERS' LIABILITY:**  
 Accident .....\$ 100,000.00 Per Occurrence  
 Disease .....\$ 500,000.00 Policy Limit  
 Disease .....\$ 100,000.00 Per Employee
- .6 **PROPERTY INSURANCE:**  
 Builder's Risk.....\$ Equal to Value of Work  
 Or  
 Installation Floater.....\$ Equal to Value of Work

§ 11.1.6 Furnish one (1) copy of the Standard Construction Contract Certificate of Insurance Form for each copy of the Standard Form of Agreement Between Owner and Contractor specifically setting forth evidence of all coverage required by Subparagraphs 11.1.1, 11.1.2 and 11.1.3. Furnish to the Owner copies of any endorsements that are subsequently issued amending limits of coverage.

§ 11.1.7 If the coverages are provided on a claims-made basis, the policy date or retroactive date shall predate the Contract: the termination date, or the policy, or applicable extended reporting period shall be no earlier than the termination date of coverages required to be maintained after final payment.

**§ 11.2 OWNER'S LIABILITY INSURANCE**

The Contractor shall purchase and maintain such insurance as will protect the Owner from his contingent liability to others for damages because of bodily injury, including death, and property damage, which may arise from operations under this Contract and other liability for damages which the Contractor is required to insure under any provision of this Contract. Certificate of this insurance will be filed with the Owner and will be the same limits set forth in 11.1.4.

**§ 11.3 PROPERTY INSURANCE**

§ 11.3.1 The Contractor shall purchase and maintain, in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located, property insurance written on a builder's risk "all-risk" or equivalent policy form in the amount of the initial Contract Sum, plus value of subsequent Contract Modifications and cost of materials supplied or installed by others, comprising total value for the entire Project at the site on a replacement cost basis without optional deductibles. Such property insurance shall be maintained, unless otherwise provided in the Contract Documents or otherwise agreed in writing by all persons and entities who are beneficiaries of such insurance, until final payment has been made as provided in Section 9.10 or until no person or entity other than the Owner has an insurable interest in the property required by this Section 11.3 to be covered, whichever is later. This insurance shall include interests of the Owner, the Contractor, Subcontractors and Sub-subcontractors in the Project.

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§ 11.3.1.1 Property insurance shall be on an "all-risk" or equivalent policy form and shall include, without limitation, insurance against the perils of fire (with extended coverage) and physical loss or damage including, without duplication of coverage, theft, vandalism, malicious mischief, collapse, earthquake, flood, windstorm, falsework, testing and startup, temporary buildings and debris removal including demolition occasioned by enforcement of any applicable legal requirements, and shall cover reasonable compensation for Architect's and Contractor's services and expenses required as a result of such insured loss.

*(Paragraph deleted)*

§ 11.3.1.3 If the property insurance requires deductibles, the Contractor shall pay costs not covered because of such deductibles.

§ 11.3.1.4 This property insurance shall cover portions of the Work stored off the site, and also portions of the Work in transit.

§ 11.3.1.5 Partial occupancy or use in accordance with Section 9.9 shall not commence until the insurance company or companies providing property insurance have consented to such partial occupancy or use by endorsement or otherwise. The Owner and the Contractor shall take reasonable steps to obtain consent of the insurance company or companies and shall, without mutual written consent, take no action with respect to partial occupancy or use that would cause cancellation, lapse or reduction of insurance.

*(Paragraphs deleted)*

#### § 11.3.7 WAIVERS OF SUBROGATION

The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents and employees, each of the other, and (2) the Architect, Architect's consultants, separate contractors described in Article 6, if any, and any of their subcontractors, sub-subcontractors, agents and employees, for damages caused by fire or other causes of loss to the extent covered by property insurance obtained pursuant to this Section 11.3 or other property insurance applicable to the Work, except such rights as they have to proceeds of such insurance held by the Owner as fiduciary. The Owner or Contractor, as appropriate, shall require of the Architect, Architect's consultants, separate contractors described in Article 6, if any, and the subcontractors, sub-subcontractors, agents and employees of any of them, by appropriate agreements, written where legally required for validity, similar waivers each in favor of other parties enumerated herein. The policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective as to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the insurance premium directly or indirectly, and whether or not the person or entity had an insurable interest in the property damaged.

§ 11.3.8 A loss insured under the Owner's property insurance shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.3.10. The Contractor shall pay Subcontractors their just shares of insurance proceeds received by the Contractor, and by appropriate agreements, written where legally required for validity, shall require Subcontractors to make payments to their Sub-subcontractors in similar manner.

§ 11.3.9 If required in writing by a party in interest, the Owner as fiduciary shall, upon occurrence of an insured loss, give bond for proper performance of the Owner's duties. The cost of required bonds shall be charged against proceeds received as fiduciary. The Owner shall deposit in a separate account proceeds so received, which the Owner shall distribute in accordance with such agreement as the parties in interest may reach, or as determined in accordance with the method of binding dispute resolution selected in the Agreement between the Owner and Contractor. If after such loss no other special agreement is made and unless the Owner terminates the Contract for convenience, replacement of damaged property shall be performed by the Contractor after notification of a Change in the Work in accordance with Article 7.

§ 11.3.10 The Owner as fiduciary shall have power to adjust and settle a loss with insurers unless one of the parties in interest shall object in writing within five (5) days after occurrence of loss

#### § 11.4 PERFORMANCE BOND AND PAYMENT BOND

§ 11.4.1 The Owner shall have the right to require the Contractor to furnish bonds covering faithful performance of the Contract and payment of obligations arising thereunder as stipulated in bidding requirements or specifically required in the Contract Documents on the date of execution of the Contract.

§ 11.4.2 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

#### ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

##### § 12.1 UNCOVERING OF WORK

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, costs of uncovering and replacement shall, by appropriate Change Order, be at the Owner's expense. If such Work is not in accordance with the Contract Documents, such costs and the cost of correction shall be at the Contractor's expense unless the condition was caused by the Owner or a separate contractor in which event the Owner shall be responsible for payment of such costs.

##### § 12.2 CORRECTION OF WORK

###### § 12.2.1 BEFORE OR AFTER DATE OF COMPLETION

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, whether discovered before or after Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

###### § 12.2.2 AFTER DATE OF COMPLETION

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of an applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.4.

§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Date of Completion by the period of time between Date of Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction, whether completed or partially completed, of the Owner or separate contractors caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

#### § 12.3 ACCEPTANCE OF NONCONFORMING WORK

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

### ARTICLE 13 MISCELLANEOUS PROVISIONS

#### § 13.1 GOVERNING LAW

The Contract shall be governed by the law of the place where the Project is located except that, if the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

#### § 13.2 SUCCESSORS AND ASSIGNS

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns and legal representatives to covenants, agreements and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make such an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate such assignment.

#### § 13.3 WRITTEN NOTICE

Written notice shall be deemed to have been duly served if delivered in person to the individual, to a member of the firm or entity, or to an officer of the corporation for which it was intended; or if delivered at, or sent by registered or certified mail or by courier service providing proof of delivery to, the last business address known to the party giving notice.

#### § 13.4 RIGHTS AND REMEDIES

§ 13.4.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights and remedies otherwise imposed or available by law.

§ 13.4.2 No action or failure to act by the Owner, Architect or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach there under, except as may be specifically agreed in writing.

#### § 13.5 TESTS AND INSPECTIONS

§ 13.5.1 Tests, inspections and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of (1) tests, inspections or approvals that do not become requirements until after bids are received or negotiations concluded, and (2) tests, inspections or approvals where building codes or applicable laws or regulations prohibit the Owner from delegating their cost to the Contractor.

§ 13.5.2 If the Architect, Owner or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection or approval not included under Section 13.5.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection or

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approval by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.5.3, shall be at the Owner's expense.

§ 13.5.3 If such procedures for testing, inspection or approval under Sections 13.5.1 and 13.5.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure including those of repeated procedures and compensation for the Architect's services and expenses shall be at the Contractor's expense.

§ 13.5.4 Required certificates of testing, inspection or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

§ 13.5.5 If the Architect is to observe tests, inspections or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.5.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

#### § 13.6 INTEREST

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at such rate as the parties may agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

#### § 13.7 TIME LIMITS ON CLAIMS

The Owner and Contractor shall commence all claims and causes of action, whether in contract, tort, breach of warranty or otherwise, against the other arising out of or related to the Contract in accordance with the requirements of the final dispute resolution method selected in the Agreement within the time period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all claims and causes of action not commenced in accordance with this Section 13.7.

### ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

#### § 14.1 TERMINATION BY THE CONTRACTOR

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, for any of the following reasons:

- .1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- .2 An act of government, such as a declaration of national emergency that requires all Work to be stopped;
- .3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- .4 The Owner has failed to furnish to the Contractor promptly, upon the Contractor's request, reasonable evidence as required by Section 2.2.1.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, repeated suspensions, delays or interruptions of the entire Work by the Owner as described in Section 14.3 constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' written notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, including reasonable overhead and profit, costs incurred by reason of such termination, and damages.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor or a Subcontractor or their agents or employees or any other persons performing portions of the Work under contract with

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the Contractor because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' written notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

#### § 14.2 TERMINATION BY THE OWNER FOR CAUSE

§ 14.2.1 The Owner may terminate the Contract if the Contractor

- .1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials;
- .2 fails to make payment to Subcontractors for materials or labor in accordance with the respective agreements between the Contractor and the Subcontractors;
- .3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
- .4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the above reasons exist, the Owner, upon certification by the Initial Decision Maker that sufficient cause exists to justify such action, may without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' written notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

- .1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- .2 Accept assignment of subcontracts pursuant to Section 5.4; and
- .3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

#### § 14.3 SUSPENSION BY THE OWNER FOR CONVENIENCE

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Time shall be adjusted for increases in the time caused by suspension, delay or interruption as described in Section 14.3.1. No adjustment shall be made to the extent

- .1 that performance is, was or would have been so suspended, delayed or interrupted by another cause for which the Contractor is responsible; or
- .2 that an equitable adjustment is made or denied under another provision of the Contract.

#### § 14.4 TERMINATION BY THE OWNER FOR CONVENIENCE

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of written notice from the Owner of such termination for the Owner's convenience, the Contractor shall

- .1 cease operations as directed by the Owner in the notice;
- .2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and
- .3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner's convenience, the Contractor shall be entitled to receive payment for Work executed, and costs incurred by reason of such termination, along with reasonable overhead and profit on the Work not executed.

## ARTICLE 15 CLAIMS AND DISPUTES

### § 15.1 CLAIMS

#### § 15.1.1 DEFINITION

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim.

#### § 15.1.2 NOTICE OF CLAIMS

Claims by either the Owner or Contractor must be initiated by written notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party must be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

#### § 15.1.3 CONTINUING CONTRACT PERFORMANCE

Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents. The Architect will prepare Change Orders and issue Certificates for Payment in accordance with the decisions of the Initial Decision Maker.

#### § 15.1.4 CLAIMS FOR ADDITIONAL COST

If the Contractor wishes to make a Claim for an increase in the Contract Sum, written notice as provided herein shall be given before proceeding to execute the Work. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

#### § 15.1.5 CLAIMS FOR ADDITIONAL TIME

§ 15.1.5.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, written notice as provided herein shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

#### § 15.1.5.2 ADVERSE WEATHER DELAYS

- 1 The Contractor shall anticipate delays in the progress of the Work, due to adverse weather, during the stipulated Contract Time in the amount of days published in recognized official data. If documented evidence (from recognized official data) indicates weather delays in excess of this amount, then the Contractor may be granted an Extension of Time for each Work Day, in excess of the normal days, in which the weather prevented work on the Project Site for fifty (50) percent or more of the Contractor's "Normal Work Day", but only if such prevented work was critical to the timely completion of the project.
- 2 Contractor's "Normal Work Day" shall be defined on the basis of a five (5) Day Work Week. Example: If the "normal" (regular) schedule is a five (5) Day Work Week, meaning Monday through Friday, then a rain on Sunday (since not a scheduled Work Day) will not necessarily delay the Work of the Project. However, site conditions, as a result of the rain, could partially or fully prevent scheduled outside work on Monday (and thereafter) thereby making the Contractor eligible to apply for a Weather Delay Extension of Time on the basis of the conditions stated in the paragraph above.

§ 15.1.5.3 Claims for increase in the Contract Time shall set forth in detail the circumstances that form the basis for the Claim, the date upon which each cause of delay began to affect the progress of the Work, the date upon which each cause of delay ceased to affect the progress of the Work and the number of days' increase in the Contract Time claimed as a consequence of each such cause of delay. The Contractor shall provide such supporting documentation as the Owner may require including, where appropriate, a revised construction schedule indicating all the activities affected by the circumstances forming the basis of the Claim.

§ 15.1.5.4 The Contractor shall not be entitled to a separate increase in the Contract Time for each one of the causes of delay which may have concurrent or interrelated effects on the progress of the Work, or for concurrent delays due to the fault of the Contractor

#### § 15.1.6 CLAIMS FOR CONSEQUENTIAL DAMAGES

The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

- .1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and
- .2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.6 shall be deemed to preclude an award of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

#### § 15.2 INITIAL DECISION

§ 15.2.1 Claims, excluding those arising under Sections 10.3, 10.4, 11.3.9, and 11.3.10, shall be referred to the Initial Decision Maker for initial decision. The Project Engineer will serve as the Initial Decision Maker. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim arising prior to the date final payment is due, unless 30 days have passed after the Claim has been referred to the Initial Decision Maker with no decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

§ 15.2.2 The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of such request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

§ 15.2.6 Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

§ 15.2.6.1 Either party may, within 30 days from the date of an initial decision, demand in writing that the other party file for mediation within 60 days of the initial decision. If such a demand is made and the party receiving the demand

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fails to file for mediation within the time required, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

*(Paragraphs deleted)*

#### § 15.5 ARBITRATION PROCEDURES FOR THE MISSISSIPPI TRANSPORTATION COMMISSION

All matters of dispute arising out of any agreement with the Mississippi Transportation Commission for planning, design, engineering, construction, erection, repair, or alteration of any building, structure, fixture, road, highway, utility or any part thereof, or any agreement with the Mississippi Transportation Commission for architectural, engineering, surveying, planning, and related professional services which provides for mediation or arbitration, shall comply with the following course for resolution. No arbitration hearing shall be granted on any claim in excess of One Hundred Thousand Dollars (\$100,000.00).

##### § 15.5.1 CONDITIONS PRECEDENT TO ARBITRATION

The aggrieved party must first notify opposing party in writing in detail of the matter(s) in dispute, the amount involved and the remedy sought. Such writing shall include copies of any documents, writings, plans, or other matter pertinent to the resolution of the dispute. The Chief Engineer of the Mississippi Department of Transportation, or his authorized representative, and a principal of the opposing party shall be the proper parties for such notice and shall be active parties in any subsequent dispute resolution.

§ 15.5.2 REQUESTS FOR ARBITRATION: Within thirty (30) days of a claim being rejected in writing by the Project Engineer, either party may request arbitration. Notices for requests for arbitration shall be made in writing to the Chief Engineer of the Mississippi Department of Transportation, P. O. Box 1850, Jackson, Mississippi 39215-1850. Such notice shall set forth in detail the matter(s) in dispute, the amount involved, and the remedy sought. A copy of the request shall be mailed to the opposite party. The party requesting arbitration must deposit the sum of two hundred dollars (\$200.00) with its request as a deposit against costs incurred by the arbitrators. Each party will be notified in writing in any manner provided by law of certified mail not less than twenty (20) days before the hearing of the date, time and place for the hearing. Appearance at the hearing waives a party's right to notice.

§ 15.5.3 SELECTION OF ARBITRATORS: Upon request for arbitration, a panel of three (3) arbitrators shall be chosen. The Chief Engineer of the Mississippi Department of Transportation shall appoint one (1) member. One (1) member shall be appointed by the Executive Director of a professional or trade association that represents interests similar to that of the non-state party. The first two shall appoint the third member.

§ 15.5.4 HEARINGS: All hearings shall be open to the public. All hearings will be held in Jackson, Mississippi, unless the parties mutually agree to another location. The hearings shall be conducted as prescribed by **Mississippi Code 1972, Annotated**, Sections 11-15-113, 11-15-115, and 11-15-117. A full and complete record of all proceedings shall be taken by a certified court reporter. The scheduling and cost of retaining the court reporter shall be the responsibility of the party requesting arbitration. The costs of transcription of the record shall be the responsibility of the party requesting such transcript. No arbitration hearing shall be held without a certified court reporter. Deliberations of the arbitrators shall not be part of the record.

§ 15.5.5 AWARDS: Awards shall be made in writing and signed by the arbitrators joining in the award. A copy of the award shall be delivered to the parties by certified mail.

§ 15.5.6 FEES AND EXPENSES: Reasonable fees and expenses, excluding counsel fees, incurred in the conduct of the arbitration shall be at the discretion of the Arbitrator except each party shall bear its own attorney's fees and costs of expert witnesses.

§ 15.5.7 MODIFICATIONS, CONFIRMATIONS, AND APPEALS: All modifications, confirmations and appeals shall be as prescribed by Mississippi Code 1972, Annotated, Section 11-15-123 et seq. All awards shall be reduced to judgment and satisfied in the same manner other judgments against the State are satisfied.

§ 15.5.8 SECRETARY FOR THE ARBITRATORS: All notices, requests, or other correspondence intended for the arbitrators shall be sent to the Chief Engineer, Mississippi Department of Transportation, P. O. Box 1850, Jackson, Mississippi 39215-1850.

*(Paragraph deleted)*

SECTION 00 91 13

ADDENDA

PART 1 - GENERAL

1.01 NOTICE TO BIDDERS

- A. Addenda issued on this Project will become part of the Standard Form of the Agreement Between the Owner and the Contractor.
- B. Addenda will be indicated on the second sheet of Section 905 (end of the Proposal/Project Manual) as addenda.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION

## SECTION 01 10 00

## SUMMARY

## PART 1 - GENERAL

## 1.01 WORK COVERED BY CONTRACT DOCUMENTS

- A. Work covered by the Contract Documents shall be provided by one (1) General Contractor as one (1) Contract to improve the Mississippi Department of Transportation site to construct Maintenance Area Headquarters and Support Buildings at DeKalb, Kemper County, Mississippi. Separate Lump Sums as described in these Specifications and Drawings are to be given for each of the following separate descriptions:
- |    |                             |  |
|----|-----------------------------|--|
| 1. | Pay Item 907-242-A006       | Construction of Maintenance Area Headquarters.   |
| 2. | Pay Item 907-242-A006       | Construction of Equipment Shed with Enclosed Bay.  |
| 3. | Pay Item 907-242-A004       | Removal and Relocation of Existing Equipment Shed. See Part 3 – Execution of this Section for items to be included in this Pay Item. |
| 4. | Pay Item 907-242-A006       | Construction of Storage Bins (Covered)   |
| 5. | Other Pay Items on Drawings | Site Improvements.   |
- B. Time of Completion: The completion of this Work is to be on or before the time indicated on the Owner and Contractor Agreement.
- C. Contractor's Duties:
1. Except as specifically noted, provide and pay for:
    - a. Labor, materials, equipment.
    - b. Tools, construction equipment, and machinery.
    - c. Other facilities and services necessary for proper execution and completion of the Work.
  2. Pay legally required sales, consumer, use, payroll, privilege and other taxes.
  3. Secure and pay for, as necessary for proper execution and completion of Work, and as applicable at time of receipt of bids:
    - a. Permits.
    - b. Government Fees.
    - c. Licenses.
  4. Give required notices
  5. Comply with codes, ordinances, rules, regulations, orders and other legal requirements of public authorities that bear on performance of Work.
  6. Promptly submit written notice to Project Engineer of observed variance of Contract Documents from legal requirements. Appropriate modifications to Contract Documents will adjust necessary changes. Assume responsibility for Work known to be contrary to such requirements, without notice.
  7. Enforce strict discipline and good order among employees. Do not employ on Work, unfit persons or persons not skilled in assigned task.

8. Schedule of Values: Submit 8 copies to the MDOT Architectural Services Unit a Schedule of Values as described in Section 01 29 73 of these Specifications. This submittal will be recorded as submittal number one for this Project. When this submittal is approved, a copy will be transmitted to Construction Administration to be used to review and compare to amounts submitted on the CAD-720 form. Other copies will be kept by Architectural Services Unit and distributed to Project Engineer, MDOT Consultants, and Contractor.
9. Sub-Contractor List: Submit 8 copies of a list, acceptable to the MDOT, of all subcontractors to be used on the Project within seven (7) days after written notice of Contract award by the MDOT. The list shall include the Firm's name, contact person, street address, e-mail address, telephone and fax numbers. Submit original to Contract Administration Division Form CAD-720 – REQUEST FOR PERMISSION TO SUBCONTRACT for each subcontractor before they are allowed to perform any Work. Contract Administration Division will provide copies of approved subcontractors to Project Engineer and Architectural Services.
10. Coordination: The Contractor is responsible for the coordination of the total Project. All subcontractors will cooperate with the Contractor so as to facilitate the general progress of the Work. Each trade shall afford all other trades every reasonable opportunity for the installation of their Work. Refer to Section 01 31 00– Project Management & Coordination.

## 1.02 CONTRACTOR'S USE OF PREMISES

- A. Confine operations at the site to areas permitted by:
  1. Law
  2. Ordinances
  3. Permits
  4. Contract Documents
  5. Owner
- B. Do not unreasonably encumber site with materials or equipment.
- C. Do not load structure with weight that will endanger structure.
- D. Assume full responsibility for protection and safekeeping of products stored on premises.
- E. Move stored products which interfere with operations of MDOT or other Contractors
- F. Obtain and pay for use of additional storage of work areas needed for operations.
- G. Limit use of site for work and storage to the area indicated on the Drawings.



### 1.03 CONSTRUCTION SEQUENCE

- A. Temporary MDOT Office Structure has been moved on site and temporary utility connections have been made. Existing Maintenance Shop and other structures noted to be removed will be demolished prior to Award of Contract. Temporary MDOT Office Structure shall remain in this location with no interruption of utilities until Maintenance Area Headquarters is constructed, Final Partial Inspection has been done, and items listed to be corrected have been done. Contractor shall allow MDOT Staff two (2) weeks to move into Maintenance Area Headquarters and move temporary office structure off site.
  - 1. The remaining Work included in this Contract can be done during Work described above, except what is shown around Temporary MDOT Office Structure. All Work shall be complete and ready for occupancy at time of Final Completion for the Work.
- B. Submit an updated copy of Contractor's construction schedule (01 32 00) showing the sequence, commencement and completion dates, and move-out and move-in dates of Owner's personnel for all phases of the Work.

### 1.04 WORK UNDER SEPARATE CONTRACTS

- A. Preceding Work: MDOT will install a temporary construction fence and gates across the south end of the site to secure site when the Existing Maintenance Shop is demolished.
- B. Subsequent Work: MDOT has awarded separate contract for abatement and demolition of existing structures at Project site. Those operations are scheduled to be complete before work under this Contract begins.

### 1.05 ACCESS TO SITE

- A. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.
- B. Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
  - 1. Driveways, Walkways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
    - a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
    - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

## 1.06 COORDINATION WITH OCCUPANTS

- A. Partial Owner Occupancy: Owner will occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits unless otherwise indicated.
1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
  2. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.
- B. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Final Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.
1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to Owner acceptance of the completed Work.
  2. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited Owner occupancy.
  3. Before limited Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of Work.
  4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of Work.

## 1.07 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.
- B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 7:00 a.m. to 5:00 p.m., Monday through Friday, unless otherwise indicated.
- C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
1. Notify Project Engineer not less than two days in advance of proposed utility interruptions.
  2. Obtain Project Engineer's written permission before proceeding with utility interruptions.

- D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
1. Notify Project Engineer not less than two days in advance of proposed disruptive operations.
  2. Obtain Project Engineer's written permission before proceeding with disruptive operations.
- E. Nonsmoking Building: Smoking is not permitted within the building or within 25 feet of entrances, operable windows, or outdoor-air intakes.

#### 1.08 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Format: The Specifications are organized into Groups, Subgroups, Divisions and Sections using CSI/CSC's "MasterFormat" 2004 Edition numbering system.
- B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
  2. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
  3. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- C. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- D. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
  2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.
  3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 REMOVAL AND RELOCATION OF EXISTING EQUIPMENT SHED.

- A. Replace existing rusted purlins and angle bracing with new materials matching size and thickness of the existing. Paint as noted below.
- B. Follow Section 09 90 00 - PAINTING AND COATING to remove rust from existing steel ridged framing, gutters & downspouts and applying full coat of primer and two (2) coats of paint. See Section 09 05 15 – COLOR DESIGN for paint and metal building colors.
- C. Check for compatibility with new paint used to coat existing painted rigid framing.
- D. Provide all other materials required to re-install Existing Equipment Shed, including but not limited to the following:
  - 1. Fasteners
  - 2. Bolts
  - 3. Washers
  - 4. Sealant

END OF SECTION

SECTION 01 25 00 SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.
- B. Related Requirements:
  - 1. Section 01 33 00 "Submittal Procedures" for submittal requirements.
  - 2. Section 01 60 00 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.02 DEFINITIONS

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

1.03 ACTION SUBMITTALS

- A. The MDOT Architect and his Consultants WILL NOT consider requests for substitutions during bidding. ONLY ONE REQUEST per product will be allowed.
- B. Substitution Requests: Within 30 days after Notice to proceed, submit four copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
  - 1. Substitution Request Form: Use facsimile of form provided in Project Manual.
  - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
    - a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
    - b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
    - c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
    - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
    - e. Samples, where applicable or requested.
    - f. Certificates and qualification data, where applicable or requested.
    - g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.

- h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
  - i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
  - j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
  - k. Cost information, including a proposal of change, if any, in the Contract Sum.
  - l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
  - m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. MDOT Architect's Action: If necessary, MDOT Architect will request additional information or documentation for evaluation within ten days of receipt of a request for substitution. MDOT Architect will notify Contractor through Project Engineer of acceptance or rejection of proposed substitution within 15 days of receipt of request, or ten days of receipt of additional information or documentation, whichever is later.
- a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
  - b. Use product specified if MDOT Architect does not issue a decision on use of a proposed substitution within time allocated.

#### 1.04 QUALITY ASSURANCE

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

### PART 2 - PRODUCTS

#### 2.01 SUBSTITUTIONS

- A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals. ONLY ONE REQUEST per product will be allowed.
  - 1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied:
    - a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
    - b. Contractor has personally investigated proposed product or method, compared the product specified with the proposed substitution, and determined that it is equal or superior in all respects to that specified.
    - c. Cost data is complete and includes all related costs under his Contract.

- d. Contractor waives all claims for additional costs related to substitution that consequently becomes apparent.
  - e. Requested substitution will not adversely affect Contractor's construction schedule.
  - f. Requested substitution has received necessary approvals of authorities having jurisdiction.
  - g. Requested substitution is compatible with other portions of the Work.
  - h. Requested substitution has been coordinated with other portions of the Work.
  - i. Requested substitution provides specified warranty.
- B. Substitutions for Convenience: Architect will consider requests for substitution if received within 30 days after the Notice to Proceed. ONLY ONE REQUEST per product will be allowed.
- 1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied:
    - a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to MDOT Architect's Consultants for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
    - b. Contractor has personally investigated proposed product or method, compared the product specified with the proposed substitution, and determined that it is equal or superior in all respects to that specified.
    - c. Cost data is complete and includes all related costs under his Contract.
    - d. Contractor waives all claims for additional costs related to substitution that consequently becomes apparent.
    - e. Requested substitution does not require extensive revisions to the Contract Documents.
    - f. Requested substitution is consistent with the Contract Documents and will produce indicated results.
    - g. Requested substitution will not adversely affect Contractor's construction schedule.
    - h. Requested substitution has received necessary approvals of authorities having jurisdiction.
    - i. Requested substitution is compatible with other portions of the Work.
    - j. Requested substitution has been coordinated with other portions of the Work.
    - k. Requested substitution provides specified warranty.

PART 3 - EXECUTION

PRODUCT SUBSTITUTION REQUEST FORM

PROJECT: \_\_\_\_\_ PROJECT NO. \_\_\_\_\_

OWNER: \_\_\_\_\_

CONTRACTOR: \_\_\_\_\_

ARCHITECT: \_\_\_\_\_

\_\_\_\_\_

CONTRACTOR'S REQUEST, WITH SUPPORTING DATA

1. Section of the Specifications to which this request applies:

\_\_\_\_\_

Product data for specified item and proposed substitution is attached (description of product, reference standards, performance and test data).

Sample is attached

2. Itemized comparison of proposed substitution with product specified.

ORIGINAL PRODUCT

SUBSTITUTION

Name, brand \_\_\_\_\_

Catalog No. \_\_\_\_\_

Manufacturer \_\_\_\_\_

Significant variations: \_\_\_\_\_

\_\_\_\_\_

Reason for Substitution:

\_\_\_\_\_

\_\_\_\_\_

3. Proposed change in Contract Sum:

Credit to Owner: \$ \_\_\_\_\_

Additional Cost to Owner: \$ \_\_\_\_\_

4. Effect of the proposed substitution on the Work:

Contract Time: \_\_\_\_\_



CONTRACTORS STATEMENT OF CONFORMANCE OF PROPOSED  
SUBSTITUTION TO CONTRACT REQUIREMENTS

I / We have investigated the proposed substitution. I / We

1. Believe that it is equal or superior in all respects to originally specified product, except as stated in 2. above;
2. Will provide same warranty as required in Contract Documents;
3. Have included all cost data and cost implications of proposed substitution; including, if required, costs to other contractors, and redesign and special inspection costs caused by use of proposed substitution;
4. Will coordinate incorporation of proposed substitution in the Work;
5. Will modify other parts of the Work as may be needed, to make all parts of the Work complete and functioning;
6. Have verified that use of this substitution conforms to all applicable codes.
7. Waive future claims for added cost to Owner caused by proposed substitution.

CONTRACTOR \_\_\_\_\_ DATE: \_\_\_\_\_  
Signature

MDOT ARCHITECT'S REVIEW AND ACTION

- \_\_\_ Accepted
- \_\_\_ Not Accepted
- \_\_\_ Provide more information in the following categories and resubmit \_\_\_\_\_
- \_\_\_ Sign Contractor's Statement of Conformance and resubmit
- \_\_\_ Proposed substitution is accepted, with the following conditions:  
\_\_\_\_\_  
\_\_\_\_\_

Change Order (Supplemental Agreements) will make the following changes:

(Add to) (Deduct from) Contract Sum: \$ \_\_\_\_\_

(Add to) (Deduct from) Contract Time: \_\_\_\_\_ days

ARCHITECT: \_\_\_\_\_ DATE \_\_\_\_\_

OWNER: \_\_\_\_\_ DATE \_\_\_\_\_

\_\_\_ Accepted \_\_\_ Not accepted

END OF SECTION

## SECTION 01 26 00

## CONTRACT MODIFICATION PROCEDURES

## PART 1 - GENERAL

## 1.01 SUMMARY

- A. Section includes administrative and procedural requirements for handling and processing Contract modifications (Supplemental Agreements) by the Project Engineer and the Contractor.

## 1.02 CHANGE ORDER (SUPPLEMENTAL AGREEMENT) PROCEDURES

- A. Change Proposed by the Project Engineer: The Project Engineer may issue a Proposal Request to the Contractor which includes a detailed description of a proposed change with supplementary or revised Drawings and Specifications and a change in Contract Time for executing the change. The Contractor shall prepare and submit an estimate within 10 days.
- B. Change Proposed by the Contractor: The Contractor may propose a change by submitting a request for change to the Project Engineer, describing the proposed change and its full effect on the Work, with a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation and a statement describing the effect on Work by separate or other Contractors. Document requested substitutions in accordance with Section 01 25 00 Substitution Procedures and Section 01 60 00 Product Requirements.
- C. Contractor's Documentation:
  - 1. Maintain detailed records of Work completed on a time and material basis. Provide full information required for evaluation of proposed changes, and substantiate costs of changes in the Work.
  - 2. Document each quotation for a change in cost or time with sufficient data allowing evaluation of the quotation.
  - 3. On request, provide additional data to support computations:
    - a. Quantities of products, labor, and equipment.
    - b. Taxes, insurance and bonds.
    - c. Overhead and profit.
    - d. Justification for change in Contract Time.
    - e. Credit for deletions from Contract, similarly documented.
  - 4. Support each claim for additional costs, and for work completed on a time and material basis, with additional information:
    - a. Origin and date of claim.
    - b. Dates and time work was performed and by whom.
    - c. Time records and wage rates paid.
    - d. Invoices and receipts for products, equipment, and subcontracts, similarly documented.

- D. Construction Change Directive: The Project Engineer may issue a document, approved by the Owner, instructing the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order (Supplemental Agreement). The document will describe changes in the Work, and will designate method of determining any change in the Contract Sum or Contract Time. The change in Work will be promptly executed.
- E. Format: The Project Engineer will prepare 5 originals of the Change Order (Supplemental Agreement) using the Mississippi Department of Transportation's Change Order (Supplemental Agreement) Form.
- F. Types of Change Orders (Supplemental Agreements):
1. Stipulated Sum Change Orders: Based on Proposal Request and Contractor's fixed price quotation, or Contractor's request for a Change Order (Supplemental Agreement) as approved by the Project Engineer and the MDOT Architect.
  2. Unit Price Change Order: For pre-determined unit prices and quantities, the Change Order (Supplemental Agreement) will be executed on a fixed unit price basis. For unit costs or quantities of units of work, which are not pre-determined, execute Work under a Construction Change Directive. Changes in Contract Sum or Contract Time will be computed as specified for Time and Material Change Order (Supplemental Agreement).
  3. Time and Material Change Order (Supplemental Agreement): Submit itemized account and supporting data after completion of change, within time limits indicated in the Standard Form of Agreement Between the Owner and the Contractor. The Project Engineer will determine the change allowable in Contract Sum and Contract Time as provided in the Contract Documents. The Contractor shall maintain detailed records of Work accomplished on Time and Material basis and shall provide full information required for evaluation of proposed changes, and to substantiate costs for changes in the Work.
- G. Execution of Change Order (Supplemental Agreement): The Project Engineer will issue Change Orders (Supplemental Agreements) for signatures of parties as provided in the Standard Form of Agreement Between the Owner and the Contractor. Final execution of all Change Orders (Supplemental Agreements) requires approval by the Owner.
- H. Correlation of Contractor Submittals: The Contractor shall promptly revise Schedule of Values and the Application for Payment forms to record each authorized Change Order (Supplemental Agreement) as a separate line item and adjust the Contract Sum. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust time for other items of Work affected by the change and resubmit. Promptly enter changes in Project Record Documents.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

## SECTION 01 29 00

## PAYMENT PROCEDURES

## PART 1 - GENERAL

## 1.01 SUMMARY

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Requirements:
  - 1. Section 01 26 00 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
  - 2. Section 01 32 00 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

## 1.02 SCHEDULE OF VALUES

- A. Scope: Submit 8 copies of the Schedule of Values to the MDOT Architect, with a copy of the Transmittal Letter to the Project Engineer, at least 10 days prior to submitting first Application for Payment. Upon Project Engineer's request, support the values given with data substantiating their correctness. Payment for materials stored on site will be limited to those listed in Schedule of Unit Material Values (refer to Article 9 of the Supplementary Conditions for requirements). Use Schedule of Values only as basis for contractor's Application for Payment
- B. The 8 copies of the Schedule of Values will be reviewed as Submittal No.1. A copy of this submittal will be reviewed by the Architect and Mechanical / Electrical Consultants. One copy will be retained by MDOT Architectural Services, one by Civil Consultant Mechanical / Electrical Consultants, one sent to Contract Administration for use in reviewing requests for Permission to Sub-Contract (CAD-720 Form), one sent to the Project Engineer, and two returned to the Contractor. If any extra copies are needed for the Contractor, adjust number submitted.
- C. Form of Submittal: Submit typewritten Schedule of Values on AIA Document G703-1992, using Table of Contents of this Specification as basis for format for listing costs of Work for Sections under Divisions 02 - 49. Identify each line item with number and title as listed in Table of Contents of this Specification.
- D. Preparing Schedule of Values:
  - 1. Itemize separate line item costs for each of the following general cost items: Performance and Payment Bonds, field supervision and layout, temporary facilities and controls, and closeout documents.
  - 2. Itemize separate line item cost for Work required by each Section of this specification. Breakdown installed cost with overhead and profit.

3. Each line item, which has installed value of more than \$20,000, break down costs to list major products for operations under each item; rounding figures to nearest dollar. Make sum of total costs of all items listed in schedule equal to total Contract Sum.
4. Group line items to show subtotal of Description A and then Description B, C, and D with the same amounts indicated on the Bid Forms and a total equal to the Contract amount indicated on the Bid Form.

E. Preparing Schedule of Unit Material Values:

1. Submit separate schedule of unit prices for materials to be stored on which progress payments will be made. Make form of submittal parallel to Schedule of Values with each line item identified same as line item in Schedule of Values. Include in unit prices only: Cost of material, delivery and unloading site, and sales tax.
2. Make sure unit prices (if required) multiplied by quantities equal material cost of that item in Schedule of Values.

F. Review and Re-submittal: After Project Engineer / MDOT Architect's review, if requested, revise and resubmit schedule in same manner

1.03 METHOD FOR PAYMENT

- A. The method of measurement and payment shall conform to the applicable provisions of Article 9 of the AIA Document A201-2007 General Conditions of the Contract for Construction.

1.04 APPLICATIONS FOR PAYMENT

A. Format:

1. Applications for Payments will be prepared on AIA forms G702-Application and Certificate for payment and G703-Continuation Sheet; or, a computer generated form containing similar data may be used.

B. Preparation of Application:

1. Present required information in type written form.
2. Execute certification by signature of authorized officer.
3. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of Work performed and for stored products.
4. List each authorized Change Order (Supplemental Agreement) as an extension on continuation sheet, listing Change Order (Supplemental Agreement) number and dollar amount as for an original Item of Work.
5. Prepare Application for Final Payment as specified in Section 01 77 00-Closeout Procedures.

C. Submittal Procedures:

1. Submit five copies of each Application for Payment to the Project Engineer and one copy to the MDOT Architect.
2. Submit an updated construction schedule with each Application for Payment as described in Section 01 32 00-Construction Progress Documentation.

3. Submit request for payment at intervals agreed upon by the Project Engineer, Owner, and Contractor.
4. Submit requests to the Project Engineer at agreed upon times, or as may be directed otherwise.

D. Substantiating Data:

1. Submit data justifying dollar amounts in question when such information is needed.
2. Provide one copy of the data with a cover letter for each submittal.
3. Indicate the Application number, date and line item number and description.

1.05 STATEMENTS AND PAYROLLS

- A. The submission by the Contractor of the actual weekly payrolls showing all employees, hours worked, hourly rates, overtime hours, etc., or copies thereof, is not required to be turned in. However, each Contractor and Subcontractor shall preserve weekly payroll records for a period of three years from the date of Contract completion. All Contractor personnel working at the project site will be paid unconditionally and not less often than once a week without subsequent deduction or rebate on any account, except such payroll deductions as are permitted by regulations, the full amounts of wages and bona fide fringe benefits due at time of payment.
- B. The payroll records shall contain the name, with an individually identifying number for each employee, classification, rate of pay, daily and weekly number of hours worked, itemized deductions and actual wages paid to each employee.
- C. Upon request, the Contractor will make payroll records available at the project site for inspection by the Department Compliance Officer or authorized representative and will permit such officer or representative to interview employees on the job during working hours.
- D. The Contractor and Subcontractors shall submit Form CAD-880, "Weekly Summary of Wage Rates", each week to the Project Engineer. The forms may be obtained from the Contract Compliance Officer, Contract Administration Division, Mississippi Department of Transportation, Jackson, Mississippi. Custom forms, approved by Contract Administration Division, may be used in lieu of CAD forms.
- E. The Contractor shall make all efforts necessary to submit this information to the Project Engineer in a timely manner. The Engineer will have the authority to suspend the work wholly or in part and to withhold payments because of the Contractor's failure to submit the required information. Submission of forms and payrolls shall be current through the first week of the estimate period in order for the Project Engineer to process an estimate.

1.06 BASIS OF PAYMENT

A. This Work will be paid for by Contract Sum for the construction in District Five. The Work includes Maintenance Area Headquarters Building, Equipment Shed with Enclosed Bay, Relocate Existing Equipment Shed and Storage Bins (Covered) in DeKalb, Kemper County, Mississippi. The Contract Sum shall be full compensation for all site work, for furnishing all materials, and all other Work and effort of whatever nature in the construction of the buildings, installation of underground and other equipment, and final clean-up of the area. It shall also be complete compensation for all equipment, tools, labor, and incidentals necessary to complete the Work.

B. Payment will be made under:

- |    |   |          |
|----|---|----------|
| 1. | Description A:<br>MDOT Project No. BWO-5213-35(001) 502587<br>Maintenance Area Headquarters Building<br>at DeKalb, Kemper County, Mississippi | lump sum |
| 2. | Description B<br>MDOT Project No. BWO-5214-35(001) 502587<br>Equipment Shed with Enclosed Bay<br>at DeKalb, Kemper County, Mississippi        | Lump Sum |
| 3. | Description C:<br>MDOT Project No. BWO-5067-35(003) 502587<br>Relocate an Existing Equipment Shed<br>at DeKalb, Kemper County, Mississippi    | Lump Sum |
| 4. | Description D:  |          |
| 5. | MDOT Project No. BWO-5221-35(001) 502587  |          |
| 6. | Storage Bins (Covered)  |          |
| 7. | at DeKalb, Kemper County, Mississippi   | Lump Sum |

**TOTAL PROJECT CONTRACT SUM**

**LUMP SUM**

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 31 00

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.01 SUMMARY

- A. Scope: Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
  - 1. Project Management.
  - 2. Requests for Information (RFIs).
  - 3. Project meetings.
- B. Project Coordinator: The General Contractor shall designate one individual as Project Coordinator (Superintendent), as referred to in the General Conditions. Prior to beginning Work his name, qualifications and address shall be submitted, in writing, to the MDOT Executive Director with copies to the Construction Engineer, Contract Administration Engineer, District Engineer, Project Engineer and MDOT Architect. Upon approval, he will remain until the Project is completed and cannot be removed during construction without just cause and without the written consent of the Project Engineer.
- C. Related Requirements:
  - 1. Section 01 73 00 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.

1.02 DEFINITIONS

- A. RFI: Request from Project Engineer, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.03 INFORMATIONAL SUBMITTALS

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



- B. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Use CSI Form 1.5A. Include the following information in tabular form:
1. Name, address, and telephone number of entity performing subcontract or supplying products.
  2. Number and title of related Specification Section(s) covered by subcontract.
  3. Drawing number and detail references, as appropriate, covered by subcontract.

#### 1.04 DUTIES OF PROJECT COORDINATOR (SUPERINTENDENT)

- A. General: 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, that depend on each other for proper installation, connection, and operation.
1. Coordination: Coordinate the work of all subcontractors and material suppliers.
  2. Supervision: Supervise the activities of every phase of Work taking place on the project.
  3. Contractor's Daily Job Diary: Submit copy of daily job diary to Project Engineer and MDOT Architect each Monday for previous week.
  4. Electrical: Take special care to coordinate and supervise the Work of electrical and other subcontractors.
  5. Communication: Establish lines of authority and communication at the job site.
  6. Location: The Project Coordinator (Superintendent) must be present on the job site at all times while work is in progress. Superintendent shall advise Project Engineer of an intended absence from the work and designate a person to be in charge of the Work during such absence.
  7. Permits: Assist in obtaining building and special permits required for construction.
- B. Interpretations of Contract Documents:
1. Consultation: Consult with Project Engineer to obtain interpretations.
  2. Assistance: Assist in resolution of questions.
  3. Transmissions: Transmit written interpretations to concerned parties.
- C. Cessation of Work: Stop all Work not in accordance with the requirements of the Contract Documents.
- D. Division 01: Coordinate and assist in the preparation of all requirements of Division 01 and specifically as follows:
1. Enforce safety requirements.
  2. Schedule of Value: Assist in preparation and be knowledgeable of each entry in the Schedule of Values.
  3. Cutting and Patching: Supervise and control all cutting and patching of other trades work.
  4. Project Meetings: Schedule with Project Engineer's approval and attend all project meetings.

5. Construction Schedules: Prepare and submit all construction schedules. Supervise Work to monitor compliance with schedules.
  6. Shop Drawings, Product Data and Samples: Administer the processing of all submittals required by the Project Manual.
  7. Testing: Coordinate all required testing.
  8. Temporary Facilities and Controls: Allocate, maintain and monitor all temporary facilities.
  9. Substitutions: Administer the processing of all substitutions.
  10. Cleaning: Direct and execute a continuing (daily) cleaning program throughout construction, requiring each trade to dispose of their debris.
  11. Project Closeout: Collect and present all closeout documents to the Project Engineer.
  12. Project Record Documents: Maintain up-to-date Project Record Documents.
- E. Changes: Recommend and assist in the preparation of requests to the Project Engineer for any changes in the Contract.
- F. Application for Payment: Assist in the preparation and be knowledgeable of each entry in the Application and Certificate for Payment.

#### 1.05 COORDINATION AND PROJECT CONDITIONS

- A. Coordinate scheduling, submittals, and Work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- B. Verify utility requirements and characteristics of operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- C. Coordinate space requirements, supports, and installation of Mechanical and Electrical Work that are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- D. Coordinate completion and clean-up of Work of separate sections in preparation for Substantial Completion and for portions of Work designated for Owner's partial occupancy, if required.
- E. After Owner occupancy of premises, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

#### 1.06 SUBCONTRACTOR'S DUTIES

- A. The Subcontractor is responsible to coordinate and supervise his employees in the Work accomplished under his part of the Contract.
- B. Schedules: Conduct Work to assure compliance with construction schedules.

- C. Suppliers: Transmit all instructions to his material suppliers.
- D. Cooperation: Cooperate with the Project Coordinator and other subcontractors.

#### 1.07 REQUESTS FOR INFORMATION (RFIs)

- A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
  - 1. MDOT Architect will return RFIs submitted to MDOT Architect by other entities controlled by Contractor with no response.
  - 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
  - 1. Project name.
  - 2. Project number.
  - 3. Date.
  - 4. Name of Contractor.
  - 5. Name of Architect
  - 6. RFI number, numbered sequentially.
  - 7. RFI subject.
  - 8. Specification Section number and title and related paragraphs, as appropriate.
  - 9. Drawing number and detail references, as appropriate.
  - 10. Field dimensions and conditions, as appropriate.
  - 11. Contractor's suggested resolution. If Contractor's solution(s) impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
  - 12. Contractor's signature.
  - 13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
  - 14. RFI Forms: CSI Form 13.2A. Identify each page of attachments with the RFI number and sequential page number.
- C. MDOT Architect's Action: MDOT Architect will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by MDOT Architect after 1:00 p.m. will be considered as received the following working day.
  - 1. The following RFIs will be returned without action:
    - a. Requests for approval of submittals.
    - b. Requests for approval of substitutions.
    - c. Requests for coordination information already indicated in the Contract Documents.
    - d. Requests for adjustments in the Contract Time or the Contract Sum.
    - e. Requests for interpretation of Architect's actions on submittals.
    - f. Incomplete RFIs or inaccurately prepared RFIs.
  - 2. MDOT Architect's action may include a request for additional information, in which case MDOT Architect's time for response will date from time of receipt of additional information.

3. MDOT Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 01 26 00 "Contract Modification Procedures."
    - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify MDOT Architect in writing within 7 days of receipt of the RFI response.
  - D. On receipt of MDOT Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.
  - E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log the first week of each month. Use CSI Log Form 13.2B. Include the following:
    1. Project name.
    2. Name and address of Contractor.
    3. Name and address of Architect.
    4. RFI number including RFIs that were dropped and not submitted.
    5. RFI description.
    6. Date the RFI was submitted.
    7. Date MDOT Architect's response was received.
  - F. On receipt of MDOT Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify MDOT Architect within seven days if Contractor disagrees with response.
    1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
    2. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.
- 1.08 PROJECT MEETINGS
- A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated. Project Meetings shall be held for the following reasons:
    1. Establish an understanding of what is expected from everyone involved.
    2. Enable an orderly Project review during the progress of the Work.
    3. Provide for systematic discussion of problems and effect remedies and clarifications.
    4. Coordination of the Work.
    5. Review installation procedures and schedules.
  - B. Scheduling and Administration: The Project Engineer shall schedule and preside over all meetings throughout the progress of the Work. Duties include the following:
    1. Review, modify / approve minutes of the previous meeting.
    2. Discuss items that have been done the previous month and anticipated work to be done within the next month.
    3. Review Contractor's Pay Request and resolve questions or conflicts with Construction Documents.

- C. Scheduling and Administration: The Contractor shall attend and administer all meetings throughout the progress of the Work. Duties include the following:
1. Preparation of agenda for meetings.
  2. Distribution of agenda and written notice 7 days in advance of date for each regularly scheduled meeting.
  3. Make physical arrangements for meetings.
  4. Record the minutes which shall include list of all participants and all significant proceedings and, in particular, all decisions, agreements, clarifications, and other data related to Project cost, time, and modifications.
  5. Distribute copies of minutes within 7 calendar days to all parties affected by decisions made at the meeting.
  6. Follow-up unresolved matters discussed at meetings and promptly effect final resolution, especially for work in progress. Advise all affected parties of result and include report of activities in next scheduled meeting.
- D. Scheduling and Administration: Representatives of Contractor's, Subcontractor's, and Supplier's attending the meetings shall be qualified and authorized to act on behalf of the entity each represents.
- E. Scheduling and Administration: Consultants may attend meetings to ascertain work is expedited consistent with Contract Documents and construction schedules.
- F. Preconstruction Conference:
1. Schedule: Schedule Pre-Construction Meeting within 10 days after Notice to Proceed.
  2. Location: A central site, convenient for all parties, designated by the Contractor and approved by the Project Engineer and the MDOT Architect.
  3. Agenda: Discuss items of significance that could affect progress, including the following:
    - a. Distribute and discuss tentative construction schedule prepared by Contractor.
    - b. Phasing.
    - c. Critical work sequencing and long-lead items.
    - d. Designation of key personnel and their duties.
    - e. Procedures for processing field decisions and Change Orders.
    - f. Procedures for RFIs.
    - g. Procedures for testing and inspecting.
    - h. Procedures for processing Applications for Payment.
    - i. Distribution of the Contract Documents.
    - j. Submittal procedures.
    - k. Preparation of record documents.
    - l. Use of the premises.
    - m. Work restrictions.
    - n. Working hours.
    - o. Owner's occupancy requirements.
    - p. Responsibility for temporary facilities and controls.
    - q. Procedures for moisture and mold control.
    - r. Procedures for disruptions and shutdowns.
    - s. Construction waste management and recycling.
    - t. Parking availability.

- u. Office, work, and storage areas.
  - v. Equipment deliveries and priorities.
  - w. First aid.
  - x. Security.
  - y. Progress cleaning.
4. Minutes: Record and distribute meeting minutes.
- G. Preinstallation Conferences: 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 Project Engineer and MDOT Architect 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 Change Orders.
    - 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 instructions.
    - 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. 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 other parties requiring information.
  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.

## H. Progress Meetings:

1. Schedule: Progress Meetings will be scheduled monthly. The Project Engineer will cancel the meeting with at least 48 hours notice if a meeting is not necessary for any particular month.
2. Place of Progress Meetings: Contractor's Field Office except as otherwise agreed.
3. Attendance: Attending shall be the Project Engineer or his representative and MDOT representatives associated with the Project, the MDOT Architect or his representative (if requested by the District) and his Consultants, the General Contractor, and all Subcontractors as pertinent to the agenda.
4. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
  - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
    - 1) Review schedule for next period.
  - b. Review present and future needs of each entity present, including the following:
    - 1) Interface requirements.
    - 2) Sequence of operations.
    - 3) Status of submittals.
    - 4) Deliveries.
    - 5) Off-site fabrication.
    - 6) Access.
    - 7) Site utilization.
    - 8) Temporary facilities and controls.
    - 9) Progress cleaning.
    - 10) Quality and work standards.
    - 11) Status of correction of deficient items.
    - 12) Field observations.
    - 13) Status of RFIs.
    - 14) Status of proposal requests.
    - 15) Pending changes.
    - 16) Status of Change Orders.
    - 17) Pending claims and disputes.
    - 18) Documentation of information for payment requests.

5. Minutes: Record and distribute the meeting minutes to each party present and to parties requiring information.
  - a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION



SECTION 01 32 00

CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
  - 1. Contractor's construction schedule.
  - 2. Construction schedule updating reports.
  - 3. Site condition reports.

1.02 SUBMITTALS

- A. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
  - 1. Submit initial schedules to the Project Engineer / MDOT Architect within 15 days after date of Notice to Proceed.
  - 2. Submit to the Project Engineer / MDOT Architect, periodically updated schedules accurately depicting progress to first day of each month.
  - 3. Submit 2 copies, one to be retained by the Project Engineer and the other forwarded to the MDOT Architect.
- B. Construction Schedule Updating Reports: Submit with Applications for Payment.
- C. Site Condition Reports: Submit at time of discovery of differing conditions.

1.03 COORDINATION

- A. Coordinate Contractor's construction schedule with the schedule of values, submittal schedule, progress reports, payment requests, and other required schedules and reports.
  - 1. Secure time commitments for performing critical elements of the Work from entities involved.
  - 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.01 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Form of Schedules: Prepare in form of horizontal bar chart. The following is a minimum requirement and other type schedules are acceptable with Project Engineer's approval.
  - 1. Provide separate horizontal bar column for each trade or operation.

2. Order: Table of Contents of Specifications.
    - a. Identify each column by major Specification section number.
  3. Horizontal Time Scale: Identify first work day of each week.
  4. Scale and Spacing: To allow space for updating.
- B. Content of Schedules:
1. Provide complete sequence of construction by activity.
  2. Indicate dates for beginning and completion of each stage of construction.
  3. Identify Work of logically grouped activities.
  4. Show projected percentage of completion for each item of Work as of first day of each month.
- C. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall project schedule.
- D. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
1. Identification of activities that have changed.
  2. Changes in early and late start dates.
  3. Changes in early and late finish dates.
  4. Changes in activity durations in workdays.
  5. Changes in the Contract Time.
- E. If the Contractor is required to produce two revised construction schedules because of lack of progress in the Work, the Owner will notify the Contractor's surety.
- 2.02 REPORTS
- A. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

## PART 3 - EXECUTION

### 3.01 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
  2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
  3. As the Work progresses, indicate final completion percentage for each activity.

- B. Distribution: Distribute copies of approved schedule to Project Engineer, MDOT Architect, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
1. Post copies in Project meeting rooms and temporary field offices.
  2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION

SECTION 01 32 33 PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.01 SUMMARY

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

- 1. Periodic construction photographs.

1.02 INFORMATIONAL SUBMITTALS

- A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.

- B. Digital Photographs: Submit (e-mail) image files on a weekly basis.

- 1. Digital Camera: Minimum sensor resolution of 8 megapixels.
- 2. Format: Minimum 3200 by 2400 pixels, in unaltered original files, with same aspect ratio as the sensor, uncropped, date and time stamped, in folder named by date of photograph, accompanied by key plan file.
- 3. Identification: Provide the following information with each image description in file metadata tag:
  - a. Name of Project.
  - b. Name of photographer.
  - c. Name of Architect.
  - d. Name of Contractor.
  - e. Date photograph was taken.
  - f. Description of vantage point, indicating location, direction (by compass point), and elevation of construction.
  - g. Unique sequential identifier keyed to accompanying key plan.

PART 2 - PRODUCTS

2.01 PHOTOGRAPHIC MEDIA

- A. Digital Images: Provide images in JPG format, produced by a digital camera with minimum sensor size of 8 megapixels, and at an image resolution of not less than 3200 by 2400 pixels.

PART 3 - EXECUTION

3.01 CONSTRUCTION PHOTOGRAPHS

- A. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.
  - 1. Maintain key plan with each set of construction photographs that identifies each photographic location.
- B. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
  - 1. Date and Time: Include date and time in file name for each image.
  - 2. Field Office Images: Maintain one set of images accessible in the field office at Project site, available at all times for reference. Identify images in the same manner as those submitted to Project Engineer / MDOT Architect.
- C. Periodic Construction Photographs: Take photographs for each day that any substantial construction activity occurs at the job site. The number of photographs to be taken shall vary, depending on the construction activity that day. The purpose of the photographs is to document the installation of the work and verify that the work is being installed properly.
- D. Project Engineer /MDOT Architect -Directed Construction Photographs: The Project Engineer / MDOT Architect may direct the Contractor to take certain photographs during his job site observation or at any time as directed.

END OF SECTION

SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. Scope: Submit to the MDOT Architectural Services Unit shop drawings, product data, and samples required by Specification Sections. Faxed submittals WILL NOT be accepted. DO NOT submit Material Safety Data Sheets for approval. Refer to Section 01 25 00 – Substitution Procedures and Section 01 60 00 – Product Requirements, for requirements concerning products that will be acceptable on this Project.
- C. Related Requirements:
  - 1. Section 01 32 00 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
  - 2. Section 01 78 23 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
  - 3. Section 01 78 39 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
  - 4. Section 01 79 00 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.02 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require MDOT Architect's responsive action.
- B. Informational Submittals: Written and graphic information and physical samples that do not require MDOT Architect's responsive action. Submittals may be rejected for not complying with requirements.

1.03 ACTION SUBMITTALS

- A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by MDOT Architect and additional time for handling and reviewing submittals required by those corrections.
  - 1. Acceptance of submittal items will not preclude rejection of these items upon discovery of defects in them prior to final acceptance of completed Work.

## 1.04 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Architect's Digital Data Files: Electronic copies of digital data files of the Contract Drawings will not be provided by Architect for Contractor's use in preparing submittals.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
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 parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
    - a. MDOT Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on MDOT Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. MDOT Architect will advise Contractor when a submittal being processed must be delayed for coordination.
  2. Partial submittals are NOT ACCEPTABLE, will be considered non-responsive, and will be returned without review.
  3. Resubmittal Review: Allow 15 days for review of each resubmittal.
- D. Paper Submittals: Place a permanent label or title block on each submittal item for identification.
1. Indicate name of firm or entity that prepared each submittal on label or title block.
  2. Provide a space approximately 3 by 4 inches on label or beside title block to record Contractor's review and approval markings and action taken by MDOT Architect.
  3. Include the following information for processing and recording action taken:
    - a. Project name.
    - b. Date.
    - c. Name of Architect.
    - d. Name of Contractor.
    - e. Name of subcontractor.
    - f. Name of supplier.
    - g. Name of manufacturer.
    - h. Submittal number or other unique identifier, including revision identifier.
      - 1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 061000.01.A).
    - i. Number and title of appropriate Specification Section.

- j. Drawing number and detail references, as appropriate.
  - k. Location(s) where product is to be installed, as appropriate.
  - l. Other necessary identification.
4. Transmittal for Paper Submittals: Accompany submittals with transmittal letter, containing data, project title and number; Contractor's name and address; the number of each Shop Drawings, product data and samples submitted; notification of deviations from Contract Documents; and other pertinent data. Submittals shall be sent to MDOT Architect for review or distribution to Consultants, with copy of Transmittal Letter sent to Project Engineer. MDOT Architect will return without review submittals received from sources other than Contractor.
- a. Transmittal Form for Paper Submittals: Use AIA Document G810 or CSI Form 12.1A.
  - b. Transmittal Form for Paper Submittals: Provide locations on form for the following information:
    - 1) Project name.
    - 2) Date.
    - 3) Destination (To:).
    - 4) Source (From:).
    - 5) Name and address of Architect.
    - 6) Name of Contractor.
    - 7) Name of firm or entity that prepared submittal.
    - 8) Names of subcontractor, manufacturer, and supplier.
    - 9) Category and type of submittal.
    - 10) Submittal purpose and description.
    - 11) Specification Section number and title.
    - 12) Specification paragraph number or drawing designation and generic name for each of multiple items.
    - 13) Drawing number and detail references, as appropriate.
    - 14) Transmittal number, numbered consecutively.
    - 15) Submittal and transmittal distribution record.
    - 16) Remarks.
    - 17) Signature of transmitter.
    - 18) Contractor's stamp, initialed or signed, certifying the review of submittal, verification of field measurements, and compliance with Contract Documents PRIOR to submitting to the MDOT Architectural Services Unit.
- E. Electronic Submittals (Optional): Identify and incorporate information in each electronic submittal file as follows:
- 1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
  - 2. Name file with submittal number or other unique identifier, including revision identifier.
    - a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Re-submittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).
  - 3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by MDOT Architect.



4. Transmittal Form for Electronic Submittals: Use electronic form acceptable to Project Engineer and MDOT Architect, containing the following information:
    - a. Project name.
    - b. Date.
    - c. Name and address of Architect.
    - d. Name of Contractor.
    - e. Name of firm or entity that prepared submittal.
    - f. Names of subcontractor, manufacturer, and supplier.
    - g. Category and type of submittal.
    - h. Submittal purpose and description.
    - i. Specification Section number and title.
    - j. Specification paragraph number or drawing designation and generic name for each of multiple items.
    - k. Drawing number and detail references, as appropriate.
    - l. Location(s) where product is to be installed, as appropriate.
    - m. Related physical samples submitted directly.
    - n. Indication of full or partial submittal.
    - o. Transmittal number, numbered consecutively.
    - p. Submittal and transmittal distribution record.
    - q. Other necessary identification.
    - r. Remarks.
  5. Metadata: Include the following information as keywords in the electronic submittal file metadata:
    - a. Project name.
    - b. Number and title of appropriate Specification Section.
    - c. Manufacturer name.
    - d. Product name.
- F. Options: Identify options requiring selection by MDOT Architect.
- G. Deviations: Identify deviations from the Contract Documents on submittals.
- H. Re-submittals: Make re-submittals in same form and number of copies as initial submittal.
1. Note date and content of previous submittal.
  2. Note date and content of revision in label or title block and clearly indicate extent of revision.
  3. Resubmit submittals until they are marked with approval notation from MDOT Architect's action stamp.
- I. Distribution of Submittals after Review:
1. Distribute copies of Shop Drawings and product data which carry MDOT Architect's / Consultant's stamp to: Project Engineer's File, Architectural Services Unit File, Architect's File(as required) / Electrical / Mechanical / Structural Engineer's File (as required), Materials' File (if concrete), Contractor's File, Job Site File, and Subcontractor, Supplier and/or Fabricator as necessary.
  2. Distribute samples as directed. The Project Engineer, MDOT Architect and Consultant (as required) shall retain one of each.

- J. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from MDOT Architect's action stamp.
- K. After an item has been accepted, no change in brand, make, manufacturer's catalog number, or characteristics will be considered unless:
  - 1. Satisfactory written evidence is presented to and approved by the Project Engineer, that manufacturer cannot make scheduled delivery of accepted item, or;
  - 2. Item delivered has been rejected and substitution of a suitable item is an urgent necessity, or;
  - 3. Other conditions became apparent which indicates acceptance of such substitute item to be in the best interest of the Owner.

## PART 2 - PRODUCTS

### 2.01 SUBMITTAL PROCEDURES

- A. General Submittal Procedure Requirements:
  - 1. Submit electronic submittals (optional-Preferred for 8 1/2 by 11 inches submittals only) via email as PDF electronic files.
    - a. MDOT Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
  - 2. Action Submittals: Submit eight paper (required for all submittals over 8 1/2 by 11 inches in size) copies of each submittal with additional number of copies, if required, by Contractor for distribution. MDOT Architect will return four copies, unless indicated otherwise.
  - 3. Informational Submittals: Submit three paper copies of each submittal unless otherwise indicated. MDOT Architect will not return copies.
  - 4. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
    - a. Provide a digital signature with digital certificate on electronically-submitted certificates and certifications where indicated.
    - b. Provide a notarized statement on original paper copy certificates and certifications where indicated.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
  - 1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
  - 2. Mark each copy of each submittal to show which products and options are applicable.
  - 3. Include the following information, as applicable:
    - a. Manufacturer's catalog cuts.
    - b. Manufacturer's product specifications.
    - c. Standard color charts.

- d. Statement of compliance with specified referenced standards.
  - e. Testing by recognized testing agency.
  - f. Application of testing agency labels and seals.
  - g. Notation of coordination requirements.
  - h. Availability and delivery time information.
4. For equipment, include the following in addition to the above, as applicable:
    - a. Wiring diagrams showing factory-installed wiring.
    - b. Printed performance curves.
    - c. Operational range diagrams.
    - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
  5. Submit Product Data concurrent with Samples.
  6. Submit Product Data in the following format:
    - a. PDF electronic file. (or)
    - b. Submit eight paper copies of each submittal with additional number of copies, if required, by Contractor for distribution. MDOT Architect will return four copies, unless indicated otherwise
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
    - a. Identification of products.
    - b. Schedules.
    - c. Compliance with specified standards.
    - d. Notation of coordination requirements.
    - e. Notation of dimensions (required) established by field measurement.
    - f. Relationship and attachment to adjoining construction clearly indicated.
    - g. Seal and signature of professional engineer if specified.
  2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 24 by 36 inches.
  3. Submit Shop Drawings in the following format:
    - a. PDF electronic file. (or)
    - b. Submit eight paper copies of each submittal with additional number of copies, if required, by Contractor for distribution. MDOT Architect will return four copies, unless indicated otherwise
- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
  2. Identification: Attach label on unexposed side of Samples that includes the following:
    - a. Generic description of Sample.
    - b. Product name and name of manufacturer.
    - c. Sample source.
    - d. Number and title of applicable Specification Section.

3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
  4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
    - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
    - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
  5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
    - a. Number of Samples: Submit two full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. MDOT Architect will return one sample with options selected.
    - b. If a specified product color is discontinued, Contractor shall notify Project Engineer promptly to determine if it affects other color selections.
  6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
    - a. Number of Samples: Submit four sets of Samples. Project Engineer and MDOT Architect will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record sample.
- E. Field Samples and Mock-Ups: Erect on Project Site at location acceptable to Project Engineer.
1. Construct each sample or mock-up complete, including Work of all trades required in the finished Work. Field Samples are used to determine standards in materials, color, texture, workmanship, and overall appearance.
  2. Work shall not be allowed using these materials until the mock-up is approved.
  3. The mock-up shall not be destroyed, until after the Work it represents is finished, without permission of the Project Engineer. This mock-up shall be used as a standard to compare to the Work it represents for color, craftsmanship, overall appearance, and how the different materials make up the whole system.

- F. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
1. Submit product schedule in the following format:
    - a. PDF electronic file. (or)
    - b. Four paper copies of product schedule or list unless otherwise indicated. Architect will return two copies.
- G. Coordination Drawings Submittals: Comply with requirements specified in Section 01 31 00 "Project Management and Coordination."
- H. Contractor's Construction Schedule: Comply with requirements specified in Section 01 32 00 "Construction Progress Documentation."
- I. Application for Payment and Schedule of Values: Comply with requirements specified in Section 01 29 00 "Payment Procedures."
- J. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 01 40 00 "Quality Requirements."
- K. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 01 77 00 "Closeout Procedures."
- L. Maintenance Data: Comply with requirements specified in Section 01 78 23 "Operation and Maintenance Data."
- M. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- N. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.
- O. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- P. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- Q. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- R. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

- S. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- T. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- U. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project.
- V. Schedule of Tests and Inspections: Comply with requirements specified in Section 01 40 00 "Quality Requirements."
- W. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- X. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- Y. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
- Z. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

## 2.02 DELEGATED-DESIGN SERVICES

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

- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file (optional) and eight paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

### PART 3 - EXECUTION

#### 3.01 CONTRACTOR'S REVIEW

- A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to MDOT Architectural Services Unit.
- B. Project Closeout and Maintenance Material Submittals: See requirements in Section 01 77 00 "Closeout Procedures."
- C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.
- D. Notify the Project Engineer in writing at the time of submission, of deviations in submittals from requirements of Contract Documents.
- E. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved by review of submittals unless written acceptance of specific deviations is given.
- F. Contractor's responsibility for errors and omissions in submittals is not relieved by MDOT Architect's / Consultant's review of submittals.
- G. Do not order materials or begin Work requiring submittals until the return of submittals bearing MDOT Architect / Consultant's stamp and initials indicating review.

#### 3.02 MDOT ARCHITECT'S / CONSULTANTS' ACTION

- A. General: MDOT Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.

- B. Action Submittals: MDOT Architect / Consultants will review with reasonable promptness, each submittal for design concept of Project and information given in Contract Documents, make marks to indicate corrections or revisions required, and return submittals to the Architectural Services Unit, which will retain one copy and forward one copy to the Project Engineer, one copy to the Materials Engineer (if concrete), and the remainder to the Contractor. MDOT Architect / Consultants will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action. Consultants will retain one copy of reviewed submittals.
- C. Informational Submittals: MDOT Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. MDOT Architect will forward each submittal to appropriate party.
- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION



SECTION 01 40 00

QUALITY REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
  - 1. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
  - 2. Requirements for Contractor to provide quality-assurance and -control services required by MDOT Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
  - 3. Specific test and inspection requirements are not specified in this Section.
- C. MDOT will provide the following inspections, sampling and testing at no cost to the Contractor:
  - 1. Section 03 20 00 "Concrete Reinforcing".
  - 2. Section 03 30 00 "Cast-In-Place Concrete".
  - 3. Section 31 23 12 "Excavation, Fill and Grading".
- D. The Contractor shall provide and pay for all other required inspection, sampling and testing.

1.02 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Project Engineer. Architect.

- C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
1. Laboratory Mockups: Full-size physical assemblies constructed at testing facility to verify performance characteristics.
- D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.
- E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.
- G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).
- J. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

### 1.03 CONFLICTING REQUIREMENTS

- A. Referenced Standards: 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 conflicting requirements that are different, but apparently equal, to Project Engineer 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 Project Engineer for a decision before proceeding.

#### 1.04 INFORMATIONAL SUBMITTALS

- A. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work.
- B. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

#### 1.05 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Materials will be inspected and sampled in accordance with current Mississippi Department of Transportation SOP pertaining to inspecting and sampling. Distribute copies of reports of inspections and tests to Project Engineer and one copy to the MDOT Architect. Include the following:
1. Date of issue.
  2. Project title and number.
  3. Name, address, and telephone number of testing agency.
  4. Dates and locations of samples and tests or inspections.
  5. Names of individuals making tests and inspections.
  6. Description of the Work and test and inspection method.
  7. Identification of product and Specification Section.
  8. Complete test or inspection data.
  9. Test and inspection results and an interpretation of test results.
  10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
  11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
  12. Name and signature of laboratory inspector.
  13. Recommendations on retesting and reinspecting.
- B. Manufacturer's Field Reports: Prepare written information documenting tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of representative making report.
  2. Statement on condition of substrates and their acceptability for installation of product.
  3. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
  4. Results of operational and other tests and a statement of whether observed performance complies with requirements.
  5. Other required items indicated in individual Specification Sections.

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

#### 1.06 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.
- F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
  - 1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.
- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329 and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
  - 1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
  - 2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
- H. Manufacturer's Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

- I. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
1. Contractor responsibilities include the following:
    - a. Provide test specimens representative of proposed products and construction.
    - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
    - c. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
    - d. When testing is complete, remove test specimens, assemblies, and mockups do not reuse products on Project, unless indicated otherwise in other Sections.
  2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Project Engineer, MDOT Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
- J. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
1. Build mockups in location and of size indicated or, if not indicated, as directed by Project Engineer.
  2. Notify Project Engineer and MDOT Architect three days in advance of dates and times when mockups will be constructed.
  3. Demonstrate the proposed range of aesthetic effects and workmanship.
  4. Obtain Project Engineer's and MDOT Architect's approval of mockups before starting work, fabrication, or construction.
    - a. Allow ten days for initial review and each re-review of each mockup.
  5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
  6. Demolish and remove mockups when directed unless otherwise indicated.
- K. Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in individual Specification Sections.
- L. Tolerances:
1. Walls: Finished wall surfaces shall be plumb and shall have a maximum variation of 1/8 inch in 8 feet when a straightedge is laid on the surface in any direction, and no measurable variation in any 2-foot direction.
  2. Ceilings: Finished ceiling surfaces shall present true, level, and plane surfaces, with a maximum variation of 1/8 inch in 8 feet when a straightedge and water level are laid on the surface in any direction and no measurable variation in any 2-foot direction.
  3. Concrete Floors: Tolerances for concrete floors and pavement are specified in Division 03.

4. Plywood Subfloors: Subfloor surfaces shall be level and shall have a maximum variation of plus or minus 1/8 inch in 10 feet. An additional tolerance of plus 1/4 inch per 2 feet of unsupported span will be allowed for camber.
5. Finished Floors: Level to within plus or minus 1/8 inch in 10 feet for resilient floor coverings.

M. Protection of Wood:

1. Provide protection of all wood materials and products, whether or not installed, including erected and installed wood framing and sheathing, from water and moisture of any kind until completion and acceptance of the project.
2. Keep informed of weather conditions and forecasts, and when there is a likelihood of rain, shall protect installed and exposed framing and sheathing and stored lumber exposed to the elements with suitable water-repellent coverings, such as canvas tarpaulins and polyethylene sheeting.
3. Millwork and trim, paneling, cabinets, shelving, and products manufactured from wood shall be kept under cover and dry at the shop until time for delivery. Such materials shall not be delivered to the site until the building is roofed, and exterior walls are sheathed and protected with building paper as a minimum, the doors and windows are installed and glazed, and there is ample interior storage space for such materials and products. Delivery shall not occur during periods of rain, heavy dew, or fog.
4. Wood materials or products which become wet from rain, dew, fog, or other source may be considered to have moisture damage and may be rejected, requiring replacement by the Contractor with new, dry materials or products at no increase in the Contract Price. Excepted materials: installed exterior wood siding, exterior wood trim, exterior wood doors, and exterior wood windows, after specified treatments, such as exterior wood stain or paint, have been applied.

N. Grout Fill: In applications where the grout installation may be subjected to moisture, the manufacturer shall submit a letter stating that the entire grout matrix does not contain any of the following:

1. Added gypsum.
2. Plaster-of-Paris
3. Sulfur trioxide levels in a portland cement component exceeding ASTM C 150's published limits.

1.07 QUALITY CONTROL

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

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.

- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
    - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
  2. Notify testing agencies at least 48 hours in advance of time when Work that requires testing or inspecting will be performed.
  3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
  4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
  5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Manufacturer's Field Services: Where indicated, engage a manufacturer's representative to observe and inspect the Work. Manufacturer's representative's services include examination of substrates and conditions, verification of materials, inspection of completed portions of the Work, and submittal of written reports. The manufacturer shall inspect and approve the application or installation work at no additional cost to Contractor or the Owner..
1. The Contractor shall make all necessary arrangements with the manufacturer of the products to be installed to provide onsite consultation and inspection services to assure the correct application or installation of the product, system, or assembly.
  2. The manufacturer's authorized representative shall be present at the time any phase of this work is started.
  3. The manufacturer's authorized representative shall inspect and approve all surfaces over which, or upon which the manufacturer's product will be applied or installed.
  4. The manufacturer's representative shall make periodic visits to the site as the work proceeds as necessary for consultation and for expediting the work in the most practical manner.
- D. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- E. Testing Agency Responsibilities: Cooperate with Project Engineer and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Project Engineer, MDOT Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
  2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
  3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.

4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
  5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
  6. Do not perform any duties of Contractor.
- F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
  2. Incidental labor and facilities necessary to facilitate tests and inspections.
  3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
  4. Facilities for storage and field curing of test samples.
  5. Delivery of samples to testing agencies.
  6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
  7. Security and protection for samples and for testing and inspecting equipment at Project site.
- G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.

#### 1.08 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Engage a qualified testing agency / special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner and as follows:
- B. Special Tests and Inspections: Conducted by a qualified testing agency / special inspector as required by authorities having jurisdiction, as indicated in individual Specification Sections and as follows:
1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
  2. Notifying Project Engineer, MDOT Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
  3. Submitting a certified written report of each test, inspection, and similar quality-control service to Project Engineer, MDOT Architect with copy to Contractor and to authorities having jurisdiction.
  4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
  5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
  6. Retesting and reinspecting corrected work.



PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 TEST AND INSPECTION LOG

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
  - 1. Date test or inspection was conducted.
  - 2. Description of the Work tested or inspected.
  - 3. Date test or inspection results were transmitted to Architect.
  - 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Project Engineer, and MDOT Architect's reference during normal working hours.

3.02 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
  - 1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01 73 00 "Execution."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION

## SECTION 01 42 00

## REFERENCES

## PART 1 - GENERAL

## 1.01 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Reviewed": When used to convey MDOT Architect's action on Contractor's submittals, applications, and requests, "reviewed" is limited to MDOT Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Installer": An installer is Contractor or another entity engaged by Contractor, as an employee, subcontractor, or contractor of lower tier, to perform a particular construction operation, including installation, erection, application, and similar operations.
- J. "Experienced": The term "experienced," when used with the term "installer," means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with the special requirements indicated; and having complied with requirements of authorities having jurisdiction.
  - 1. Using a term such as "carpentry" does not imply that accredited or unionized individuals of a corresponding generic name, such as "carpenter", must perform certain construction activities. It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.
- K. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.02 INDUSTRY STANDARDS

A. Identification and Purpose:

1. Identification: Throughout the Contract Documents are references to nationally known and recognized Codes, Reference Standards, Reference Specifications, and similar documents that are published by Regulatory Agencies, Trade and Manufacturing Associations and Societies, Testing Agencies and others. References also include certain Project Documents or designated portions.
2. Purpose: All named and otherwise identified "Reference Standards" are "by reference" hereby incorporated into these Specifications as though fully written and hereby serve to establish specific requirements and pertinent characteristics for materials and workmanship as well as methods for testing / reporting on compliance thereto.

B. Procedures and Responsibilities:

1. Compliance with Laws and Codes of governmental agencies having jurisdiction shall be mandatory and take precedence over the requirements of all other Reference Standards. For products or workmanship specified by Associations, Trade, or Federal Standards, comply with the requirements of the standard, except when supplemented instructions indicate a more rigid standard and / or define more precise requirements.
  - a. Should specified reference standards conflict with regulatory requirements or the Contract Documents, request Project Engineer's / MDOT Architect's clarification before proceeding.
2. The Contractor (including any and all Parties furnishing and / or installing any portion of The Work) shall be familiar with the indicated codes and standards. It shall be the Contractor's responsibility to verify the detailed requirements of the specifically named codes and standards and to verify (and provide written certification, when required) that the items procured for use in this Work (and their installation, as applicable) meet or exceed the specified requirements.
3. The contractual relationship of the Parties to the Contract shall not be altered from the requirements of the Contract Documents by mention or inference otherwise in any reference document.

C. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated or when earlier editions are specifically required by Codes.

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

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.03 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.

AABC	Associated Air Balance Council
AAMA	American Architectural Manufacturers Association
AASHTO	American Association of State Highway and Transportation Officials
AATCC	American Association of Textile Chemists and Colorists
ABMA	American Bearing Manufacturers Association
ACI	American Concrete Institute (Formerly: ACI International)
ACPA	American Concrete Pipe Association
AEIC	Association of Edison Illuminating Companies, Inc. (The)
AF&PA	American Forest & Paper Association
AGA	American Gas Association
AHAM	Association of Home Appliance Manufacturers
AHRI	Air-Conditioning, Heating, and Refrigeration Institute (The)
AI	Asphalt Institute
AIA	American Institute of Architects (The)
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
AMCA	Air Movement and Control Association International, Inc.
ANSI	American National Standards Institute
AOSA	Association of Official Seed Analysts, Inc.
APA	APA - The Engineered Wood Association
APA	Architectural Precast Association
API	American Petroleum Institute
ARI	Air-Conditioning & Refrigeration Institute (See AHRI)
ARI	American Refrigeration Institute (See AHRI)
ARMA	Asphalt Roofing Manufacturers Association
ASCE	American Society of Civil Engineers

ASCE/SEI	American Society of Civil Engineers/Structural Engineering Institute (See ASCE)
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
ASME	ASME International (American Society of Mechanical Engineers)
ASSE	American Society of Safety Engineers (The)
ASSE	American Society of Sanitary Engineering
ASTM	ASTM International (American Society for Testing and Materials International)
ATIS	Alliance for Telecommunications Industry Solutions
AWEA	American Wind Energy Association
AWI	Architectural Woodwork Institute
AWMAC	Architectural Woodwork Manufacturers Association of Canada
AWPA	American Wood Protection Association (Formerly: American Wood-Preservers' Association)
AWS	American Welding Society
AWWA	American Water Works Association
BHMA	Builders Hardware Manufacturers Association
BIA	Brick Industry Association (The)
BICSI	BICSI, Inc.
BIFMA	BIFMA International (Business and Institutional Furniture Manufacturer's Association)
BISSC	Baking Industry Sanitation Standards Committee
BOCA	BOCA (Building Officials and Code Administrators International Inc.) (See ICC)
BWF	Badminton World Federation (Formerly: International Badminton Federation)
CDA	Copper Development Association
CEA	Canadian Electricity Association
CEA	Consumer Electronics Association
CFFA	Chemical Fabrics & Film Association, Inc.
CFSEI	Cold-Formed Steel Engineers Institute

CGA	Compressed Gas Association
CIMA	Cellulose Insulation Manufacturers Association
CISCA	Ceilings & Interior Systems Construction Association
CISPI	Cast Iron Soil Pipe Institute
CLFMI	Chain Link Fence Manufacturers Institute
CPA	Composite Panel Association
CRI	Carpet and Rug Institute (The)
CRRC	Cool Roof Rating Council
CRSI	Concrete Reinforcing Steel Institute
CSA	Canadian Standards Association
CSA	CSA International (Formerly: IAS - International Approval Services)
CSI	Construction Specifications Institute (The)
CSSB	Cedar Shake & Shingle Bureau
CTI	Cooling Technology Institute (Formerly: Cooling Tower Institute)
CWC	Composite Wood Council (See CPA)
DASMA	Door and Access Systems Manufacturers Association
DHI	Door and Hardware Institute
ECA	Electronic Components Association
ECAMA	Electronic Components Assemblies & Materials Association (See ECA)
EIA	Electronic Industries Alliance (See TIA)
EIMA	EIFS Industry Members Association
EJMA	Expansion Joint Manufacturers Association, Inc.
ESD	ESD Association (Electrostatic Discharge Association)
ESTA	Entertainment Services and Technology Association (See PLASA)
EVO	Efficiency Valuation Organization

FM Approvals	FM Approvals LLC
FM Global	FM Global (Formerly: FMG - FM Global)
FRSA	Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc.
FSA	Fluid Sealing Association
FSC	Forest Stewardship Council U.S.
GA	Gypsum Association
GANA	Glass Association of North America
GS	Green Seal
HI	Hydraulic Institute
HI/GAMA	Hydronics Institute/Gas Appliance Manufacturers Association (See AHRI)
HMMA	Hollow Metal Manufacturers Association (See NAAMM)
HPVA	Hardwood Plywood & Veneer Association
HPW	H. P. White Laboratory, Inc.
IAPSC	International Association of Professional Security Consultants
IAS	International Approval Services (See CSA)
ICBO	International Conference of Building Officials (See ICC)
ICC	International Code Council
ICEA	Insulated Cable Engineers Association, Inc.
ICPA	International Cast Polymer Alliance
ICRI	International Concrete Repair Institute, Inc.
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers, Inc. (The)
IES	Illuminating Engineering Society (Formerly: Illuminating Engineering Society of North America)
IESNA	Illuminating Engineering Society of North America (See IES)
IEST	Institute of Environmental Sciences and Technology
IGMA	Insulating Glass Manufacturers Alliance

IGSHPA	International Ground Source Heat Pump Association
ILI	Indiana Limestone Institute of America, Inc.
Intertek	Intertek Group (Formerly: ETL SEMCO; Intertek Testing Service NA)
ISA	International Society of Automation (The) (Formerly: Instrumentation, Systems, and Automation Society)
ISAS	Instrumentation, Systems, and Automation Society (The) (See ISA)
ISFA	International Surface Fabricators Association (Formerly: International Solid Surface Fabricators Association)
ISO	International Organization for Standardization
ISSFA	International Solid Surface Fabricators Association (See ISFA)
ITU	International Telecommunication Union
KCMA	Kitchen Cabinet Manufacturers Association
LMA	Laminating Materials Association (See CPA)
LPI	Lightning Protection Institute
MBMA	Metal Building Manufacturers Association
MCA	Metal Construction Association
MFMA	Maple Flooring Manufacturers Association, Inc.
MFMA	Metal Framing Manufacturers Association, Inc.
MHIA	Material Handling Industry of America
MIA	Marble Institute of America
MMPA	Moulding & Millwork Producers Association (Formerly: Wood Moulding & Millwork Producers Association)
MPI	Master Painters Institute
MSS	Manufacturers Standardization Society of The Valve and Fittings Industry Inc.
NAAMM	National Association of Architectural Metal Manufacturers
NACE	NACE International (National Association of Corrosion Engineers International)
NADCA	National Air Duct Cleaners Association
NAIMA	North American Insulation Manufacturers Association



NBGQA	National Building Granite Quarries Association, Inc.
NCAA	National Collegiate Athletic Association (The)
NCMA	National Concrete Masonry Association
NEBB	National Environmental Balancing Bureau
NECA	National Electrical Contractors Association
NeLMA	Northeastern Lumber Manufacturers Association
NEMA	National Electrical Manufacturers Association
NETA	InterNational Electrical Testing Association
NFHS	National Federation of State High School Associations
NFPA	NFPA (National Fire Protection Association)
NFPA	NFPA International (See NFPA)
NFRC	National Fenestration Rating Council
NHLA	National Hardwood Lumber Association
NLGA	National Lumber Grades Authority
NOFMA	National Oak Flooring Manufacturers Association (See NWFA)
NOMMA	National Ornamental & Miscellaneous Metals Association
NRCA	National Roofing Contractors Association
NRMCA	National Ready Mixed Concrete Association
NSF	NSF International (National Sanitation Foundation International)
NSPE	National Society of Professional Engineers
NSSGA	National Stone, Sand & Gravel Association
NTMA	National Terrazzo & Mosaic Association, Inc. (The)
NWFA	National Wood Flooring Association
PCI	Precast/Prestressed Concrete Institute
PDI	Plumbing & Drainage Institute
PLASA	PLASA (Formerly: ESTA - Entertainment Services and Technology Association)

RCSC	Research Council on Structural Connections
RFCI	Resilient Floor Covering Institute
RIS	Redwood Inspection Service
SAE	SAE International (Society of Automotive Engineers)
SBCCI	Southern Building Code Congress International, Inc. (See ICC)
SCTE	Society of Cable Telecommunications Engineers
SDI	Steel Deck Institute
SDI	Steel Door Institute
SEFA	Scientific Equipment and Furniture Association
SEI/ASCE	Structural Engineering Institute/American Society of Civil Engineers (See ASCE)
SIA	Security Industry Association
SJI	Steel Joist Institute
SMA	Screen Manufacturers Association
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association
SMPTE	Society of Motion Picture and Television Engineers
SPFA	Spray Polyurethane Foam Alliance
SPIB	Southern Pine Inspection Bureau
SPRI	Single Ply Roofing Industry
SRCC	Solar Rating and Certification Corporation
SSINA	Specialty Steel Industry of North America
SSPC	SSPC: The Society for Protective Coatings
STI	Steel Tank Institute
SWI	Steel Window Institute
SWPA	Submersible Wastewater Pump Association
TCA	Tilt-Up Concrete Association
TCNA	Tile Council of North America, Inc.
TEMA	Tubular Exchanger Manufacturers Association, Inc.

TIA	Telecommunications Industry Association (Formerly: TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance)
TIA/EIA	Telecommunications Industry Association/Electronic Industries Alliance (See TIA)
TMS	The Masonry Society
TPI	Truss Plate Institute
TPI	Turfgrass Producers International
TRI	Tile Roofing Institute
UBC	Uniform Building Code (See ICC)
UL	Underwriters Laboratories Inc.
UNI	Uni-Bell PVC Pipe Association
USAV	USA Volleyball
USGBC	U.S. Green Building Council
USITT	United States Institute for Theatre Technology, Inc.
WASTEC	Waste Equipment Technology Association
WCLIB	West Coast Lumber Inspection Bureau
WCMA	Window Covering Manufacturers Association
WDMA	Window & Door Manufacturers Association
WI	Woodwork Institute (Formerly: WIC - Woodwork Institute of California)
WMMPA	Wood Moulding & Millwork Producers Association (See MMPA)
WSRCA	Western States Roofing Contractors Association
WWPA	Western Wood Products Association

B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.

DIN	Deutsches Institut für Normung e.V.
IAPMO	International Association of Plumbing and Mechanical Officials
ICC	International Code Council

ICC-ES ICC Evaluation Service, LLC

C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.

COE	Army Corps of Engineers
CPSC	Consumer Product Safety Commission
DOC	Department of Commerce National Institute of Standards and Technology
DOD	Department of Defense
DOE	Department of Energy
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FG	Federal Government Publications
GSA	General Services Administration
HUD	Department of Housing and Urban Development
LBL	Lawrence Berkeley National Laboratory Environmental Energy Technologies Division
OSHA	Occupational Safety & Health Administration
SD	Department of State
TRB	Transportation Research Board National Cooperative Highway Research Program
USDA	Department of Agriculture Agriculture Research Service U.S. Salinity Laboratory
USDA	Department of Agriculture Rural Utilities Service
USDJ	Department of Justice Office of Justice Programs National Institute of Justice
USP	U.S. Pharmacopeia
USPS	United States Postal Service

D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list.

- CFR Code of Federal Regulations  
Available from Government Printing Office
- DOD Department of Defense  
Military Specifications and Standards  
Available from Department of Defense Single Stock Point
- DSCC Defense Supply Center Columbus (See FS)
- FED-STD Federal Standard (See FS)
- FS Federal Specification  
Available from Department of Defense Single Stock Point  
  
Available from Defense Standardization Program  
  
Available from General Services Administration  
  
Available from National Institute of Building Sciences/Whole Building Design Guide
- MILSPEC Military Specification and Standards (See DOD)
- USAB United States Access Board
- USATBCB U.S. Architectural & Transportation Barriers Compliance Board (See USAB)

E. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.

- CBHF State of California  
Department of Consumer Affairs  
Bureau of Home Furnishings and Thermal Insulation
- CCR California Code of Regulations  
Office of Administrative Law  
California Title 24 Energy Code
- CDHS California Department of Health Care Services (Formerly: California Department of Health Services) (See CCR)
- CDPH California Department of Public Health  
Indoor Air Quality Program
- CPUC California Public Utilities Commission
- SCAQMD South Coast Air Quality Management District

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Project No. BWO-5213-35(001) 502587  
BWO-5214-35(001) 502587  
BWO-5067-35(003) 502587  
BWO-5221-35(001) 502587  
LWO-5035-35(002) 502587

TFS Texas Forest Service  
Forest Resource Development and Sustainable Forestry

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 45 23 TESTING AND INSPECTION SERVICES - CONTRACTOR

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Laboratory selection and payment.
2. Laboratory duties.
3. Contractor's responsibilities.

B. Related Sections:

1. Individual specifications sections contain specific tests and inspections to be performed.
2. Section 01 45 29 – Testing Laboratory Services –MDOT.

1.02 REFERENCES

A. ASTM International (ASTM):

1. D3666 - Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials.
2. E329 - Standard Specification for Agencies Engaged in Construction Inspection and/or Testing.
3. E543 - Standard Specification for Agencies Performing Nondestructive Testing.

1.03 QUALITY ASSURANCE

- A. Employment of Testing Laboratory shall in no way relieve Contractor of his obligations to perform work in accordance with Contract Documents.
- B. Contractor shall employ and pay for services of an independent testing laboratory to perform specified testing and inspection.
- C. Refer to the Conditions of the Contract for provisions related to special inspections and testing.
- D. Qualifications of Laboratory:
  1. Meet requirements of ASTM [C1077] [D3666] [D3740] [E329] [and] [E543].
  2. Authorized to operate in State in which project is located.

1.04 LABORATORY DUTIES

- A. Cooperate with Project Engineer, Architect and Contractor; provide qualified personnel after due notice.

- B. Perform specified inspections, sampling, and testing of materials and methods of construction:
  - 1. Comply with specified standards.
  - 2. Ascertain compliance or noncompliance of materials with requirements of Contract Documents.
- C. Promptly notify Project Engineer, MDOT Architect, Architect and Contractor of observed irregularities or deficiencies of Work or products.
- D. Promptly submit written report of each test and inspection; submit electronically in Adobe PDF format to Project Engineer, Architect, MDOT Architect and Contractor.
- E. Each report to include:
  - 1. Date issued.
  - 2. Project title and number.
  - 3. Testing Laboratory name, address, and telephone number.
  - 4. Name of Inspector and signature of individual in charge.
  - 5. Date and time of sampling or inspection.
  - 6. Record of temperature and weather conditions.
  - 7. Date of test.
  - 8. Identification of product and specification section.
  - 9. Location of sample or test in project.
  - 10. Type of inspection or test.
  - 11. Results of tests and compliance or noncompliance with Contract Documents.
  - 12. Interpretation of test results when requested by Project Engineer, MDOT Architect, Architect or Contractor.
- F. Perform additional tests when required by Project Engineer, MDOT Architect, Architect or Contractor.
- G. Laboratory is not authorized to:
  - 1. Release, revoke, alter, or enlarge on requirements of Contract Documents.
  - 2. Approve or accept any portion of work.
  - 3. Perform any duties of Contractor.

#### 1.05 CONTRACTOR'S RESPONSIBILITIES

- A. Cooperate with Laboratory personnel, provide access to Work, and to manufacturer's operations.
- B. When materials require testing prior to being incorporated into Work, secure and deliver to Laboratory adequate quantities of representative samples of materials proposed to be used.
- C. Furnish copies of product test reports as required.



- D. Furnish incidental labor and facilities:
  - 1. To provide access to work to be tested.
  - 2. To obtain and handle samples at site or at source of product to be tested.
  - 3. To facilitate inspections and tests.
  - 4. For safe storage and curing of test samples.
- E. Notify Laboratory sufficiently in advance of operations to allow for Laboratory assignment of personnel and scheduling of tests.
- F. Make arrangements with Laboratory and pay for additional samples and tests required for Contractor's convenience.
- G. When tests or inspections cannot be performed after such notice, reimburse Owner for Laboratory personnel and travel expenses incurred due to Contractor's negligence.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

## SECTION 01 45 29

## TESTING LABORATORY SERVICES - MDOT

## PART 1 - GENERAL

## 1.01 SUMMARY

- A. Scope: The Contractor shall use testing laboratory services of the Mississippi Department of Transportation for all testing required in this Section. These services will be provided to the Contractor by the MDOT at no charge. Use of said services shall in no way relieve the Contractor of his obligation to perform Work in accordance with the Contract. Refer to Section 01 45 23 Testing and Inspection Services – Contractor for additional testing and inspection services required to be provided by the Contractor.
- B. Inspection, Sampling and Testing are required for:
1. Section 31 23 12, Excavation, Fill and Grading.
  2. Section 03 20 00, Concrete Reinforcing.
  3. Section 03 30 00, Cast-In-Place Concrete.

## 1.02 LABORATORY'S DUTIES

- A. Materials will be inspected and sampled in accordance with current Mississippi Department of Transportation SOP pertaining to inspecting and sampling.
- B. Prepare reports of inspections and tests including:
1. Date issued.
  2. Project title and number.
  3. Testing laboratory, name and address.
  4. Name and signature of inspector.
  5. Date of inspection or sampling.
  6. Record of temperature and weather.
  7. Date of test.
  8. Identification of product and Specification Section.
  9. Location of Project.
  10. Type of inspection or test.
  11. Observations regarding compliance with Contract Documents requirements.
- C. Distribute copies of reports of inspections and tests to Project Engineer and one copy to the MDOT Architect.

## 1.03 CONTRACTOR'S RESPONSIBILITIES

- A. Cooperate with laboratory personnel to provide to laboratory in required quantities preliminary representative samples of materials to be tested.
- B. When required, furnish copies of mill test reports. Furnish to laboratory, casual labor to obtain and handle samples at the site and to facilitate inspections and tests.
- C. Provide facilities for laboratory's exclusive use for storage and curing of test samples.

- D. Notify laboratory in advance of operations to allow for assignment of personnel and scheduling of tests.

1.04 MATERIAL CERTIFICATIONS AND CERTIFIED TEST REPORTS

- A. All certifications shall meet the following requirements:
  - 1. Have letterhead of the manufacturer, producer, supplier, or fabricator.
  - 2. Include the project number.
  - 3. Itemized list of materials covered by the certification.
  - 4. Contain a material conformance statement, which certifies that the materials conform to the specific specification requirements.
  - 5. Certification for all steel and steel wire products must also include a certified statement by the manufacturer that all of the manufacturing processes are of domestic origin.
  - 6. Signature of a responsible company official.
  
- B. All certified test reports shall meet the following requirements:
  - 1. Have letterhead of the manufacturer, producer, supplier, fabricator, or laboratory.
  - 2. Include name and description of material, lot, batch, or heat number, etc., as applicable.
  - 3. Show results of each required test, and state that the test was run according to the test method specified.
  - 4. Test reports for all steel and steel wire products must also include a certified statement by the manufacturer that all of the manufacturing processes are of domestic origin.
  - 5. Signature of a responsible laboratory official.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
- B. Related Requirements:
  - 1. Section 01 10 00 "Summary" for work restrictions and limitations on utility interruptions.

1.02 USE CHARGES

- A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Project Engineer, MDOT Architect, occupants of Project, testing agencies, and authorities having jurisdiction.
- B. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.
- C. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.03 INFORMATIONAL SUBMITTALS

- A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.
- B. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.
- C. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire prevention program.

1.04 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.
- C. Accessible Temporary Egress: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.

1.05 PROJECT CONDITIONS

- A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Portable Chain-Link Fencing: Minimum 2-inch, 0.148-inch- thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch-OD line posts and 2-7/8-inch-OD corner and pull posts, with 1-5/8-inch-OD top and bottom rails. Provide concrete bases for supporting posts.

2.02 TEMPORARY FACILITIES

- A. Field Offices: The Contractor is not required to furnish a field office, but shall provide at the job site duplicates of all correspondence, shop drawings, plans, specifications, samples, etc. required to administer the Project. These duplicates will be permanently kept as reference and shall not be used in the field. Contractor shall provide the Project Engineer and the MDOT Architect with job site and emergency telephone numbers.
- B. Storage and Fabrication Sheds: It shall be the Contractor's option to provide watertight storage facilities for storage of cement, lime, and / or other materials subject to water damage. If storage facilities are used, it shall be of sufficient size to hold all materials required for logically grouped activities on the site at one time, and shall have floors raised at least 6 inches above the ground on heavy joists or sleepers. Fully enclosed trailer is allowed, but location must be coordinated with Project Engineer.

2.03 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
  - 1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.

2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in system and remove at end of construction and clean HVAC system as required in Section 01 77 00 "Closeout Procedures".

### PART 3 - EXECUTION

#### 3.01 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

#### 3.02 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
  1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
  1. Connect temporary sewers to system indicated as directed by authorities having jurisdiction.
- C. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.
- D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
- E. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

- F. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
- G. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
  - 1. Install electric power service overhead unless otherwise indicated.
  - 2. Connect temporary service to Owner's existing power source, as directed by Owner.
- H. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
  - 1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
- I. Telephone Service: Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.

### 3.03 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:
  - 1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
  - 2. Maintain support facilities until Project Engineer schedules Final Completion inspection. Remove before Final Completion. Personnel remaining after Final Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
- B. Temporary Use of Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.
  - 1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
  - 2. Prepare subgrade and install subbase and base for temporary roads and paved areas according to Section 31 20 00 "Earth Moving."
  - 3. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.
  - 4. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course according to Section 32 12 16 "Asphalt Paving."

- C. Traffic Controls: Comply with requirements of authorities having jurisdiction.
  - 1. Protect existing site improvements to remain including curbs, pavement, and utilities.
  - 2. Maintain access for fire-fighting equipment and access to fire hydrants.
  - 3. The drive is to remain open at all times. A flagman will be required to control traffic when construction vehicles are present.
- D. Parking: Use designated areas of Owner's existing parking areas for construction personnel.
- E. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
  - 1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
  - 2. Remove snow and ice as required to minimize accumulations.
- F. Project Signs: Unauthorized signs are not permitted.
- G. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 01 73 00 "Execution."
- H. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
  - 1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

3.04 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
- B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
- C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to requirements of 2003 EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.



- D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.
1. Provide pumps as required to keep the excavation free from standing water and shall slope the excavation to prevent water from running toward existing buildings at all times.
- E. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.
- F. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.
- G. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.
- H. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- I. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.
- J. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
1. Where heating or cooling is needed and permanent enclosure is not complete, insulate temporary enclosures.
- K. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire prevention program.
1. Prohibit smoking in construction areas.
  2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
  3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

**3.05 MOISTURE AND MOLD CONTROL**

- A. Contractor's Moisture Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.
- B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect materials from water damage and keep porous and organic materials from coming into prolonged contact with concrete.
- C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
  - 1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
  - 2. Keep interior spaces reasonably clean and protected from water damage.
  - 3. Discard or replace water-damaged and wet material.
  - 4. Discard, replace, or clean stored or installed material that begins to grow mold.
  - 5. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.
- D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
  - 1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
  - 2. Remove materials that cannot be completely restored to their manufactured moisture level within 72 hours.

**3.06 OPERATION, TERMINATION, AND REMOVAL**

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Burning of Trash: No burning of trash or debris shall be done on Owner's property. All such materials shall be removed from the site and disposed of in accordance with local laws and ordinances.
- C. Maintenance: Maintain facilities in good operating condition until removal.
  - 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.
- D. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- E. Conduct of workers: Workmen, who, because of improper conduct or persistent violation of Owner's requirements, become objectionable, shall be removed at the Owner's request. Inform all workmen of Owner's requirements.

- F. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been 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 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 property of Contractor. Owner reserves right to take possession of Project identification signs.
  2. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 01 77 00 "Closeout Procedures."

END OF SECTION

SECTION 01 60 00                      PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.01        SUMMARY

- A.    Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
- B.    Related Requirements: Section 01 25 00 "Substitution Procedures" for requests for substitutions.

1.02        DEFINITIONS

- A.    Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
  - 1.    Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
  - 2.    New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
  - 3.    Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B.    Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

**1.03 ACTION SUBMITTALS**

- A. **Comparable Product Requests:** Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
1. **MDOT Architect's Action:** If necessary, MDOT Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. MDOT Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or ten days of receipt of additional information or documentation, whichever is later.
    - a. **Form of Approval:** As specified in Section 01 33 00 "Submittal Procedures."
    - b. **Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.**
- B. **Basis-of-Design Product Specification Submittal:** Comply with requirements in Section 01 33 00 "Submittal Procedures." Show compliance with requirements.

**1.04 QUALITY ASSURANCE**

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

**1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING**

- A. **Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.**
- B. **Delivery and Handling:**
1. **Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.**
  2. **Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.**
  3. **Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.**
  4. **Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.**
- C. **Storage:**
1. **Store products to allow for inspection and measurement of quantity or counting of units.**
  2. **Store materials in a manner that will not endanger Project structure.**

3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.

1.06 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
  1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
  2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
  1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
  2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
  3. Refer to other Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Section 01 77 00 "Closeout Procedures."

PART 2 - PRODUCTS

2.01 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
  1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
  2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
  3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.

4. Where products are accompanied by the term "as selected," MDOT Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.

B. Product Selection Procedures:

1. Products specified only by reference standards, select any product meeting standards by any manufacturer.
2. Products specified by naming several (minimum of three) products or manufacturers, select any product and manufacturer named. Contractor must submit request, as required for substitution, for any product not specifically named and GIVE REASONS for not using product specified. Substitutions WILL NOT be granted unless reasons are considered justified.
3. Products specified by naming one or more products, but indicating the option of selecting equivalent products by stating "or approved equal" after specified product, Contractor must submit request, as required for substitution, for any product not specifically named.
4. Products specified by naming only one product and manufacturer, an equivalent product will always be accepted if it is equal in all respects (size, shape, texture, color, etc.). The Contractor must submit a request for substitution as set forth in this section.
5. Products specified by naming only one product and manufacturer and stating no substitutions will be accepted, there is no option and no substitutions will be allowed.

C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 01 25 00 "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.02 COMPARABLE PRODUCTS

- A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
  2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
  3. Evidence that proposed product provides specified warranty.
  4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
  5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION



SECTION 01 73 00 EXECUTION

PART 1 - GENERAL

1.01 SUMMARY

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

1. Construction layout.
2. Field engineering and surveying.
3. Installation of the Work.
4. Cutting and patching.
5. Progress cleaning.
6. Starting and adjusting.
7. Protection of installed construction.
8. Correction of the Work.

B. Related Requirements:

1. Section 01 10 00 "Summary" for limits on use of Project site.
2. Section 01 77 00 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.
3. Section 07 84 13 "Penetration Firestopping" for patching penetrations in fire-rated construction.

1.02 INFORMATIONAL SUBMITTALS

- A. Certificates: Submit certificate signed by land surveyor or professional engineer certifying that location and elevation of improvements comply with requirements.
- B. Certified Surveys: Submit three copies signed by land surveyor or professional engineer.

1.03 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

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

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

2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety
4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in MDOT Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

## PART 2 - PRODUCTS

### 2.01 MATERIALS

- A. General: Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
  1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to MDOT Architect for the visual and functional performance of in-place materials.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.
  1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
  2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
  1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.

2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
  3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

### 3.02 PREPARATION

- A. Existing Utility Information: Furnish information to local utility and the Project Engineer that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 01 31 00 "Project Management and Coordination."

### 3.03 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Project Engineer and MDOT Architect promptly.
- B. General: Engage a land surveyor or professional engineer to lay out the Work using accepted surveying practices.
1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
  2. Establish limits on use of Project site.
  3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
  4. Inform installers of lines and levels to which they must comply.
  5. Check the location, level and plumb, of every major element as the Work progresses.
  6. Notify Project Engineer and MDOT Architect when deviations from required lines and levels exceed allowable tolerances.
  7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.
- D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
- E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Project Engineer and MDOT Architect.

#### 3.04 FIELD ENGINEERING

- A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
- B. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
  - 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.

#### 3.05 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
  - 1. Make vertical work plumb and make horizontal work level.
  - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
  - 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Final Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

- G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
  - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Project Engineer. Mounting heights shall comply with ADA and OSHA requirements.
  - 2. Allow for building movement, including thermal expansion and contraction.
  - 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

### 3.06 CUTTING AND PATCHING

- A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
  - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Temporary Support: Provide temporary support of work to be cut.
- C. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- D. Adjacent Occupied Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- E. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.

- F. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
  2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
  3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
  4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
  5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
  6. Proceed with patching after construction operations requiring cutting are complete.
- G. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
  2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
  3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
  4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
  5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
- H. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

### 3.07 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.

2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
  3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
1. Remove liquid spills promptly.
  2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways.
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.
- 3.08 STARTING AND ADJUSTING
- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: Comply with qualification requirements in Section 01 40 00 "Quality Requirements"

3.09 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION



SECTION 01 74 19

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
  - 1. Recycling nonhazardous construction waste.
  - 2. Disposing of nonhazardous construction waste.
- B. Related Requirements:
  - 1. Section 04 20 00 "Unit Masonry" for disposal requirements for masonry waste.
  - 2. Section 31 10 00 "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

1.02 DEFINITIONS

- A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction. Construction waste includes packaging.
- B. Disposal: Removal off-site of construction waste and subsequent recycling, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

1.03 ACTION SUBMITTALS

- A. Waste Management Plan: Submit plan within 15 days of date established for the Notice to Proceed.

1.04 INFORMATIONAL SUBMITTALS

- A. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

1.05 QUALITY ASSURANCE

- A. Waste Management Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination."

1.06 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.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 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.
- B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. Coordinator shall be present at Project site full time for duration of Project.
- C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.
  - 1. Distribute waste management plan to everyone concerned within five 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, and recycled.
  - 2. Comply with Section 01 50 00 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.02 RECYCLING CONSTRUCTION WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.
  - 1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
  - 2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
  - 3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
  - 4. Store components off the ground and protect from the weather.
  - 5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor.

3.03 RECYCLING CONSTRUCTION WASTE

A. Packaging:

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

B. Wood Materials:

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

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

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

3.04 DISPOSAL OF WASTE

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

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

B. Burning: Do not burn waste materials.

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

END OF SECTION

SECTION 01 77 00

CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
  - 1. Final completion procedures.
  - 2. Warranties.
  - 3. Final cleaning.
  - 4. Repair of the Work.
  
- B. Related Requirements:
  - 1. Section 01 32 33 "Photographic Documentation" for submitting final completion construction photographic documentation.
  - 2. Section 01 78 23 "Operation and Maintenance Data" for operation and maintenance manual requirements.
  - 3. Section 01 78 39 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
  - 4. Section 01 79 00 "Demonstration and Training" for requirements for instructing Owner's personnel.

1.02 FINAL INSPECTIONS

- A. Engineer and Architect's Inspection: The Contractor shall make written request for a Final Inspection to the Project Engineer and MDOT Architect. Notice is to be given 10 calendar days prior to this inspection. At the day of inspection, the Contractor shall have in hand 6 copies of the HVAC Test and Balance Report, Reference Specification Sections in Division 23 and 6 copies of a list prepared by the Contractor of deficiencies, which will be edited by the Project Engineer, MDOT Architect and Consultants. A copy of these composite lists will be given to the Contractor for correcting the Work. Within 15 calendar days after this revised list is received, the Contractor shall make all corrections of the items listed. If, in the Project Engineer and MDOT Architect's judgment, the Project is not ready for an Inspection, the Project Engineer may schedule another inspection.
  
- B. Owner's Inspection: After the Project Engineer and MDOT Architect have determined the Project to be Complete and all punch list items have been corrected, an Owner's Inspection will be scheduled. The Contractor shall submit a letter that states all items have been corrected and submit required closeout Documents. The Owners may add to the punch list items; if it is determined that corrective work still needs to be done. Within 15 calendar days after this revised list is received, the Contractor shall make all corrections of the items listed.

- C. Correction of Work before Final Payment: Contractor shall promptly remove from the Owner's premises, all materials condemned for failure to conform to the Contract, whether incorporated in Work or not, and Contractor shall, at his own expense, replace such condemned materials with those conforming to the requirements of the Contract. Failure to remedy such defects after 10 days written notice will allow the Owner to make good such defects and such costs shall be deducted from the balance due the Contractor or charged to the Contractor in the event no payment is due.
- D. Should additional inspections by the MDOT Architect's Consultants of the Work be required due to failure of the Contractor to remedy defects listed, the Project Engineer may deduct the expense of additional Consultants inspections from the Contract Sum in the Owner / Contractor Agreement. The additional expense will be based on the rate shown for services in the Consultants' Architect or Engineering Services Contract.

#### 1.03 FINAL ACCEPTANCE

- A. The Mississippi Department of Transportation does not recognize the term "Substantial Completion". The Project Engineer shall determine when the building is complete to the point it can be used for its intended purpose and occupied. This date shall be the Date of Completion.
- B. Final Payment shall not be made until items covered in Closeout Procedures are satisfied. This date shall be the Date of Final Acceptance.

#### 1.04 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: All Warranties and Extended Warranties shall use this Date of Completion as the starting date of Warranty Period.
- B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
  - 1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
  - 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
  - 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
  - 4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
- C. Provide additional copies of each warranty to include in operation and maintenance manuals.

## 1.05 CLOSEOUT DOCUMENTS

- A. Unless otherwise notified, the Contractor shall submit to the Owner through the Project Engineer to the MDOT Architect 2 copies the following before final payment is made:
1. Request for Final Payment: AIA Document G702, current edition, completed in full or a computer generated form having similar data.
  2. Contractor's Affidavit of Payment of Debts and Claims: AIA Document G706, current edition, completed in full.
  3. Release of Liens and Certification that all Bills Have Been Paid: AIA Document G706A, current edition, completed in full or a sworn statement and affidavit from the Contractor to the Owner stating that all bills for this project have been paid and that the Owner is released from any and all claims and / or damages.
  4. Consent of Surety Company to Final Payment: AIA Document G707, current edition, completed in full by the Bonding Company.
  5. Power of Attorney: Closeout Documents should be accompanied by an appropriate Power of Attorney.
  6. Guarantee of Work: Sworn statement that all Work is asbestos free and guaranteed against defects in materials and workmanship for one year from Date of Completion, except where specified for longer periods.
    - a. Word the guaranty as follows: "We hereby guarantee all Work performed by us on the above captioned Project to be free from asbestos and defective materials. We also guarantee workmanship for a period of one (1) year or such longer period of time as may be called for in the Contract Documents for such portions of the Work".
    - b. All guarantees and warranties shall be obtained in the Owner's name.
    - c. Within the guaranty period, if repairs or changes are requested in connection with guaranteed Work which, in the opinion of the Owner, is rendered necessary as a result of the use of materials, equipment, or workmanship which are inferior, defective, or not in accordance with the terms of the Contract, the Contractor shall promptly, upon receipt of notice from and without expense to the Owner, place in satisfactory condition in every particular, all such guaranteed Work, correct all defects wherein and make good all damages to the building, site, equipment or contents thereof which, in the opinion of the Owner, is the result of the use of materials, equipment, or workmanship which are inferior, defective or not in accordance with the terms of the Contract; and make good any Work or materials or the equipment and contents of said buildings or site disturbed in fulfilling any such guaranty.
    - d. If, after notice, the Contractor fails to proceed promptly to comply with the terms of the guaranty, the Owner may have the defects corrected and the Contractor and his sureties shall be liable for all expense incurred.
    - e. All special guaranties applicable to definite parts of the Work stipulated in the Project Manual or other papers forming part of the Contract shall be subject to the terms of this paragraph during the first year of the life of such special guaranty.

7. Project Record Documents: Furnish all other record documents as set forth in Section 01 78 39 - Project Record Documents.
  - a. Provide all certificates, warranties, guarantees, bonds, or documents as called for in the individual Sections of the Project Manual. The Contractor is responsible for examining the Project Manual for these requirements.
8. Additional Documents Specified Within the Project Manual:
  - a. General Provide all Operational and Maintenance documents as called for in the individual Sections of the Project Manual. The Contractor is responsible for examining the Project Manual for these requirements.
  - b. Maintenance Stock: Deliver to Owner all required additional maintenance materials as required in the various Sections of the Specifications.

## PART 2 - PRODUCTS

### 2.01 MATERIALS

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

## PART 3 - EXECUTION

### 3.01 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
  1. Complete the following cleaning operations before requesting Engineer and Architect final inspection.
    - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
    - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
    - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
    - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
    - e. Remove snow and ice to provide safe access to building.
    - f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.

- g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
  - h. Sweep concrete floors broom clean in unoccupied spaces.
  - i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
  - j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
  - k. Remove labels that are not permanent.
  - l. Wipe surfaces of mechanical and electrical equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
  - m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
  - n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
  - o. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
  - p. Leave Project clean and ready for occupancy.
- C. Pest Control: Comply with pest control requirements in Section 01 50 00 "Temporary Facilities and Controls." Prepare written report.

### 3.02 REPAIR OF THE WORK

- A. Complete repair and restoration operations before requesting Final Inspection.
- B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
  - 1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
  - 2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration.
    - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
  - 3. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION



SECTION 01 78 23

OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
  - 1. Operation and maintenance documentation directory.
  - 2. Emergency manuals.
  - 3. Operation manuals for systems, subsystems, and equipment.
  - 4. Product maintenance manuals.
  - 5. Systems and equipment maintenance manuals.

1.02 CLOSEOUT SUBMITTALS

- A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
  - 1. MDOT Architect will comment on whether content of operations and maintenance submittals are acceptable.
  - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Format: Submit operations and maintenance manuals in the following format:
  - 1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to MDOT Architect.
    - a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
    - b. Enable inserted reviewer comments on draft submittals.
  - 2. Three paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. MDOT Architect will return one copy.
- C. Manual Submittal: Submit each manual in final form prior to requesting Final Inspection and at least 15 days before commencing demonstration and training. MDOT Architect will return one copy with comments.
  - 1. Correct or revise each manual to comply with MDOT Architect's comments. Submit two copies of each corrected manual within 15 days of receipt of MDOT Architect's comments and prior to commencing demonstration and training.

## PART 2 - PRODUCTS

## 2.01 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information.
- B. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
  - 1. Title page.
  - 2. Table of contents.
  - 3. Manual contents.
- C. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:
  - 1. Subject matter included in manual.
  - 2. Name and address of Project.
  - 3. Name and address of Owner.
  - 4. Date of submittal.
  - 5. Name and contact information for Contractor.
  - 6. Name and contact information for Architect.
  - 7. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
  - 8. Cross-reference to related systems in other operation and maintenance manuals.
- D. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
- E. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- F. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
  - 1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.

2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.
- G. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.
1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
    - a. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents, and indicate Specification Section number(s) on bottom of spine. Indicate volume number for multiple-volume sets.
  2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
  3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
  4. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
    - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
    - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

## 2.02 EMERGENCY MANUALS

- A. Content: Organize manual into a separate section for each of the following:
1. Type of emergency.
  2. Emergency instructions.
  3. Emergency procedures.
- B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
1. Fire.
  2. Flood.
  3. Gas leak.
  4. Water leak.
  5. Power failure.

6. Water outage.
  7. System, subsystem, or equipment failure.
  8. Chemical release or spill.
- C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- D. Emergency Procedures: Include the following, as applicable:
1. Instructions on stopping.
  2. Shutdown instructions for each type of emergency.
  3. Operating instructions for conditions outside normal operating limits.
  4. Required sequences for electric or electronic systems.
  5. Special operating instructions and procedures.

### 2.03 OPERATION MANUALS

- A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
  2. Performance and design criteria if Contractor is delegated design responsibility.
  3. Operating standards.
  4. Operating procedures.
  5. Operating logs.
  6. Wiring diagrams.
  7. Control diagrams.
  8. Piped system diagrams.
  9. Precautions against improper use.
  10. License requirements including inspection and renewal dates.
- B. Descriptions: Include the following:
1. Product name and model number. Use designations for products indicated on Contract Documents.
  2. Manufacturer's name.
  3. Equipment identification with serial number of each component.
  4. Equipment function.
  5. Operating characteristics.
  6. Limiting conditions.
  7. Performance curves.
  8. Engineering data and tests.
  9. Complete nomenclature and number of replacement parts.
- C. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
  2. Equipment or system break-in procedures.
  3. Routine and normal operating instructions.
  4. Regulation and control procedures.

- 5. Instructions on stopping.
- 6. Normal shutdown instructions.
- 7. Seasonal and weekend operating instructions.
- 8. Required sequences for electric or electronic systems.
- 9. Special operating instructions and procedures.

- D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.04 PRODUCT MAINTENANCE MANUALS

- A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- C. Product Information: Include the following, as applicable:
  - 1. Product name and model number.
  - 2. Manufacturer's name.
  - 3. Color, pattern, and texture.
  - 4. Material and chemical composition.
  - 5. Reordering information for specially manufactured products.
- D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
  - 1. Inspection procedures.
  - 2. Types of cleaning agents to be used and methods of cleaning.
  - 3. List of cleaning agents and methods of cleaning detrimental to product.
  - 4. Schedule for routine cleaning and maintenance.
  - 5. Repair instructions.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds. Include procedures to follow and required notifications for warranty claims.

**2.05 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS**

- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
1. Standard maintenance instructions and bulletins.
  2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
  3. Identification and nomenclature of parts and components.
  4. List of items recommended to be stocked as spare parts.
- D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
1. Test and inspection instructions.
  2. Troubleshooting guide.
  3. Precautions against improper maintenance.
  4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
  5. Aligning, adjusting, and checking instructions.
  6. Demonstration and training video recording, if available.
- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
1. Schedule Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
  2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

PART 3 - EXECUTION

3.01 MANUAL PREPARATION

- A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- B. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
  - 1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
  - 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
- E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
  - 1. Do not use original project record documents as part of operation and maintenance manuals.
  - 2. Comply with requirements of newly prepared Record Drawings in Division 01 Section 01 78 39 "Project Record Documents."
- F. Comply with Section 01 77 00 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION

SECTION 01 78 39

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes administrative and procedural requirements for project record documents, including the following:
  - 1. Record Drawings.
  - 2. Record Project Manual (Proposal)
  - 3. Record Product Data.
- B. Related Requirements:
  - 1. Section 01 78 23 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.02 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
  - 1. Number of Copies: Submit copies of record Drawings as follows:
    - a. Submittal:
      - 1) Submit PDF electronic files of scanned record prints and two set(s) of marked-up record prints.
      - 2) Print each drawing, whether or not changes and additional information were recorded.
- B. Record Project Manual (Proposal): Submit two paper copies and one annotated PDF electronic files of Project Manual (Proposal), including addenda and contract modifications.
- C. Record Product Data: Submit two paper copies and one annotated PDF electronic files and directories of each submittal.

PART 2 - PRODUCTS

2.01 RECORD DRAWINGS

- A. Record Prints: Maintain two sets of marked-up paper copies of the Contract Drawings (half-size) and Shop Drawings, incorporating new and revised Drawings as modifications are issued.
  - 1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.



- a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
  - b. Record data as soon as possible after obtaining it.
  - c. Record and check the markup before enclosing concealed installations.
  2. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
  3. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
  4. Note Construction Change Directive numbers, alternate numbers, Change Order (Supplemental Agreements) numbers, and similar identification, where applicable.
- B. Record Digital Data Files: Immediately before inspection for Final Completion review marked-up record prints with Project Engineer and MDOT Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
1. Format: Annotated PDF electronic file.
  2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
  3. Refer instances of uncertainty to Project Engineer and MDOT Architect for resolution.
- C. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
  2. Format: Annotated PDF electronic file.
  3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
  4. Identification: As follows:
    - a. Project name.
    - b. Date.
    - c. Designation "PROJECT RECORD DRAWINGS."
    - d. Name of Consulting Architect (if applicable).
    - e. Name of Contractor.

## 2.02 RECORD PROJECT MANUAL (PROPOSAL)

- A. Preparation: Mark Project Manual (Proposal) to indicate the actual product installation where installation varies from that indicated in the Technical Specifications, addenda, and contract modifications.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.

3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. Note related Change Orders (Supplemental Agreements), record Product Data, and record Drawings where applicable.

B. Format: Submit record Project Manual (Proposal) as scanned PDF electronic file(s) of marked-up paper copy of Project Manual (Proposal).

## 2.03 RECORD PRODUCT DATA

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

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

B. Format: Submit record Product Data as scanned PDF electronic file(s) of marked-up paper copy of Product Data.

## PART 3 - EXECUTION

### 3.01 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

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

C. The information, except Contract Drawings, shall be arranged and labeled by corresponding Specification Section, neatly bound in three ring binders, indexed, and all shop drawings readable without being removed or unstapled.

D. The name and address of each subcontractor and material supplier shall be listed in front of each binder along with the Project Manual (Proposal).

E. Sufficient information, such as as-built control drawings for air handling system and variable drive controls, shall be furnished to allow qualified personnel to service equipment.

END OF SECTION

SECTION 01 79 00

DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
  - 1. Demonstration of operation of systems, subsystems, and equipment.
  - 2. Training in operation and maintenance of systems, subsystems, and equipment.
  - 3. Demonstration and training video recordings.

1.02 INFORMATIONAL SUBMITTALS

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
  - 1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

1.03 CLOSEOUT SUBMITTALS

- A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.
  - 1. At completion of training, submit complete training manual(s) for Owner's use prepared and bound in format matching operation and maintenance manuals.

1.04 QUALITY ASSURANCE

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
- B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 01 40 00 "Quality Requirements," experienced in operation and maintenance procedures and training.
- C. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination." Review methods and procedures related to demonstration and training.

## 1.05 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.
- B. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

## PART 2 - PRODUCTS

## 2.01 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
  - 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
    - a. System, subsystem, and equipment descriptions.
    - b. Performance and design criteria if Contractor is delegated design responsibility.
    - c. Operating standards.
    - d. Regulatory requirements.
    - e. Equipment function.
    - f. Operating characteristics.
    - g. Limiting conditions.
    - h. Performance curves.
  - 2. Documentation: Review the following items in detail:
    - a. Emergency manuals.
    - b. Operations manuals.
    - c. Maintenance manuals.
    - d. Project record documents.
    - e. Identification systems.
    - f. Warranties and bonds.
    - g. Maintenance service agreements and similar continuing commitments.
  - 3. Emergencies: Include the following, as applicable:
    - a. Instructions on meaning of warnings, trouble indications, and error messages.
    - b. Instructions on stopping.
    - c. Shutdown instructions for each type of emergency.
    - d. Operating instructions for conditions outside of normal operating limits.
    - e. Sequences for electric or electronic systems.
    - f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:
  - a. Startup procedures.
  - b. Equipment or system break-in procedures.
  - c. Routine and normal operating instructions.
  - d. Regulation and control procedures.
  - e. Control sequences.
  - f. Safety procedures.
  - g. Instructions on stopping.
  - h. Normal shutdown instructions.
  - i. Operating procedures for emergencies.
  - j. Operating procedures for system, subsystem, or equipment failure.
  - k. Seasonal and weekend operating instructions.
  - l. Required sequences for electric or electronic systems.
  - m. Special operating instructions and procedures.
5. Adjustments: Include the following:
  - a. Alignments.
  - b. Checking adjustments.
  - c. Noise and vibration adjustments.
  - d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
  - a. Diagnostic instructions.
  - b. Test and inspection procedures.
7. Maintenance: Include the following:
  - a. Inspection procedures.
  - b. Types of cleaning agents to be used and methods of cleaning.
  - c. List of cleaning agents and methods of cleaning detrimental to product.
  - d. Procedures for routine cleaning
  - e. Procedures for preventive maintenance.
  - f. Procedures for routine maintenance.
  - g. Instruction on use of special tools.
8. Repairs: Include the following:
  - a. Diagnosis instructions.
  - b. Repair instructions.
  - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
  - d. Instructions for identifying parts and components.
  - e. Review of spare parts needed for operation and maintenance.

### PART 3 - EXECUTION

#### 3.01 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 01 78 23 "Operation and Maintenance Data."

#### 3.02 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
  - 1. Owner will furnish Contractor with names and positions of participants.
- C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
  - 1. Schedule training with Owner, through Project Engineer, with at least seven days' advance notice.
- D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.
- E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.

### 3.03 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

- A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
  - 1. At beginning of each training module, record each chart containing learning objective and lesson outline.
- B. Video Recording Format: Provide high-quality color video recordings with menu navigation in format acceptable to Project Engineer and MDOT Architect.
- C. Narration: Describe scenes on video recording by dubbing audio narration off-site after video recording is recorded. Include description of items being viewed.
- D. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

END OF SECTION

SECTION 03 10 00 CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes all concrete formwork and other related items necessary to complete project indicated by Contract Documents unless specifically excluded.
- B. Related Sections:
  - 1. Section 03 20 00 – Concrete Reinforcing.
  - 2. Section 03 30 00 – Cast-in-Place Concrete.

1.02 PROJECT CONDITIONS

- A. Examine the substrate over which concrete forms are installed and advise the Project Engineer of conditions detrimental to the installation of concrete formwork. Do not proceed until unsatisfactory conditions have been corrected.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Wood Forms: 3/4 inch exterior grade plywood on studs and joists.
- B. Form Ties: Standard snap ties, 1-1/2 inch break-back.
- C. Form Oil: Oil must not affect bonding of finishes on exposed concrete. Approved non-staining type equal to the following:
  - 1. Nox-Crete Products Group Nox-Crete Form Coating EB,
  - 2. SEI Form Release Gcc-100,
  - 3. Dayton Superior Bio-Release EF

PART 3 - EXECUTION

3.01 FORMWORK

- A. Forms shall be properly aligned, adequately braced and mortar tight to produce concrete shapes required by Drawings. Align forms so that the actual surface does not vary from true surface more than 1/8 inch. The surface shall be clean, undamaged, and free of offsets and irregularities at joints. Adequately brace and frame to retain true shapes under vibration and placing strains without leaks, bowing, or deflection.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

- C. Studs, girts, and walls shall not be less than 2 by 4's, S4S, construction of standard grade Douglas fir, or equal, selected for straightness. All walls shall consist of at least two 2 by 4's. Studs shall not be spaced more than 16 inches, girts not more than 24 inches and ties not more than 27 inches, on center.
- D. Lightly oil wood forms prior to placing reinforcing, and with oil not permitted on the reinforcing. Where oil form is used, remove excess before pouring concrete.
- E. Unless indicated otherwise, chamfer exterior corners and edges of permanently exposed concrete.
- F. Comply with recommendations of "Recommended Practice for Concrete Form work" ACI 347 unless indicated otherwise.

### 3.02 INSERTS AND FASTENING DEVICES FOR OTHER WORK

- A. Provide for installation of inserts, hangers, metal ties, anchors, bolts, dowels, nailing strips, grounds and other fastening devices required for attachment of other Work
- B. Locate partitions for other trades prior to pouring concrete in order that conduits, sleeves and inserts required by others will be installed in the proper locations.
- C. Do not install sleeves in any concrete beams or piers except upon approval of the Project Engineer.
- D. Do not install aluminum conduits in concrete.

### 3.03 VAPOR RETARDERS

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
  - 1. Lap joints 6 inches and seal with manufacturer's recommended tape. Refer to Section 07 26 00 – Vapor Retarders.

### 3.04 FORM REMOVAL

- A. Grade beam and column forms may be removed 24 hours after a pour is completed.
- B. Floor slab wood forms may be removed 10 days after pour, providing compressive strength has reached a minimum of 2500 psi based on job cast cylinders.

END OF SECTION



SECTION 03 20 00

CONCRETE REINFORCING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes all concrete reinforcing and the related items necessary to complete the Project indicated by the Contract Documents unless specifically excluded.
- B. Related Sections:
  - 1. Section 03 10 00 – Concrete Forming and Accessories.
  - 2. Section 03 30 00 – Cast-in-Place Concrete.

1.02 SUBMITTALS

- A. Submit reinforcing steel shop drawings and materials list prior to placement for MDOT Architect's approval.
  - 1. Shop drawings shall include complete DIMENSIONED placing plans including control joint locations, order lists, bend diagrams, and DETAILS SHOWING DIMENSIONS WITH CLEARANCES.
  - 2. Submittals not including this requirement will be considered as an incomplete submittal and will be returned to Contractor for re-submittal.
- B. Furnish mill certificates for steel bar reinforcement, to the Project Engineer certifying that each shipment meets specifications. The fabricator will furnish certificates with bar lists to designate location of shipment and the time steel is delivered to the project.

1.03 QUALITY ASSURANCE

- A. Reinforcing bars shall conform to ASTM A 615 "Deformed Billet-Steel Bars for Concrete".
- B. Mesh reinforcement shall conform to ASTM A 185 "Welded Steel Wire Fabric for Concrete Reinforcement".
- C. Accessories shall conform to American Concrete Institute ACI 301 "Specifications for Structural Concrete for Buildings".
- D. Placement shall be in accordance with approved shop drawings and ACI 318 "Standard Building Code Requirements for Reinforced Concrete".
- E. Comply with ACI 315 "Manual of Standard Practice of Detailing Reinforced Concrete Structures".

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Reinforcing bar steel and mesh shall be handled, shipped and stored in a manner that will prevent distortion or other damage.

- B. Materials shall be stored in a manner to prevent excessive rusting and fouling with dirt, grease, or other bond-breaking coatings.

1.05 PROJECT CONDITIONS

- A. Examine the substrate over which concrete forms are installed and advise the Project Engineer of conditions detrimental to the installation of concrete formwork. Do not proceed until unsatisfactory conditions have been corrected.
- B. Coordinate placement of concrete reinforcing with installation of concrete formwork, vapor barriers, concrete inserts, conduit and all other items occurring in the area.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Steel Bar Reinforcement: Bar reinforcement shall conform to ASTM A 615, grade 60, of domestic manufacture. Bars shall be new; free from rust, scale, oil, or other coatings that will prevent bond.
- B. Welded Steel Wire Fabric: Fabric shall conform to ASTM A 185, new, free from rust and other coatings that will prevent bond.
- C. Accessories: Metal accessories as required shall support reinforcing bars and comply with ACI 315. Chairs and bolsters for use in exposed concrete shall have plastic coated or stainless steel legs or shall be plastic.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Fabricate and place reinforcement in accordance with the latest requirements of the American Concrete Institute and the approved shop drawings. Fabrication shall not proceed until MDOT Architect's approval is obtained.
- B. Reinforcing for one day's pour shall be completely placed and an inspection made by the Project Engineer / MDOT Architect prior to starting the pour.

- C. Concrete Protection for Reinforcement: Minimum coverage shall be as follows unless shown otherwise on drawings:
- |    |                            |  |
|----|----------------------------|--|
| 1. | Footings (bottom of steel) | 3 inches clear                                   |
| 2. | Slabs                      | 1-1/2 inches clear top and 3/4 inch clear bottom |
| 3. | Beams                      | 1-1/2 inch clear to stirrups                     |
| 4. | Walls                      | 2-1/2 inches clear                               |
| 5. | Columns                    | 2 inches clear to verticals                      |
- D. Steel Dowels for successive work shall be wired in correct position before placing concrete. The "sticking" of dowels after placing concrete will not be permitted.
- E. Lap all bars 24 bar diameters at corners, splices and intersections.
- F. Interrupt Reinforcing steel at control joints in floor slabs.
- G. Do not weld reinforcing steel unless specifically approved by the Project Engineer.

END OF SECTION

SECTION 03 30 00 CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, finishes, and other related items necessary to complete Project indicated by Contract Documents unless specifically excluded
- B. Related Sections:
  - 1. Section 03 10 00 - Concrete Forming and Accessories.
  - 2. Section 03 20 00 - Concrete Reinforcing.
  - 3. Section 07 26 00 - Vapor Retarders.
  - 4. Section 09 90 00 – Painting and Coating.

1.02 SUBMITTALS

- A. Submit concrete mix design, concrete compression test reports and product data and manufacturer's installation instructions for concrete curing compound.

1.03 TESTING LABORATORY SERVICES

- A. The Owner will provide testing as specified in Section 01 45 29.

1.04 QUALITY ASSURANCE

- A. Concrete work shall conform to all requirements of ACI 301, Specifications for Structural Concrete for Buildings and ACI 318 Building Code Requirements for Reinforced Concrete, latest editions, except as modified by supplemental requirements herein.
- B. Mix Design: Concrete mix design proportioning shall be by a certified MDOT Class III technician and submitted to the Project Engineer prior to placing concrete. Mix proportions shall meet the requirements of the 804.02.10 Section of the MDOT's Standard Specifications, 2004 Edition, except concrete requiring a trowel finish shall not be air entrained and shall meet the compressive strength requirements for Class B concrete. Concrete shall be sampled according to ASTM C 172 and compression test cylinders made and cured according to ASTM C 31. Control of mixes is to be maintained at the Ready-Mix Plant and on the job site. Adjustments of the mix proportions shall meet the requirements of Section 804.02.10.4 of MDOT's Standard Specifications, 2004 Edition.

- C. The Owner will mold and cure compression test cylinders (two cylinders per set) from concrete at the job site from the first placement of each mix design placed each day and additionally for each 75 cubic yards, or fraction thereof, of each mix design placed in a single day. In addition to sampling concrete in accordance with ASTM C 172, the Owner will follow the sampling requirements Paragraph 6.1.2 in the latest edition of the Department's *Concrete Field Manual*.
1. Cylinders will be tested in accordance with ASTM C 39. The Owner will mold one set of cylinders for ensuring the concrete meets the minimum 28-day acceptance requirements.
  2. The Owner will mold three sets of cylinders for form removal in accordance with Subsection 907-804.03.15. Forms may be removed when the compressive strength of the field cured cylinders reaches 2000 psi.
  3. In addition to determining the slump, temperature, and total air content of the concrete used for molding the test cylinders, the Owner will determine the yield of each mix design during the first placement of each mix design.
  4. Copies of all test reports shall be furnished to the ready mixed concrete producer and as directed by the Project Engineer.

#### 1.05 COORDINATION

- A. Verify that all pipes under grade have been installed and tested before being covered. Check and verify materials and locations of inserts, anchors, and items required by other trades before pouring concrete. Concerned subcontractors shall be notified of date of pour in sufficient time to allow for completion of their work.
- B. The Contractor shall notify the Project Engineer upon completing formwork and all reinforcing steel for the next intended pour, and shall not commence pouring operation until all forms and reinforcing steel are approved by the Project Engineer.
- C. Project Engineer shall have free access to all materials used, and the required samples are to be furnished by the Contractor, as directed.
- D. Inspection and written approval from the floor-covering subcontractor is required for slab finish receiving floor covering.

### PART 2 - PRODUCTS

#### 2.01 CONCRETE, GENERAL

- A. All concrete, unless otherwise specifically approved in writing by the Project Engineer, shall be transit-mixed in accordance with ASTM C94. Control of concrete shall be under supervision of testing laboratory as described in Section 01 45 29.
- B. All concrete, unless noted otherwise, shall be Class B.
- C. Maximum slump for normal weight concrete shall be 4 inches. Slump may be increased to 8 inches with an approved water reducer.

## 2.02 CONCRETE MATERIALS

- A. Portland Cement: ASTM C-150, Type I.
- B. Water: From an approved source.
- C. Structural Concrete Aggregate: Coarse aggregate size number 57 or 67 shall be used and shall meet the requirements of MDOT Standard Specifications, 2004 Edition.
- D. Admixtures: Admixtures shall be from the MDOT Approved List. Non-uniform addition of mixtures that result in erratic setting of the concrete will cause rejection of the concrete with subsequent removal from the structure at the concrete producer's expense.

## 2.03 RELATED MATERIALS

- A. Preformed Expansion Joint Fillers: Provide pre-molded, asphalt impregnated board in widths and thickness required by conditions (1/2-inch minimum). Joint fillers shall conform to ASTM D994, D1751 or D1752.
- B. Chemical Hardener (Sealer): Colorless aqueous solution containing a blend of magnesium fluosilicate and zinc fluosilicate combined with a wetting agent containing not less than 2 pounds of fluosilicates per gallon. Sealer shall not interfere with floor finish. Refer to Section 09 90 00 for Concrete Floor Stain and Sealer in main shop area and as scheduled on Drawings.
- C. Curing Compound: Clear bond, manufactured by Guardian Chemical Co., Kure-N-Seal, manufactured by BASF / Sonneborn, Safe-Cure, manufactured by Dayton Superior Corp. or approved equal. Compound shall not interfere with bonding or floor finish.
- D. Non-Shrink Grout: Shall be one part Portland cement to 2-1/2 parts of fine aggregate or Cement grout ASTM C 387 Dry Package mixtures similar and equal to Masterflow 713 Plus, manufactured by BASF / Master Builders; Five Star Grout, U.S. Grout Company or approved equal.

## 2.04 CONCRETE MIXES

- A. Ready-Mixed Concrete: Ready-mix concrete shall be mixed and delivered in accordance with requirements of ASTM C 94. Uniformly and accurately control proportions of material weight. Slump tolerances given in ASTM C 94 apply. Calcium chloride shall not be used.
- B. Failure of concrete to meet the specified requirements may result in rejection with subsequent removal and replacement or re-testing (including coring, load test, etc.) at the supplier's expense.
  - 1. Concrete exhibiting adverse reaction as a result of the presence of deleterious substances shall be removed and replaced or repaired in a manner completely satisfactory to the Project Engineer.
  - 2. All cost of such corrective action, including all necessary testing, shall be borne by the concrete producer.

- C. The Contractor may request adjustment to concrete mix design when characteristics of materials, job conditions, weather, test results, or circumstances warrant, at no additional cost to the Owner and as approved by the Project Engineer. Laboratory test data for revised mix designs and strength results must be submitted to and approved before using in the Work.

### PART 3 - EXECUTION

#### 3.01 CONCRETE PLACEMENT

- A. Concrete shall be placed so as to avoid segregation of materials and to prevent cold joints by avoiding re-handling, by keeping pours generally level, and by adequate vibration. Placing is not to be started during rain or snow, and if placing is underway when such conditions occur, continue operations only long enough to provide a suitable construction joint.
- B. During hot weather or periods of low humidity combined with a definite breeze, rapid loss of moisture shall be discouraged by thorough wetting of forms and by using a fine fog spray when finishing. At these times particular attention shall be given to providing an adequate number of finishers to expedite this operation. During cold weather fresh concrete shall be protected from freezing.
- C. Prior to placing, forms shall be cleaned free of foreign material and shall be washed down with water. Placing shall be a continuous operation between planned construction joints with fresh cement mixed only with plastic concrete already in place. Avoid cold joints.
- D. Vibration shall be thorough, using vibrators small enough to work within reinforcing. The vibrator shall be inserted at many points about 24 inches apart. Avoid over-vibration and transporting concrete in form by vibration. A spare vibrator, which will operate, shall be kept on the job during all placing operations.

#### 3.02 CONSTRUCTION JOINTS

- A. Locate construction joints and provide shear keys as directed by the Project Engineer / MDOT Architect. Allow concrete to set for 24 hours before an adjoining pour is started. Slabs across the joint shall be level and the surface shall be level and shall not be feathered. Before proceeding with the following pour at a joint, thoroughly clean the joint, remove all loose material, and brush in a thick cement slurry.

#### 3.03 CURING

- A. Keep all concrete moist for 5 days after placing by covering with concrete curing paper, by leaving forms in place or by using curing compound. All combined with regular wetting as necessary.

### 3.04 PATCHING

- A. Honeycombed and defective concrete shall be removed and replaced, or repaired, as directed by the Project Engineer. Form tie holes and minor areas, as determined by the Project Engineer, shall be repaired as follows:
1. Completed patch shall be indistinguishable from surrounding surfaces in color and texture.
  2. Patching mixture, using same cement sand as used in concrete shall consist of 1 part cement to 2-parts sand, with just enough mixing water to permit placing. Premix mixture, allow standing at least 30 minutes before using, stirring with trowel during this period.
  3. Remove material to sound concrete, dampen surface and brush thick 1 to 1 cement sand bond coat into surface.
  4. When bond coat begins to lose water sheen, thoroughly pack patching mixture in place, leaving it somewhat higher than adjacent surface. Embed pieces of gravel by hand into patch.

### 3.05 FINISHES FOR FLATWORK

- A. Trowel finish floor surfaces scheduled as concrete finish walking surfaces, or floor surfaces scheduled to receive floor covering. Trowel finished surfaces shall be true planes within 1/8 inch in 10 feet as determined by a 10 foot straightedge placed anywhere on the slab in any direction.
- B. Smooth trowel finish after the surface is screeded and floated. Start troweling when all water has disappeared from the surface to first level the surface, then start final troweling when concrete has set where it no longer shows indentation from finger pressure. Trowel to a hard, smooth surface free of marks. Dusting of cement or cement and sand will not be permitted.
- C. Interior floors, with concrete finish scheduled, shall receive an application of hardener compound applied according to manufacturer's published instructions. Concrete surfaces to receive ceramic floor tile or brick shall receive float finish.
- D. Exterior walks and ramps shall have smooth trowel and fine broom finish.
- E. Exterior sign base shall have a Class 2, Rubbed Finish as follows:
1. After removal of forms, the Class 1 finish shall be completed and the rubbing of concrete shall be started as soon as its condition will permit. Immediately before starting this work, the concrete shall be kept thoroughly saturated with water for at least three hours.
  2. Surface shall be rubbed with a medium course Carborundum stone using a small amount of mortar on its face. The mortar shall be composed of cement and sand mixed in the proportions used in the concrete being finished. Rubbing shall be continued until all form marks, projections, and irregularities have been removed, all voids filled, and a uniform surface has been obtained.
  3. The final finish shall be obtained by rubbing with a fine Carborundum stone and water. This rubbing shall continue until the entire surface is a smooth texture and uniform color.
  4. After the final rubbing is completed and the surface has dried, it shall be rubbed with burlap to remove loose powder and objectionable marks.



3.06 FINISHES FOR GRADE BEAMS

- A. Exposed grade beam faces shall have a smooth form finish obtained by using selected form facing plywood, arranged orderly and symmetrically with a minimum of seams.
  - 1. Repair and patch defective areas with all fins or other projections completely removed and smoothed. Provide grout cleaned finish consisting of 1 part Portland Cement to 1-1/2 parts fine sand by column, and mix with water to the consistency of thick paint.
  - 2. Blend standard Portland cement and white Portland cement, amounts determined by trial patches, so that the final color of dry grout will closely match adjacent concrete surfaces.
- B. Thoroughly wet concrete surfaces and apply grout immediately to coat surfaces and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least 36 hours after rubbing.

END OF SECTION

SECTION 04 20 00

UNIT MASONRY

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Brick veneer masonry work as indicated on the Drawings, schedules and accessories as specified in this Section.
- B. Related Sections:
  - 1. Section 05 50 00 "Metal Fabrications" for furnishing steel lintels and shelf angles (where required) for unit masonry.
  - 2. Section 09 05 15 "Color Design" for brick type and mortar color.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Including specifications and other data for each type of masonry unit and accessory required. Include instructions for handling, storage, installation, cleaning and protection of each. Indicate by transmittal that the Installer has received a copy of each instruction.
- B. Samples for Verification: For each type and color of exposed masonry unit and colored mortar.

1.03 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For each type and size of product indicated. For masonry units include data on material properties.
- B. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
  - 1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
  - 2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

1.04 QUALITY ASSURANCE

- A. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.
- B. Fire-rated Masonry: Wherever a fire-resistance classification is shown or scheduled for unit masonry construction (4 hour, 3 hour, and similar designations), comply with the requirements for materials and installation established by the American Insurance Association and other governing authorities for the construction shown.

- C. Sample Panels: Build sample panels to verify selections made under sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 01 40 00 "Quality Requirements" for mockups.
1. Prior to installation of masonry work, erect sample wall panel mock-up materials, bond and joint tooling shown or specified for final Work. Provide special features as directed for caulking and contiguous work. Build mock-up at the site, where directed, of full thickness and approximately 4 feet by 3 feet unless otherwise shown, indicating the proposed range of color, texture and workmanship to be expected in the completed Work.
  2. Obtain Project Engineer / MDOT Architect's acceptance of visual qualities of the mock-up before start of masonry work. Retain mock-up during construction as a standard for judging completed masonry work. Do not alter, move or destroy mock-up until Work is completed. Provide mock-up panel for each type of exposed unit masonry work.

#### 1.05 PROJECT CONDITIONS

- A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
- B. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
- C. Protect partially completed masonry against weather, when Work is not in progress, by covering top of walls with strong, waterproof, non-staining membrane. Extend membrane a minimum of 2 inches down both sides of walls and anchor securely in place.

## PART 2 - PRODUCTS

### 2.01 ACCEPTABLE BRICK MANUFACTURERS

- A. Equivalent products by the following manufacturers are acceptable:
  1. Acme Brick Company, Jackson, Mississippi
  2. Boral Brick, Hattiesburg, Mississippi
  3. Calstar Products, Racine, Wisconsin
  4. Columbus Brick, Columbus, Mississippi
  5. Old South Brick & Supply Company, Jackson, Mississippi
- B. Substitution shall fully comply with specified requirements of Section 01 25 00 - Substitution Procedures and Section 01 60 00 - Product Requirements.

### 2.02 MASONRY UNITS, GENERAL

- A. Obtain masonry units from one manufacturer, of uniform texture and color for each kind required, for each continuous area and visually related areas.

- B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.
- C. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

#### 2.03 BRICK, GENERAL

- A. Unless otherwise indicated or specified, provide modular size brick (7-5/8 inches long x 2-1/4 inches high x 3-3/4 inches wide) for exposed vertical brickwork. At Contractor's option, provide solid or cored brick for vertical brickwork. Do not use cored brick with net cross-sectional area less than 75 percent of gross area in the same plane or with core holes closer than 3/4 inch from any edge. Use solid brick in locations where the cores in cored bricks are exposed to view.
- B. Face Brick: Brick exposed to view ASTM C 216, Grade SW for exterior exposures.
- C. Building (Common) Brick: Brick not exposed to view, ASTM C 62, Grade SW for exterior exposures and Grade MW for interior masonry which will be concealed by other work. Select from manufacturer's standard colors and textures.

#### 2.04 MORTAR AND GROUT MATERIALS

- A. Mortar mixes shall comply with the requirements of ASTM C 270 Standard Specification for Mortar for Unit Masonry. Type S mortar shall be used for exterior Work. Type N mortar shall be used for interior Work. Mortar color for face brick shall be as selected by the Project Engineer / MDOT Architect from manufacturer's standard colors. Mortar color for building (common) brick shall be natural color or white cement as required to produce the required standard mortar color.
- B. Portland Cement: ASTM C 150, Type I, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
- C. Hydrated Lime: ASTM C 207, Type S.
- D. Sand: ASTM C 144, except for joints less than 1/4 inch, use aggregate graded with 70 to 100 percent passing the No. 16 sieve.
- E. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207, Type S.
- F. Masonry Cement: ASTM C 91.
  - 1. Equivalent products by the following manufacturers are acceptable:
    - a. Ash Grove Packaging, Jackson, MS. Tel. (800) 467-0860.
    - b. Holcim (US) Inc., Dundee, MI. Tel. (800) 831-9507.
    - c. National Cement Company, Inc., Birmingham, AL. Tel. (205) 870-7680.

- G. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortar.
1. Equivalent products by the following manufacturers are acceptable:
    - a. Bayer Corp., Industrial Chemicals Div., Martinsville, WV. Tel. (800) 662-2927.
    - b. Davis Colors, Los Angeles, CA. Tel. (800) 356-4848.
    - c. Solomon Grind-Chem Services, Inc., Springfield, IL. Tel. (800) 624-0261.
- H. Colored Cement Product: Packaged blend made from portland cement and lime, masonry cement or mortar cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.
1. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
  2. Pigments shall not exceed 10 percent of portland cement by weight.
  3. Pigments shall not exceed 5 percent of masonry cement or mortar cement by weight.
  4. Available Products:
    - a. Colored Portland Cement-Lime Mix:
      - 1) Ash Grove Packaging, Jackson, MS. Tel. (800) 467-0860.
      - 2) Holcim (US) Inc., Dundee, MI. Tel. (800) 831-9507.
      - 3) Lehigh Cement Company, Allentown, PA. Tel. (610) 366-4600.
    - b. Colored Masonry Cement:
      - 1) Ash Grove Packaging, Jackson, MS. Tel. (800) 467-0860.
      - 2) Holcim (US) Inc., Dundee, MI. Tel. (800) 831-9507.
      - 3) Lehigh Cement Company, Allentown, PA. Tel. (610) 366-4600.
      - 4) National Cement Company, Inc., Birmingham, AL. Tel. (205) 870-7680.
- I. Aggregate for Mortar: ASTM C 144.
1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
  2. White-Mortar Aggregates: Natural white sand or crushed white stone.
  3. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
- J. Aggregate for Grout: ASTM C 404.
- K. Refractory Mortar Mix: Ground fireclay or non-water-soluble, calcium aluminate, medium-duty refractory mortar that passes ASTM C 199 test; or an equivalent product acceptable to authorities having jurisdiction.
- L. Water: Potable.

## 2.05 MASONRY ACCESSORIES

- A. Brick Veneer Masonry Work: Provide adjustable wire ties conforming to ASTM A 82 Specification for Steel Wire, Plain, for Concrete Reinforcement. The wire shall be a minimum of W1.7, 9 gage. Plate portions of adjustable ties shall be a minimum of 14 gage in thickness. Plate portion shall conform to ASTM A 366 Standard Specification for Steel, Carbon, Cold-Rolled Sheet, Commercial Quality. All tie components shall be hot-dip galvanized after fabrication and shall conform to ASTM A 153 Standard Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware, Class B-2.
- B. Anchoring Devices for Masonry: Provide straps, bars, bolts and rods fabricated from not less than 16 gage sheet metal or 3/8 inch diameter rod stock, unless otherwise indicated.
- C. Concrete Inserts for Masonry:
  - 1. Furnish dovetail slots with filler strips, where masonry abuts concrete. Fabricate from 24 gage galvanized steel unless otherwise indicated.
  - 2. For installation of concrete inserts, see concrete sections of these Specifications. Advise concrete installer of specific requirements regarding his placement of inserts, which are to be used, by the masonry installer for anchoring of masonry Work.
- D. Flashing for Brick Veneer Walls: Provide concealed flashing, shown to be built into masonry, as specified in Section 07 65 26 – Self Adhering Sheet Flashing, unless otherwise indicated.

## 2.06 MASONRY MAT &amp; WEEP VENTS

- A. Manufacturer and Type: Products equal to CavClear Masonry Mat and CavClear Weep Vents as manufactured by Archovations, Inc., PO Box 241, Hudson, WI 54016. Telephone (888) 436-2620.
  - 1. Description: Airspace maintenance and drainage system for masonry cavities to prevent mortar from making contact with the backup to ensure water management. The system shall be fluid conducting, non-absorbent, mold and mildew resistant polymer mesh consisting of 100 percent recycled polymer with PVC binder. Weep Vents shall have "M" notched bottom. Color to be selected by the MDOT Architect from full range of standard colors.
  - 2. Mat size: 1-1/4 inch thick by 16 inches high by 8 feet long.
  - 3. Weep Vent Size: 1/2 inch thick by 2-1/2 inches high by 3-1/2 inches wide.
- B. Equivalent products by the following manufacturers are acceptable:
  - 1. Advanced Building Products, Inc., Springvale, ME Tel: (800) 252-2306.
  - 2. Colbond Geosynthetics, Enka, NC. Tel. (800) 664-6638.
- C. Substitutions shall fully comply with specified requirements and Section 01 25 00-Substitution Procedures and Section 01 60 00 - Product Requirements.

## PART 3 - EXECUTION

## 3.01 INSPECTION

- A. Masonry installer must examine the areas and conditions under which masonry is to be installed and notify the Project Engineer and the Contractor in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to masonry installer.

## 3.02 INSTALLATION

- A. Build single-wythe walls to the actual thickness of the masonry units, using units of nominal thickness shown or specified.
- B. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
- C. Build chases and recesses as shown and as required for the work of other trades. Provide not less than 8 inches of masonry between chase or recess and jamb of openings and between adjacent chases and recesses.
- D. Cut masonry units with motor driving saw designed to cut masonry with clean, sharp, un-chipped edges. Cut units as required to provide pattern shown and to fit adjoining Work neatly. Use full units without cutting wherever possible.
- E. Wet brick having ASTM C67 absorption rates greater than 0.025 oz. per sq. inch per minute. Determine absorption by drawing a circle the size of a quarter on typical units and place 20 drops of water inside the circle. Wet brick units only if water is absorbed within 1-1/2 minutes. The units shall be wetted thoroughly 3 to 24 hours prior to their use so as to allow moisture to become distributed throughout the unit. The units shall be surface dry when laid.
- F. Frozen Materials and Work: Do not use frozen materials or materials mixed or coated with ice or frost. For masonry, which is specified to be wetted, comply with the BIA recommendations. Do not use calcium chloride in mortar or grout.
- G. Pattern Bond: Lay masonry work in a running bond unless indicated otherwise.
- H. Layout walls in advance for accurate spacing of surface bond patterns with uniform joint widths and to properly locate openings, movement type joints, returns and offsets. Avoid the use of less-than half-size units at corner, jambs and wherever possible at other locations. Lay-up walls plumb and true and with courses level, accurately spaced and coordinated with other work.
- I. Stopping and Resuming Work: Rack back 1/2 masonry unit length in each course; do not tooth. Clean exposed surfaces of set masonry, wet units lightly (if specified to be wetted), and remove loose masonry units and mortar prior to laying fresh masonry.

### 3.03 TOLERANCES

#### A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch or minus 1/4 inch.
2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch.
3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

#### B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.

#### C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
3. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch.

### 3.04 MORTAR BEDDING AND JOINTING

#### A. Lay hollow brick as follows:

1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.

#### B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.



- C. Maintain joints widths shown, except for minor variations required to maintain bond alignment. If not shown, lay walls with 3/8 inch joints.
- D. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- E. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.
- F. Remove masonry units disturbed after laying; clean and relay in fresh mortar. Do not pound corners at jambs to fit stretcher units that have been set in position. If adjustments are required, remove units, clean off mortar, and reset in fresh mortar.

### 3.05 EXTERIOR BRICK VENEER WALLS

- A. Individual Metal Ties: Provide ties as shown installed in horizontal joints, but not less than one metal tie for 2.67 sq. ft. of wall area spaced not to exceed 24 inches on center horizontally and 16 inches on center vertically.
  - 1. Stagger ties in alternate courses. Provide additional ties within 12 inches of openings and space not more than 36 inches apart around perimeter of openings.
  - 2. At intersecting and abutting walls, provide ties at no more than 24 inches on center vertically.
  - 3. Fasten ties to wood frame with corrosion-resistant nails that penetrate the sheathing and are driven a minimum of 1-1/2 inches into the studs.
- B. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.
- C. Apply air barrier to face of backup wythe (plywood sheathing) to comply with Section 07 27 26 "Fluid-Applied Membrane Air Barriers."

### 3.06 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

- A. Anchor masonry to structural steel and concrete where masonry abuts or faces structural steel or concrete to comply with the following:
  - 1. Provide an open space not less than 1/2 inch wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
  - 2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
  - 3. Space anchors as indicated, but not more than 24 inches on center vertically and 36 inches on center horizontally.

### 3.07 ANCHORING MASONRY VENEERS

- A. Anchor masonry veneers to wall framing with masonry-veneer anchors to comply with the following requirements:
1. Fasten screw-attached anchors through sheathing to wall framing with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
  2. Embed tie sections in masonry joints. Provide not less than 2 inches of air space between back of masonry veneer and face of sheathing.
  3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
  4. Space anchors as indicated, but not more than 16 inches on center vertically and 24 inches on center horizontally with not less than 1 anchor for each 2.67 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 36 inches, around perimeter.

### 3.08 LINTELS

- A. Install loose lintels of steel and other materials where shown.

### 3.09 CONTROL AND EXPANSION JOINTS

- A. Provide vertical expansion, control and isolation joints in masonry. Build-in related masonry accessory items as the masonry work progresses. Rake out mortar in preparation for application of caulking and sealants
- B. Control / Expansion Joint Spacing: If locations of control / expansion joints are not shown, place vertical joints spaced not to exceed 25'-0" on center. Locate control / expansion joints at points of natural weakness in the masonry work.

### 3.10 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.
- B. Install flashing as follows unless otherwise indicated:
1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
  2. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.

3. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall and adhere flexible flashing to top of metal drip edge.
  4. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall and adhere flexible flashing to top of metal flashing termination.
- C. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:
1. Use specified weep/vent products to form weep holes.
  2. Space weep holes 24 inches on center unless otherwise indicated.
- D. Place cavity drainage material full height in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.
- E. Install vents in head joints in exterior wythes at spacing indicated. Use specified weep/vent products to form vents.
1. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

### 3.11 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units which are loose, chipped, broken, stained or otherwise damaged or if units do not match adjoining units as intended. Provide new units to match units and install with fresh mortar or grout, pointed to eliminate evidence of replacement.
1. Protect the base of the wall from mud splashes and mortar droppings.
- B. Pointing: During the tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar. Point up all joints at corners, openings and adjacent work to provide a neat uniform appearance, properly prepared for application of caulking or sealant compounds.
- C. In-Progress Cleaning:
1. Good workmanship and job housekeeping practices shall be used to minimize the need for cleaning the masonry.
  2. Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
1. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes.
  2. Protect surfaces from contact with cleaner.
  3. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.

4. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions. Muriatic acid is NOT acceptable.
6. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.12 MASONRY WASTE DISPOSAL

- A. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
  1. Do not dispose of masonry waste as fill within 18 inches of finished grade.
- B. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION

SECTION 05 12 00 STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes structural steel framing members, support members, with required bracing, welds, fasteners, base plates, bearing plates, grout, anchor bolts and other related items necessary to complete Project indicated by Contract Documents unless specifically excluded.
- B. Related Sections:
  - 1. Section 09 05 15 "Color Design".
  - 2. Section 09 90 00 "Painting and Coating"

1.02 DEFINITIONS

- A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

1.03 PERFORMANCE REQUIREMENTS

- A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand loads indicated and comply with other information and restrictions indicated.
  - 1. Select and complete connections using schematic details indicated and AISC 360.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication of structural-steel components. Shop drawings shall conform to requirements of current AISC Specifications. Indicate sizes, spacing, connections, and location of structural members. Indicate net weld lengths and welded connections with AWS welding symbols.

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer and fabricator.
- B. Welding certificates.
- C. Mill test reports for structural steel, including chemical and physical properties.
- D. Source quality-control reports.

**1.06 QUALITY ASSURANCE**

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.
- B. Installer Qualifications: A qualified installer with a minimum of five (5) years experience.
- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- D. Comply with applicable provisions of the following specifications and documents:
  - 1. AISC 303.
  - 2. AISC 360.
  - 3. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

**PART 2 - PRODUCTS****2.01 STRUCTURAL-STEEL MATERIALS**

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. W-Shapes: ASTM A 992/A 992M
- C. Channels, Angles, M or, S-Shapes: ASTM A 572/A 572M, Grade 50.
- D. Plate and Bar: ASTM A 572/A 572M, Grade 50.
- E. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.
- F. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.
- G. Welding Electrodes: Comply with AWS requirements.

**2.02 BOLTS, CONNECTORS, AND ANCHORS**

- A. General: All bolts not indicated otherwise on the Drawings are 3/4 inch. All connections not noted otherwise on the Drawings shall be framed connections.
- B. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers; all with plain finish.
- C. Unheaded Anchor Rods: ASTM F 1554, Grade 55, weldable.
  - 1. Configuration: Hooked.
  - 2. Finish: Plain

- D. Headed Anchor Rods: ASTM F 1554, Grade 55, weldable, straight.
    - 1. Finish: Plain
  - E. Threaded Rods: ASTM A 36/A 36M
    - 1. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C
  - F. Clevises and Turnbuckles: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1035.
- 2.03 PRIMER
- A. Primer: Shop coat paint, ICI Devflex 4020, Rustoleum 769, Tnemec 99, Southern Coatings 476, or approved equal. Shop coat shall be compatible with finish coats specified in Section 09 90 00 Painting and Coating.
- 2.04 GROUT
- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.
    - 1. Grout shall have a 14-day compressive strength of 6000 psi when mixed to its flowable state.
- 2.05 FABRICATION
- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.
    - 1. Fabrication shall not proceed until MDOT Architect's approval is obtained.
- 2.06 SHOP CONNECTIONS
- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
    - 1. Joint Type: Snug tightened.
  - B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

**2.07 SHOP PRIMING**

- A. Shop prime steel surfaces except the following:
1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
  2. Surfaces to be field welded.
  3. Surfaces to be high-strength bolted with slip-critical connections.
  4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
  5. Galvanized surfaces.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
1. SSPC-SP 3, "Power Tool Cleaning."
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

**2.08 SOURCE QUALITY CONTROL**

- A. Testing Agency: Engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports required by AHJ and ICC Building Code.
1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
- B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.
- C. Bolted Connections: Shop-bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- D. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
1. Liquid Penetrant Inspection: ASTM E 165.
  2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
  3. Ultrasonic Inspection: ASTM E 164.
  4. Radiographic Inspection: ASTM E 94.



### PART 3 - EXECUTION

#### 3.01 EXAMINATION

- A. Verify, with steel Erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.02 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Base Bearing and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
  - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
  - 2. Weld plate washers to top of baseplate.
  - 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
  - 4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

#### 3.03 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 for type of bolt and type of joint specified."
  - 1. Joint Type: Snug tightened
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
  - 1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.

3.04 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.
- B. Bolted Connections: Bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325."
- C. Welded Connections: Field welds will be visually inspected according to AWS D1.1/D1.1M.
  - 1. In addition to visual inspection, field welds will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
    - a. Liquid Penetrant Inspection: ASTM E 165.
    - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
    - c. Ultrasonic Inspection: ASTM E 164.
    - d. Radiographic Inspection: ASTM E 94.
- D. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

END OF SECTION

SECTION 05 50 00 METAL FABRICATIONS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. All miscellaneous metal work. The Work includes, but is not limited to, pipe railings, pipe bollards, grate inlet, steel lintels and miscellaneous framing & supports.

B. Related Sections:

1. Section 09 05 15 – Color Design.
2. Section 09 90 00 - Painting and Coating: Painting for all ferrous metal exposed to view and not covered by masonry or concrete.

1.02 ACTION SUBMITTALS

A. Product Data: For the following:

1. Paint products.
2. Grout.

B. Shop Drawings: Show fabrication and installation details for metal fabrications.

1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

PART 2 - PRODUCTS

2.01 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces without blemishes.

B. Structural shapes shall be standard sections conforming to the American Society for Testing Materials Specification A-36. Punch and drill as necessary for work of others. Provide all bearing plates and all anchors, bolts, and etc. The Work shall be true and free of twists, bends and open joints between component parts. Materials shall be thoroughly straightened in the shop before laid off or worked in any way, care being used to avoid injury to the material.

C. Gray cast iron shall conform to ASTM A48-83, class 30. All castings shall be of uniform quality, free from blowholes, shrinkage defects, swells, cracks or other defects. Castings shall be free of fins, burrs and slag.

- D. Expansion bolts shall be equal to Phillips Red Head or "cinch" bolts as manufactured by the National Lead Company. Hilti Fasteners, Rawlplug Company and Wej-it Corporation are acceptable manufacturers. Use toggle type bolts or similar for all anchorage into hollow construction.
- E. Bolt or weld connections: Provide necessary lugs and brackets for anchorage. Welding shall be in accordance with current "Code of Fusion, Welding and Gas Cutting in Building Construction, Part A - Structural Steel" issued by the American Welding Society, both for fabrication and erection. All welders shall have certification, as a result of tests prescribed by the American Welding Society.
- F. Detail metal Work for ample size, strength and stiffness and as indicated. Countersink and provide reinforcement where necessary; drill or punch holes for bolts and screws. At the proper time furnish the necessary templates, patterns and items of miscellaneous metal, such as sleeves, inserts and similar items to be built into adjoining Work.
- G. Fabricate metal Work with sharp lines and angles, with smooth true surfaces and clean edges. Form exposed joints to exclude water. Furnish certificates from manufacturers stating that materials comply with the specification requirements.
- H. Provide as necessary holes of proper number and spacing for the attachment of Work of other trades. Do not use cutting torch in field without permission of the Project Engineer.
- I. Anchor bolts, washers, nuts and clamps shall be furnished where indicated on the Drawings and where necessary for properly securing Work in place. All bolts and anchors used on the exterior of the building or built into exterior walls shall be cadmium plated. Miscellaneous angles and plates not indicated or specified otherwise shall not be less than 1/4 inch thick.
- J. Shop paint and field touch up shall be ICI Devflex 4020, Rustoleum 769, Tnemec 99, Southern Coatings 476, or approved equal. Shop coat shall be compatible with finish coats specified in Section 09 90 00 – Paints and Coatings

## 2.02 FASTENERS

- A. General: Fastenings shall be invisible where possible. Where exposed, screws, bolts, and the like shall be vandal-proof. All welded exposed joints on steel manufactured items; etc. shall be ground smooth and filled to receive paint
- B. Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls.
  - 1. Provide stainless-steel fasteners for fastening aluminum.
  - 2. Provide stainless-steel fasteners for fastening stainless steel.
  - 3. Provide stainless-steel fasteners for fastening nickel silver.
  - 4. Provide bronze fasteners for fastening bronze.

- C. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.
- D. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
  - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
  - 2. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

## 2.03 PIPE RAILINGS

- A. Fabricate railings and posts from 1-1/4 inch round tube steel, ASTM A 53, Type E or S, Grade A, Schedule 40. Shop prime after fabrication. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to a radius of approximately 1/32-inch, unless otherwise shown.
- B. Welded Connections: Cope intersections of rails and posts, weld joints and grind smooth. Butt weld end-to-end joints of railings or use welding connectors, at fabricator's option. At connections to steel supports, weld post directly to steel supports, unless otherwise indicated.
- C. Anchorage: Use type of bracket with pre-drilled hole for exposed bolt anchorage. For stud partitions and framing use lag bolts set into wood backing between studs and framing members. Coordinate with stud installations for accurate location of backing members.
- D. Expansion: Provide expansion joints at locations indicated, or if not indicated, at intervals not to exceed 40 feet. Provide slip joint with internal sleeve extending 2 inches beyond joint on either side; fasten internal sleeve securely to one side; locate joint within 6 inches of posts.

## 2.04 PIPE BOLLARDS

- A. 8-inch round extra strong steel pipe 1/2-inch thick, 36KSI. Form bent corners to the radius shown without causing grain separation or otherwise impairing the Work.

## 2.05 GRATE INLET

- A. Heavy duty cast iron grate and frame equal to Neenah Foundry Model R-6672-J. Equivalent products by Dews Foundry and Barry Pattern Foundry are acceptable.

## 2.06 LOOSE LINTELS

- A. Provide loose galvanized steel lintels for openings and recesses in masonry walls and partitions. Weld adjoining members together to form a single unit where indicated. Provide a minimum of 8 inches bearing at each side of openings.

**2.07 MISCELLANEOUS FRAMING AND SUPPORTS**

- A. Provide miscellaneous steel framing and supports which are not a part of structural steel framework, as required to complete Work.
- B. Fabricate miscellaneous units to sizes, shapes, and profiles indicated, or, if not indicated, of required dimensions to receive adjacent other work to be retained by framing. Except as otherwise indicated, fabricate from structural steel shapes, plates and steel bars of welded construction using mitered joints for field connection. Cut, drill and tap units to receive hardware and similar items.
- C. Galvanize exterior miscellaneous frames and supports.

**2.08 MISCELLANEOUS MATERIALS**

- A. Metal Primers: Where materials come in contact with dissimilar materials which may cause harmful reaction, where exposed to moisture, or such as aluminum to cement mortar or concrete, the surface shall be protected by zinc chromate primer, bituminous paint or other approved paint.
- B. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- D. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- E. Concrete: Comply with requirements in Section 03 30 00 "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3500 psi.

**2.09 FABRICATION, GENERAL**

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Use connections that maintain structural value of joined pieces.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges. Remove sharp or rough areas on exposed surfaces.
- C. Weld corners and seams continuously to comply with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. At exposed connections, finish exposed welds and surfaces smooth and blended.

- D. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Locate joints where least conspicuous.
- E. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- F. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors not less than 24 inches on center.

### PART 3 - EXECUTION

#### 3.01 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. At exposed connections, finish exposed welds and surfaces smooth and blended.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

#### 3.02 INSTALLING METAL BOLLARDS

- A. Anchor bollards in place with concrete footings. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.
- B. Fill bollards solidly with concrete, mounding top surface to shed water.

3.03 INSTALLING BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
- C. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.04 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION



SECTION 06 10 00 ROUGH CARPENTRY

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Concealed wood grounds and blocking to frame openings, form terminations, to provide anchorage and / or support of other interior and exterior locations; plywood, furring channels and rough hardware.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product.
  - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements
  - 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.

1.03 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.
- B. Evaluation Reports: For the following, from ICC-ES:
  - 1. Wood-preservative-treated wood.
  - 2. Fire-retardant-treated wood.
  - 3. Engineered wood products.
  - 4. Power-driven fasteners.
  - 5. Expansion anchors.
  - 6. Metal framing anchors.

1.04 COORDINATION

- A. Fit carpentry Work to other Work; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds and similar supports to allow proper attachment of other Work.

1.05 QUALITY CONTROL

- A. Factory mark each piece of lumber and plywood to identify the type, grade, agency providing the inspection service, the producing mill and other qualities as specified.

## 1.06 DELIVERY, STORAGE AND PROTECTION

- A. Delivery: Keep materials dry during delivery and storage.
- B. Storage: Stack lumber and plywood, and provide air circulation within stacks. Protect against exposure to weather and contact with damp or wet surfaces.
- C. Protection: Protect installed carpentry work from damage by work of other trades until Owner's acceptance of the Work. Contractor shall comply with manufacturer's required protection procedures.

## 1.07 PROJECT CONDITIONS

- A. Installer shall examine all parts of the supporting structure and the conditions under which the carpentry Work is to be installed, and notify the Contractor in writing of any conditions detrimental to the proper and timely completion of the Work.
- B. Do not proceed with the installation until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

## PART 2 - PRODUCTS

## 2.01 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
  - 1. Factory mark each piece of lumber with grade stamp of grading agency.
  - 2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.
  - 3. Provide dressed lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.
- C. Engineered Wood Products: Provide engineered wood products acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.
  - 1. Allowable Design Stresses: Provide engineered wood products with allowable design stresses, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

## 2.02 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.
  - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- D. Application: Treat items indicated on Drawings, and the following:
  - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
  - 2. Wood sills, sleepers, blocking, furring, and similar concealed members in contact with masonry or concrete.
  - 3. Wood floor plates that are installed over concrete slabs-on-grade.

## 2.03 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
  - 1. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
  - 2. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
- C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.

- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
- E. Application: Treat all rough carpentry unless otherwise indicated, items indicated on Drawings, and the following:
  - 1. Framing for raised platforms.
  - 2. Concealed blocking.
  - 3. Framing for non-load-bearing exterior walls.
  - 4. Roof construction.
  - 5. Plywood backing panels.

#### 2.04 DIMENSION LUMBER FRAMING

- A. Non-Load-Bearing Interior Partitions: Construction, Stud, or No. 3 grade.
  - 1. Application: All interior partitions.
  - 2. Species:
    - a. Mixed southern pine; SPIB.
    - b. Northern species; NLGA.
    - c. Eastern softwoods; NeLMA.
    - d. Western woods; WCLIB or WWPA.
- B. Framing Other Than Non-Load-Bearing Interior Partitions: Construction or No. 2 grade.
  - 1. Application: Framing other than interior partitions
  - 2. Species:
    - a. Southern pine; SPIB.
    - b. Douglas fir-larch; WCLIB or WWPA.
    - c. Mixed southern pine; SPIB.
    - d. Douglas fir-south; WWPA.
    - e. Hem-fir; WCLIB or WWPA.
    - f. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
- C. Framing Other Than Non-Load-Bearing Interior Partitions: Any species and grade with a modulus of elasticity of at least 1,500,000 psi and an extreme fiber stress in bending of at least 1000 psi for 2-inch nominal thickness and 12-inch nominal width for single-member use.
  - 1. Application: Framing other than interior partitions.

#### 2.05 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
  - 1. Blocking.
  - 2. Nailers.
  - 3. Furring.
  - 4. Grounds.

- B. For items of dimension lumber size, provide Construction or No. 2 grade lumber of any species.
- C. For concealed boards, provide lumber with 19 percent maximum moisture content and the following species and grades:
  - 1. Mixed southern pine; No. 2 grade; SPIB.
  - 2. Western woods; Construction or No. 2 Common grade; WCLIB or WWPA.

## 2.06 PLYWOOD

- A. Plywood General: For each use, comply with the requirements for "Softwood Plywood/Construction and Industrial" PS 1 by the U.S. Department of Commerce.
- B. Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.
- C. Exposed Plywood: Where plywood will be exposed to view, provide 5/8 inch (1/2 inch at Mezzanine floor) minimum thickness Interior Type plywood B-C Plugged Grade, unless otherwise specified or shown on Drawings. Unless specifically stated otherwise, all exposed plywood shall be painted or stained from standard colors as selected by Project Engineer / MDOT Architect.
- D. Plywood Subfloor: T&G panels shall be 3/4 inch thick and comply with APA-The Engineered Wood Association rated Sturd-I-Floor, Exposure 1.
- E. Exterior Plywood: Exterior type, medium density, C Grade for concealed faces.
  - 1. Wall sheathing: 1/2 - inch thick.

## 2.07 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
  - 1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners of Type 304 stainless steel.
- B. Power-Driven Fasteners: NES NER-272.
- C. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

## 2.08 FURRING CHANNELS

- A. "Hat-Shaped", 7/8 inch by 2-9/16 inches, cold-rolled, 20 gage, galvanized.

**2.09 MISCELLANEOUS MATERIALS**

- A. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.

**PART 3 - EXECUTION****3.01 INSTALLATION, GENERAL**

- A. Use only sound, thoroughly seasoned materials of the longest practical lengths and sizes to minimize jointing. Use materials free from warp that cannot be easily corrected by anchoring and attachment. Sort out and discard warped material and material with other defects that would impair the quality of the Work.
- B. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- C. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- D. Install fire-retardant treated plywood backing panels with classification marking of testing agency exposed to view.
- E. Do not splice structural members between supports unless otherwise indicated.
- F. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
- G. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
  - 1. NES NER-272 for power-driven fasteners.
  - 2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
  - 3. Table R602.3(1), "Fastener Schedule for Structural Members."

**3.02 ATTACHMENT AND ANCHORAGE**

- A. Use finishing nails for finish Work. 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; pre-drill as required.
- B. Exposed Plywood: Panel ends and edges shall have spacing of 1/8 inch maximum, unless otherwise indicated by the panel manufacturer. Fasten 6 inches on center along supported panel edges and 10 inches on center at intermediate supports.

- C. Plywood Sheathing: Panel ends and edges shall have spacing of 1/8 inch, unless otherwise indicated by the panel manufacturer. Nail 6 inches on center along supported panel edges and 10 inches on center at intermediate supports with 6d common nails for panels' 1/2 -inch thick and 8d nails for panels 3/4 inch thick.
- D. Plywood Subfloor: Fasten to supporting members using combination of glue and wood screws. Mastic construction adhesives shall comply with the APA Glued Floor System and ASTM standard D3498, Standard Specification for Adhesives for Field-Gluing Plywood to Lumber Framing for Floor Systems (based on APA Specification AFG-01). Fasten screws at 6 inches on center along all edges and 10 inches on center at intermediate supports.
- E. Plywood Flooring (Mezzanine): Fasten to plywood subfloor using combination of glue and wood screws. Lay perpendicular to plywood subfloor and stagger joints in both directions. Fasten screws at 6 inches on center along all edges and 10 inches on center at intermediate supports. Install in accordance with installation instructions of The Composite Panel Association.
- F. Furring Channels: Fasten to purlins using self-drilling, self-tapping screws, Spaced at 6 inches on center.

### 3.03 WOOD GROUND, NAILERS, BLOCKING, AND SLEEPERS

- A. Provide wherever shown and where required for screeding or attachment of other work. Form to shapes as shown and cut as required for true line and level of work to be attached. Set true to line and level, plumb with intersections true to required angle. Coordinate location with other Work involved.
- B. Attach to substrates securely with anchor bolts and other attachment devices as shown as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise shown. Building into masonry; anchor to formwork before concrete placement.
- C. Provide grounds of dressed, preservative treated, key-beveled lumber not less than 1-1/2 inch wide and of the thickness required to bring face of ground to exact thickness of finish material involved. Remove temporary grounds when no longer required.

### 3.04 WOOD FURRING

- A. Install plumb and level with closure strips at all edges and openings. Shim with wood as required.
- B. Suspended Furring: Provide of size and spacing shown, complete including hangers and all attachment devices. Level to a tolerance of 1/8 inch in 12 feet

3.05 WOOD FRAMING

- A. Set wood framing accurately to required lines and levels. Provide framing members of sizes and on spacing shown, and frame openings as shown, or if not shown, comply with the recommendation of the "Manual for Housing Framing" of the National Forest Products Association. Cut, join, and tightly fit framing around other Work. Do not splice structural members between supports unless otherwise detailed.
- B. Anchor and nail as shown, or if not shown, to comply with Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.

3.06 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes sufficiently wet that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION



SECTION 06 17 33

WOOD I-JOISTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. This work includes the complete furnishings and installation of all Wood I-Joists, Rim Joists, Rim Boards, hangers and accessories as shown on the Drawings herein specified and necessary to complete the work.
2. These products shall be designed and manufactured to the standards set forth in ICC ES ESR-1153.

1.02 ACTION SUBMITTALS

- A. Shop Drawings: Submit shop drawings indicating all Wood I-Joists types, connections, framing members and accessories. Shop drawings shall bear the seal of a professional Engineer registered in the State of Mississippi.

1.03 QUALITY ASSURANCE

- A. Provide the services of a structural engineer registered to practice in the State of Mississippi to design the wood I-Joists and applicable temporary and permanent bracing to sustain the indicated loads for the spans, profiles and arrangements needed to complete the Work.
- B. Comply with provisions of all applicable standards and codes and the 2012 International Building Code.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Wood I-Joists, if stored prior to erection, shall be stored in a vertical position and protected from the weather. Handle with care to avoid damage.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Flange members, web members, and adhesives shall conform to the provisions of ICC ES ESR-1153.

2.02 FABRICATION

- A. Wood I-Joists shall be equal to TJI® joists as manufactured by iLevel Trus Joist® Commercial by Weyerhaeuser in a plant listed in the reports referred to above and under the supervision of an approved third-party inspection agency.

- B. Size, stress and arrangement shall be determined by dimensions indicated on the Drawings. Top and bottom chords shall be 3-1/2 inches wide and depth of wood I-joint shall be 16 inches (similar and equal to TJI® 560 joists). Each I-Joist shall be custom designed to fit the dimensions indicated on the Drawings. Complete design calculations showing internal layout, member forces, and stress control points are to be furnished for each I-Joist design. Design Calculations shall bear the seal of a professional Engineer registered in the State of Mississippi.

2.03 TOLERANCES

- A. Depth: Plus or minus 1/16 inch.
- B. Flange Width: Plus or minus 1/16 inch.

2.04 IDENTIFICATION

- A. Each of the joists shall be identified by a stamp indicating the joist series, ICC-ES evaluation report number, manufacturer's name, plant number, date of fabrication, and the independent inspection agency's logo.

2.05 OTHER MATERIALS

- A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Project Engineer.

PART 3 - EXECUTION

3.01 ACCEPTABLE INSTALLERS

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods needed for proper performance of the Work.

3.02 EXAMINATION

- A. Examine the areas and conditions under which Work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.03 PREPARATION

- A. Erection bracing in addition to specified bridging is to be provided to keep the I-Joists straight and plumb as required to assure adequate lateral support for the individual I-Joist and entire system until the sheathing material has been applied. The Contractor will give one week notification prior to enclosing the I-Joists to provide opportunity for inspection of the installation by the manufacturer's representative and the Project Engineer.

3.04 INSTALLATION

- A. Coordinate as required with other trades to assure proper and adequate provision in the Work of those trades for interface with the Work of this Section.
- B. Temporary construction loads that cause member stresses beyond design limits are not permitted.
- C. Install the Work of this Section in strict accordance with the original design, pertinent requirements of agencies having jurisdiction and manufacturer's recommended installation procedures and approved shop drawings. Anchor all components firmly into position.

END OF SECTION

## SECTION 06 40 00

## ARCHITECTURAL WOODWORK

## PART 1 - GENERAL

## 1.01 SUMMARY

- A. Section Includes: Architectural woodwork as shown on the Drawings and schedules. Architectural woodwork is defined to include (in addition to items so designated on the Drawings) miscellaneous exposed wood members commonly known as "Finish Carpentry" or "Millwork", except where specified under another Section of these Specifications
- B. The types of architectural woodwork include, but are not limited to:
  - 1. Standing and Running Trim.
  - 2. Cabinets with stain or for paint finish.
  - 3. Countertops.
  - 4. Shelving.
  - 5. Hardware.
  - 6. Miscellaneous work.
- C. Related Sections:
  - 1. Section 05 50 00 – Metal Fabrications.
  - 2. Section 06 10 00 – Rough Carpentry.
  - 3. Section 09 05 15 – Color Design.
  - 4. Section 09 90 00 – Painting and Coating

## 1.02 DEFINITIONS

- A. Terms used in this Section are in accordance with terminology of the Architectural Woodwork Institute, Architectural Woodwork Quality Standards, Eighth Edition, Version 1.0, 2003

## 1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product, including panel products, cabinet hardware and accessories with installation instructions and finishing materials and processes.
- B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
- C. Samples:
  - 1. Lumber for transparent finish, for each species and cut, finished on one side and one edge.
  - 2. Veneer leaves representative of and selected from flitches to be used for transparent-finished cabinets.
  - 3. Lumber and panel products with shop-applied opaque finish, for each finish system and color, with exposed surface finished.

4. Thermoset decorative panels, for each color, pattern, and surface finish.
5. Exposed cabinet hardware and accessories, one unit for each type and finish.

1.04 QUALITY ASSURANCE

- A. Unless otherwise shown or specified, comply with specified provisions of the Architectural Woodwork Institute (AWI) and approved "Quality Standards".
- B. Quality Marking: Mark each unit of architectural woodwork with mill's or fabricator's identification and grade marks, located on surfaces which will not be exposed after installation FIELD CONDITIONS
- C. Millwork fabricator shall comply with the following:
  1. Have a minimum of five (5) years documented experience and shall have completed projects of similar scope and size to the work of this project.
  2. Have technologically advanced woodworking facilities employing the use of modern equipment and techniques for fabricating and finishing to meet the level of quality for the manufacture of all fabrication specified.
  3. Employ skilled workmen experienced in the fabrication and finishing of premium quality millwork.
  4. Be responsible for fabrication, finishing and installation of all products and procedures specified in this Section.
- D. Comply with the indicated standards as applicable for the following types of architectural woodwork
  1. Lumber: AWI Section 100.
  2. Standing and running trim: AWI Section 300.
  3. Cabinets and Countertops: AWI Section 400, A, B, C.
  4. Shelving: AWI Section 600.
  5. Miscellaneous work: AWI Section 700.
  6. Finishing: AWI Section 1500.
  7. Installation of woodwork: AWI Section 1700.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Protect woodwork during transit, delivery, storage and handling to prevent damage, soiling and deterioration. Do not deliver woodwork until painting, wet work, grinding and similar operations which could damage, soil or deteriorate woodwork have been completed in installation areas. If, due to unforeseen circumstances, woodwork must be stored in other than installation areas, store only in areas meeting requirements specified for installation areas.

1.06 FIELD CONDITIONS

- A. The installer shall examine the substrates and conditions under which the work is to be installed; and notify the Contractor in writing of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer

- B. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

## PART 2 - PRODUCTS

### 2.01 ARCHITECTURAL WOODWORK FABRICATORS

- A. Fabricators: Subject to compliance with requirements available fabricators offering products that may be incorporated into the Work include, but are not limited to, the following:
  1. Easley & Easley Millwork, Inc., Jackson, MS. Tel. (601) 372-8881.
  2. Scanlon -Taylor Millwork Company, Jackson, MS. Tel. (601) 362-5333.
  3. Southeastern Constructors, Inc., Brandon, MS. Tel. (601) 825-9791.

### 2.02 BASIC MATERIALS AND FABRICATION METHODS

- A. Except as otherwise indicated, comply with the following requirements for architectural woodwork not specifically indicated as pre-fabricated or pre-finished standard products.
- B. Wood Moisture Content: Provide kiln-dried lumber and maintain optimum 8 to 13 percent range (damp region) moisture content in solid wood (hardwood and softwood) through fabrication, installation, and finishing operations of interior Work.
- C. Wood for Painted Finish: Comply with AWI quality standards for selection of species, grade and cut (fabricator's option, except as otherwise indicated). Wood for trim shall be maple or other closed-grain hardwood subject to Project Engineer/ MDOT Architect's prior approval.
- D. Wood for Stained Finish: Comply with AWI quality standards for selection of species, grade and cut.
- E. Plastic Laminate: Comply with NEMA LD3; type, thickness, color, pattern and finish as indicated for each application.
- F. Design and Construction Features: Comply with the details shown for profile and construction for architectural woodwork; and where not otherwise shown, comply with applicable Quality Standards, with alternate details at fabricator's option.
- G. Pre-Cut Openings: Fabricate architectural woodwork with pre-cut openings, wherever possible, to receive hardware, appliances, plumbing fixtures, electrical work and similar items. Locate openings accurately and use templates or roughing-in diagrams for proper size and shape. Smooth the edges of cut outs and where located in countertops and similar exposures, seal the edges of cut outs with a water resistant coating.

- H. Measurements: Before proceeding with fabrication of woodwork required to be fitted to other construction, obtain measurements and verify dimensions and shop drawing details as required for accurate fit. Where sequence of measuring substrates before fabrication would delay the project, proceed with fabrication (without field measurements) and provide ample borders and edges to allow for subsequent scribing and trimming of woodwork for accurate fit.

#### 2.03 ARCHITECTURAL WOODWORK TYPES

- A. Wood Cabinets: Custom Grade. On exposed portions provide solid wood and plywood (no plywood substitutes) meeting the requirements for the specified Quality Grade.
1. Exposed surfaces: Birch.
  2. Semi-Exposed surfaces: Birch.
  3. Concealed surfaces: Birch
- B. Plastic Laminate Finished Casework: Grade: Premium, Plastic Laminate for Horizontal Surfaces: 0.050" thick, General Purpose Type (high pressure). Plastic Laminate for External Vertical Surfaces: 0.028" thick, General Purpose Type (high pressure).
- C. Plastic Laminate Colors and Patterns: As selected by the Project Engineer / MDOT Architect from manufacturer's standard products, satin finish (5-34 reflectance).

#### 2.04 CABINETS HARDWARE AND ACCESSORY MATERIALS

- A. Provide cabinet hardware and accessory materials associated with architectural woodwork, except for units that are specified as "door hardware" in other sections of these specifications. Except as otherwise indicated, comply with ANSI A156.9 "American National Standard for Cabinet Hardware." Unless shown or noted otherwise, cabinet hardware shall comply with the following:
1. Hinges: Concealed type equal to Blum No.125 Series using full side adjustment.
  2. Pulls: Wire type equal to Stanley No. 4484.
  3. Grommets: 2 inches diameter molded plastic grommet liner with cap.
  4. Drawer guides: Equal to K&V No. 1300.
  5. Adjustable shelf hardware (side support) equal to K&V No. 255-256.
  6. Keyboard: Multi-Platform Articulating Keyboard Platform equal to Kensington Model KMW60067. Equivalent products by Fellows and Safco are acceptable.
  7. Hardware finishes to be selected by the Project Engineer / MDOT Architect.

#### 2.05 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- C. Adhesives: Do not use adhesives that contain urea formaldehyde.

## 2.06 FABRICATION

- A. Complete fabrication, including assembly, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
- B. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

## PART 3 - EXECUTION

### 3.01 PREPARATION

- A. Before installation, condition cabinets to average prevailing humidity conditions in installation areas.
- B. Deliver concrete inserts and similar anchoring devices to be built into substrates, well in advance of the time substrates are to be built. Prior to installation of architectural woodwork, examine shop fabricated work for completion, and complete work as required, including back priming and removal of packing.

### 3.02 INSTALLATION

- A. Install the work plumb, level, true and straight with no distortions. Shim as required using concealed shims. Install to a tolerance of 1/8-inch in 8 feet for plumb and level (including countertops); and with 1/16-inch maximum offsets in revealed adjoining surfaces. Scribe and cut work to fit adjoining work, and refinish cut surfaces or repair damaged finish at cuts.
- B. Secure woodwork with anchors or blocking built-in or directly attached to substrates. Attach to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation. Except where pre-finished matching fastener heads are required, use fine finishing nails for exposed nailing, countersunk and filled flush with woodwork, and matching final finish where transparent finish is indicated.
- C. Casework: Install without distortion so that doors and drawers will fit openings properly and be accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete the installation of hardware and accessory items as indicated.



- D. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to the greatest extent possible. Stagger joints in adjacent and related members. Cope at returns, miter at corners, and comply with Quality Standards for joinery.
- E. Countertops: Anchor securely to base units and other support systems as indicated.

3.03 PREPARATION FOR SITE FINISHING

- A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth ready for painted or stained finishes.

3.04 ADJUSTMENT, CLEANING, FINISHING AND PROTECTION

- A. Repair damaged and defective woodwork wherever possible to eliminate defects functionally and visually; where not possible to repair properly, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean hardware, lubricate and make final adjustments for proper operation. Clean woodwork on exposed and semi-exposed surfaces. Touch up shop applied finishes to restore damaged or soiled areas.
- C. Refer to Section 09 90 00 for final finishing of installed painted and stained architectural woodwork.
- D. Protection: The Installer of architectural woodwork shall advise the Contractor of final protection and maintenance conditions necessary to ensure that the Work will be without damage or deterioration at the time of acceptance

END OF SECTION

SECTION 07 21 00

CELLULOSE THERMAL INSULATION

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Building insulation for interior walls, exterior walls, and floors.
  - 1. Pneumatically blown dry into floor assemblies.
  - 2. Pneumatically sprayed damp into open wall cavities.
- B. Related Sections: Section 13 34 19 Metal Building Systems for thermal glass-fiber blanket insulation.

1.02 ACTION SUBMITTALS

- A. Product Data: Submit manufacturer's product and technical data for insulation describing location, extent, material and method of application prior to installation for MDOT Architect's acceptance.

1.03 INFORMATIONAL SUBMITTALS

- A. Product test reports.
- B. Research/evaluation reports.

1.04 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in the manufacture of Cellulose Thermal Insulation with 10 years minimum experience.
- B. Installer: Company specializing in Cellulose Thermal Insulation Products, with 5 years minimum experience, who has completed work similar to that indicated for this project and with a record of successful in-service performance and is approved by manufacturer to install manufacturer's products. Submit identification of at least 3 projects of similar scope and complexity along with name, address, and telephone number of the Architect, Owner and General Contractor.

1.05 PRODUCT HANDLING

- A. Protect the materials of this section before, during and after installation and to protect the installed work and materials of all other trades. In the event of damage, immediately make all repairs or replacements as necessary.

1.06 WARRANTY

- A. Provide manufacturer's standard life time warranty.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Drawings and Specifications are based on products manufactured by NU-WOOL Company, Inc., 2472 Port Sheldon Street, Jenison, MI. Tel. (800) 748-0128.
- B. Equivalent products by the following manufacturers are acceptable:
  - 1. Fiberlite Technologies, Inc., Joplin, MO. Tel: (800) 641-4296.
  - 2. Hamilton Manufacturing Inc., Twin Falls, Idaho. Tel: (208)733-9689.
- C. Alternate Manufacturers: Products produced by other manufacturers that fully meet or exceed the specified requirements may be considered under provisions of Section 01 25 00-Substitution Procedures and Section 01 60 00-Product Requirements.

2.02 CELLULOSE INSULATION MATERIALS

- A. Cellulose Insulation: Insulation shall be manufactured from recycled newspapers containing a minimum of 85 percent paper fiber content. Fibers shall be treated with boric acid and sodium polyborate (ammonium or aluminum sulfate are NOT allowed) to create permanent flame resistance.
  - 1. Shall contain a EPA registered fungicide, be mold-resistant, non-toxic, and non-corrosive.
  - 2. Shall not irritate normal skin.
  - 3. Shall not give off odor during or after installation.
  - 4. Shall not attract vermin or insects.
  - 5. Shall not adversely affect other building materials.
- B. Thermal Performance: Cellulose insulation shall resist the flow of heat. Heat transfer is limited as indicated by its R-Value of 3.8 per inch. Air infiltration through the material shall be limited by the density of the material and methods used to install it.
- C. Sound Control: Cellulose insulation shall provide significant noise reduction in walls and floors.
- D. Standards: Cellulose insulation shall conform to the CPSC standard 16 CFR Parts 1209 and 1404. In addition, the cellulose insulation shall meet or exceed all of the test requirements of ASTM C-739, E-84 and E-119, and UL-723.

2.03 MATERIAL CHARACTERISTICS

- A. The following properties were tested by Underwriters Laboratories (R-8078):
  - 1. Settled Density: The maximum density after long-term settling of dry application: 1.6 lb/ft<sup>3</sup>.
  - 2. Thermal Resistance: The average thermal resistance per inch: 3.8 (R-Value/in).
  - 3. Flammability Characteristics: Critical Radiant Flux - greater than or equal to 0.12 watts/cm<sup>2</sup>; Smoldering Combustion - less than or equal to 15 percent.

4. Moisture Vapor Sorption: This requirement assures that normal variations in relative humidity will not adversely affect thermal resistance. Cellulose insulation shall meet the requirements of less than 15 percent for maximum weight gain under the specified test conditions.
5. Surface Burning Characteristics: Flame Spread – 15; Smoke Developed – 5.

### PART 3 - EXECUTION

#### 3.01 INSPECTION

- A. Examine the areas and conditions where building insulation is to be installed and notify the Contractor and MDOT Architect of conditions detrimental to the proper and timely completion of the work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

#### 3.02 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated. If printed instructions are not available, or do not apply to the project conditions, consult the manufacturer's technical representative for specific recommendations before proceeding with the work

#### 3.03 INSTALLATION

- A. Extend insulation full thickness as shown over entire area to be insulated. Fit tightly around obstructions, and fill voids with insulation. Remove projections, which interfere with placement.
- B. Nu-Wool Insulation: Cellulose insulation shall be pneumatically blown dry into floor assemblies after mechanical, plumbing, electrical and other utility installations have been completed and in compliance with manufactures instructions.
- C. Nu-Wool WALLSEAL: Cellulose insulation shall be pneumatically sprayed with a controlled water fog for adhesion into open wall cavities after mechanical, plumbing, electrical and other utility installations have been completed. Drywall may be installed 24 hours after application. Total drying time is approximately 30 days. Installation shall be made only by Nu-Wool factory-certified WALLSEAL contractors using approved equipment.

END OF SECTION

SECTION 07 26 00 VAPOR RETARDERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Vapor retarder under concrete floor slab.
2. Concrete curing paper on top of freshly poured concrete floor slab.
3. Floor protection paper used for positive protection of finished floors.

1.02 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical product data, installation instructions and recommendations for products specified.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Drawings and specifications are based on products manufactured by Fortifiber Corporation, 300 Industrial Drive, Fernley, NV 89408. Tel. (800) 773-4777.
- B. Equivalent products by the following manufacturers are acceptable:
1. Grace Construction Products, Cambridge, Ma. Tel: (800) 444-6459.
  2. Griffolyn ® Division, Reef Industries, Inc., Houston, TX. Tel: (800) 231-6074.
  3. Stego Industries LLC, San Juan Capistrano, CA. Tel: (877) 464-7834.
- C. Substitutions shall fully comply with specified requirements, Section 01 25 00-Substitution Procedures and Section 01 60 00-Product Requirements.

2.02 VAPOR RETARDER

- A. Membrane shall be a 15 mil polyolefin film meeting ASTM E-1745-97 Class A Test Method, equal to Fortifiber Corporation, Moistop® Ultra™ 15, including Moistop® tape and sealants with the following characteristics:
1. Moisture Vapor Permeance: ASTM E-154, Section 7 (E-96, Method A) = .02 perms.
  2. Tensile Strength: ASTM E-154, Section 9 (Method D-882) = (70lb f/in min)-MD & CD.
  3. Puncture Resistance: ASTM D-1709, Method B = 3,000 Grams.

2.03 CONCRETE CURING PAPER

- A. Laminated tri directional glass fiber reinforced long fibered kraft curing papers with double coating of high-melting-point asphalt, meeting ASTM C-171 Test Method, equal to "Orange Label Sisalkraft®".

2.04 FLOOR PROTECTION PAPER

- A. Non-staining reinforced floor protection paper consisting of two heavy kraft sheets and glass reinforcing fibers laminated with a non-staining adhesive, meeting ASTM D 828 and ASTM D 781 Test Methods, equal to "Seekure®".

PART 3 - EXECUTION

3.01 PREPARATION

- A. Ensure items that pass through building paper / membrane are properly and rigidly installed, substrate is free of projections and irregularities that may be detrimental to proper installation of building paper / membrane.

3.02 INSTALLATION

A. Vapor Retarder:

1. Unroll underslab vapor retarder over thoroughly compacted subgrade and turn down at inside perimeter of grade beams.
2. Seal joints watertight, with a pressure sensitive tape as recommended by manufacturer, allowing a minimum overlap of 6 inches.
3. Apply tape evenly over seams and rub out wrinkles formed during application.
4. Seal pipes and conduits passing through the membrane with Moistop boot and tape.
5. Inspect membrane thoroughly and repair all punctures immediately before placing concrete. Equipment, tools, and procedures that might puncture the membrane shall not be used while placing and finishing the concrete.
6. Comply with manufacturer's recommendations and installation procedures as outlined in ASTM E-1643.

B. Curing Paper:

1. Unroll concrete curing paper over the entire surface once the concrete has set sufficiently hard to permit application without marring the surface.
2. Lap joints 4 inches and seal with pressure sensitive tape.
3. Apply tape evenly over seams and rub out wrinkles formed during application.
4. Ensure that all tears or penetrations are repaired.

C. Floor Protection Paper:

1. Apply floor protection paper immediately after floor covering is installed.
2. Do not remove until final completion and acceptance by the Project Engineer.
3. Lay paper in widest practical width with 6-inch laps to provide complete coverage of flooring.
4. Seal joints with minimum 2 inch wide pressure sensitive tape.

3.03 CLEANING

- A. Inspect vapor barrier membrane thoroughly and keep clean. Remove dirt, oils, mud, debris, etc. prior to placing concrete.

END OF SECTION

SECTION 07 27 26

FLUID-APPLIED MEMBRANE AIR BARRIERS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following:

1. Materials and installation methods for fluid applied (fully adhered), vapor permeable air barrier membrane system located in the non-accessible part of the wall.
2. Materials and installation methods to bridge and seal air leakage pathways in roof and foundation junctions, window and door openings, control and expansion joints, masonry ties, piping and other penetrations through the wall assembly.

B. Related Sections:

1. Division 04 Section "Unit Masonry Assemblies" for embedded flashings.
2. Division 07 Section "Joint Sealants" for joint-sealant materials and installation.

1.02 DEFINITIONS

A. ABAA: Air Barrier Association of America.

B. Air Barrier Assembly: The collection of air barrier materials and auxiliary materials applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.03 PERFORMANCE REQUIREMENTS

A. General: Air barrier shall be capable of performing as a continuous vapor-permeable air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

B. The air barrier shall have the following characteristics:

1. It must be continuous, with all joints made airtight.
2. It shall have an air permeability not to exceed 0.004 cfm/sq. ft. under a pressure differential of 0.3 in. water. (1.57 psf.) (equal to 0.02L/sq. m @ 75 Pa.).
3. It shall be capable of withstanding positive and negative combined design wind, fan and stack pressures on the envelope without damage or displacement, and shall transfer the load to the structure. It shall not displace adjacent materials under full load.
4. It shall be durable or maintainable.



5. The air barrier shall be joined in an airtight and flexible manner to the air barrier material of adjacent systems, allowing for the relative movement of systems due to thermal and moisture variations and creep. Connection shall be made between:
  - a. Foundation and walls.
  - b. Walls and windows or doors.
  - c. Different wall systems.
  - d. Wall and roof.
  - e. Wall and roof over unconditioned space.
  - f. Walls, floor and roof across construction, control and expansion joints.
  - g. Walls, floors and roof to utility, pipe and duct penetrations.
6. All penetrations of the air barrier and paths of air infiltration/exfiltration shall be made airtight.

#### 1.04 REFERENCES

- A. The following standards and publications are applicable to the extent referenced in the text. The most recent version of these standards is implied unless otherwise stated.
- B. American Society for Testing and Materials (ASTM):
  1. C920 Specifications for Elastomeric Joint Sealants
  2. C1193 Guide for Use of Joint Sealants
  3. D412 Standard Test Methods for Rubber Properties in Tension
  4. D570 Test Method for Water Absorption of Plastics
  5. D1004 Test Method for Initial Tear Resistance of Plastic Film and Sheeting
  6. D1876 Test Method for Peel Resistance of Adhesives
  7. D1938 Test Method for Tear Propagation Resistance of Plastic Film and Sheeting
  8. D1970 Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
  9. D4258 Practice for Surface Cleaning Concrete for Coating
  10. D4263 Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
  11. E96 Test Methods for Water Vapor Transmission of Materials
  12. E154 Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover
  13. E162 Test Method for Surface Flammability of Materials Using a Radiant Heat Source
  14. E1186 Practice for Air Leakage Site Detection in Building Envelopes and Air Retarder Systems
  15. E2178-01 Standard Test Method for Air Permeance of Building Materials
  16. E2357 Standard Test Method for Determining Air Leakage of Air Barrier Assemblies.

#### 1.05 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
  1. Include installers of other construction connecting to air barrier, including masonry, sealants, windows, and door frames.

2. Review air barrier requirements including surface preparation, substrate condition and pretreatment, minimum substrate curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, sequence of installation, and protection and repairs.

1.06 ACTION SUBMITTALS

- A. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of air barrier.
- B. Shop Drawings: Show locations and extent of air barrier. Include details for substrate joints and cracks, counterflashing strip, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
  1. Include details of interfaces with other materials that form part of air barrier.

1.07 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For air barriers, certifying compatibility of air barrier and accessory materials with Project materials that connect to or that come in contact with the barrier; signed by product manufacturer.
- B. Qualification Data: For Applicator.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for air barriers, submit certified test report showing compliance with requirements specified for ASTM E2178.
- D. Warranty: Submit a sample warranty identifying the terms and conditions stated in Article 1.09.

1.08 QUALITY ASSURANCE

- A. Applicator Qualifications: A firm experienced in applying air barrier materials similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials and products in labeled packages. Store and handle in strict compliance with manufacturer's instructions, recommendations and material safety data sheets. Protect from damage from sunlight, weather, excessive temperatures and construction operations. Remove damaged material from the site and dispose of in accordance with applicable regulations.
- B. Do not double-stack pallets of fluid applied membrane components on the job site. Provide cover on top and all sides, allowing for adequate ventilation.
- C. Protect fluid-applied membrane components from freezing and extreme heat.
- D. Sequence deliveries to avoid delays, but minimize on-site storage.

## 1.10 PROJECT CONDITIONS

- A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended by air barrier manufacturer. Protect substrates from environmental conditions that affect performance of air barrier. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

## 1.11 WARRANTY

- A. Material Warranty: Manufacturer's standard form in which manufacturer agrees to replace fluid-applied air barrier membrane materials that fail within specified warranty period when installed and used in strict conformance with written manufacturer's instructions.
1. Failures include, but are not limited to, the following:
    - a. Failure to maintain air permeance rating not to exceed 0.02 L/s/sq. m. when tested per ASTM E2178, within specified warranty period.
    - b. Failure to maintain a vapor permeance rating greater than 10 perms when tested in accordance with ATM E96, Method B.
  2. Warranty Period: Five years from date of Completion.

## PART 2 - PRODUCTS

### 2.01 PERFORMANCE REQUIREMENTS

- A. General: Air barrier shall be capable of performing as a continuous vapor-permeable air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

### 2.02 VAPOR-PERMEABLE MEMBRANE AIR-BARRIER

- A. Fluid-Applied, Vapor-Permeable Membrane Air Barrier: synthetic polymer membrane.
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. Synthetic Polymer Membrane:
      - 1) Carlisle Coatings & Waterproofing Inc.; Barritech VP.
      - 2) Grace, W. R., & Co. - Conn.; Perm-A-Barrier VP. (Basis-of-Design)
      - 3) Henry Company; Air-Bloc 31
      - 4) Tremco Incorporated, an RPM company; ExoAir 230.
  2. Physical and Performance Properties:
    - a. Membrane Air Permeance: Not to exceed **0.0004 cfm/sq. ft. of surface area (at specified thickness) at 1.57-lbf/sq. ft.** when applied to CMU wall; when tested per ASTM E2178.
    - b. Membrane Vapor Permeance: Not less than **11.2 perms**; when tested per ASTM E96.
    - c. UV Exposure Limit: Not more than 180 calendar days; per ASTM D412 and ASTM E96-Method B.

## 2.03 AUXILIARY MATERIALS

- A. General: Auxiliary materials recommended by air barrier manufacturer for intended use and compatible with air barrier membrane. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
- B. Liquid Membrane for Details and Terminations: Provide Bituthene Liquid Membrane as manufactured by Grace Construction Products.
- C. Wall Primer (for Use with Throughwall Flashing and Tapes Applied to Substrate): Liquid waterborne primer recommended for substrate by manufacturer of air barrier material.
1. Flash Point: No flash to boiling point.
  2. Solvent Type: Water.
  3. VOC Content: Not to exceed 10 g/l.
  4. Application Temperature: 25 degrees F and above.
  5. Freezing point (as packaged): 21 degrees F.
  6. Product: Perm-A-Barrier WB Primer manufactured by Grace Construction Products.
- D. Flexible Membrane Wall Flashing: 0.8 mm (32 mils) of self-adhesive rubberized asphalt integrally bonded to 0.2 mm (8 mil) of cross-laminated, high-density polyethylene film to provide a min. 1.0 mm (40 mil) thick membrane. Membrane shall be interleaved with disposable silicone-coated release paper until installed, conforming with the following:
1. Water Vapor Transmission: ASTM E96, Method B: 2.9 ng/m<sup>2</sup>sPa (0.05 perms) max.
  2. Water Absorption: ASTM D570: max. 0.1 percent by weight.
  3. Puncture Resistance: ASTM E154: 356 N (80 lbs.) min.
  4. Tear Resistance:
    - a. Initiation ASTM D1004: min. 58 N (13.0 lbs.) M.D.
    - b. Propagation ASTM D1938: min. 40 N (9.0 lbs.) M.D.
  5. Lap Adhesion at -4°C (25°F): ASTM D1876: 880 N/m (5.0 lbs./in.) of width.
  6. Low Temperature Flexibility ASTM D1970: Unaffected to -43°C (-45°F)
  7. Tensile Strength: ASTM D412, Die C Modified: min. 5.5 MPa (800 psi)
  8. Elongation, Ultimate Failure of Rubberized Asphalt: ASTM D412, Die C: min. 200 percent.
  9. Product: Perm-A-Barrier Wall Flashing manufactured by Grace Construction Products.
- E. Joint Reinforcing Strip: Air barrier manufacturer's approved tape.
- F. Transition Tape: 0.9 mm (36 mils) of self-adhesive rubberized asphalt integrally bonded to 0.1 mm (4 mils) of cross-laminated, high-density polyethylene film to provide a min. 1.0 mm (40 mil) thick membrane. Membrane shall be interleaved with disposable silicone-coated release paper until installed, conforming with the following:
1. Water Vapor Transmission: ASTM E96, Method B: 2.9 ng/m<sup>2</sup>sPa (0.05 perms) max.
  2. Water Absorption: ASTM D570: max. 0.1 percent by weight
  3. Puncture Resistance: ASTM E154: 356 N (80 lbs.) min.

4. Tear Resistance:
    - a. Initiation ASTM D1004: min. 58 N (13.0 lbs.) M.D.
    - b. Propagation ASTM D1938: min. 40 N (9.0 lbs.) M.D.
  5. Lap Adhesion at -4°C (25°F): ASTM D1876: 880 N/m (5.0 lbs./in.) of width
  6. Low Temperature Flexibility ASTM D1970: Unaffected to -43°C (-45°F)
  7. Tensile Strength: ASTM D412, Die C Modified: min. 5.5 MPa (800 psi)
  8. Elongation, Ultimate Failure of Rubberized Asphalt: ASTM D412, Die C: min. 200 percent
  9. Product: Perm-A-Barrier Detail Membrane or Perm-A-Barrier Aluminum Flashing manufactured by Grace Construction Products.
- G. Substrate Patching Membrane: Manufacturer's standard trowel-grade substrate filler.
- H. Sprayed Polyurethane Foam Sealant: 1- or 2-component, foamed-in-place, polyurethane foam sealant, 1.5 to 2.0 lb/cu. ft; flame spread index of 25 or less according to ASTM E 162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.
- I. Joint Sealant: ASTM C 920, single-component, neutral-curing silicone; Class 100/50 (low-modulus), Grade NS, Use NT related to exposure, and, as applicable to joint substrates indicated, Use O. Comply with Division 7 Section "Joint Sealants."

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.
1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
  2. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 SURFACE PREPARATION

- A. Refer to manufacturer's literature for requirements for preparation of substrates. Surfaces shall be sound and free of voids, and sharp protrusions. Remove contaminants such as grease, oil and wax from exposed surfaces. Remove dust, dirt, and debris. Use repair materials and methods that are acceptable to manufacturer of the fluid-applied air barrier system.
- B. Exterior sheathing panels: Ensure that the boards are sufficiently stabilized with corners and edges fastened with appropriate screws. Pre-treat all board joints with 50 - 75mm (2-3 in.) wide, manufacturer's recommended self-adhesive tape. Gaps greater than 6mm (1/4 in.) should be filled with mastic or caulk, allowing sufficient time to fully cure before application of the tape and fluid applied air barrier system. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

- C. Related Materials: Treat construction joints and install flashing as recommended by manufacturer.
- D. Clean, prepare, treat, and seal substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air barrier application
- E. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.
- F. At changes in substrate plane, apply sealant or Bituthene Liquid Membrane at sharp corners and edges to form a smooth transition from one plane to another.
- G. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

### 3.03 JOINT TREATMENT

- A. Plywood Sheathing: Fill joints greater than 1/4 inch with sealant according to ASTM C 1193 and with air barrier manufacturer's written instructions. Apply first layer of fluid air barrier membrane at joints. Tape joints with joint reinforcing strip after first layer is dry. Apply a second layer of fluid air barrier membrane over joint reinforcing strip.

### 3.04 AIR BARRIER MEMBRANE INSTALLATION

- A. Apply air barrier membrane to achieve a continuous air barrier according to air barrier manufacturer's written instructions.
- B. Apply air barrier membrane within manufacturer's recommended application temperature ranges.
- C. Apply a continuous unbroken air barrier to substrates according to the following minimum thickness. Apply membrane in full contact around protrusions such as masonry ties.
  - 1. Vapor- Permeable Membrane Air Barrier: 90-mil wet film thickness, 45-mil dry film thickness.
- D. Do not cover air barrier until it has been inspected by Project Engineer/ MDOT Architect.
- E. Fill correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air barrier components.

### 3.05 TRANSITION STRIP INSTALLATION

- A. Install strips, transition strips, and auxiliary materials according to air barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier.

- B. Apply primer to substrates to receive transition tapes at required rate and allow to dry. Limit priming to areas that will be covered by transition tape in same day. Reprime areas exposed for more than 24 hours.
- C. Connect and seal exterior wall air barrier membrane continuously to exterior glazing and window systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials. Do not cover air barrier until it has been tested and inspected by Owner's testing agency.
- D. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.
- E. Apply joint sealants forming part of air barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- F. Wall Openings: Prime concealed perimeter frame surfaces of windows, storefronts, and doors. Apply transition strip so that a minimum of **3 inches** of coverage is achieved over both substrates. Maintain **3 inches** of full contact over firm bearing to perimeter frames with not less than **1 inch** of full contact.
  - 1. Transition Strip: Roll firmly to enhance adhesion.

### 3.06 CLEANING AND PROTECTION

- A. Protect air barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
  - 1. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. Remove and replace air barrier exposed for more than 180 days.
- B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construction.
- C. Remove masking materials after installation.

END OF SECTION

SECTION 07 65 26

SELF-ADHERING SHEET FLASHING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Self-adhesive flashing used to seal around exterior windows, doors, common through-wall penetrations such as hose bibbs, vents, electrical boxes, exterior lights, and where required to weatherproof the building.
2. Waterproof membrane flashing used to seal around exterior brick ledges, copings at masonry walls, and where required to waterproof the building.

B. Related Sections: Section 07 27 26 – Fluid-Applied Membrane Air Barriers.

1.02 ACTION SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data, installation instructions and recommendations for product specified.

1.03 INFORMATIONAL SUBMITTALS

- A. Sample warranty.

1.04 WARRANTY

- A. Special Warranty: Provide Manufacturer's standard 10 year material and labor warranty.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Equivalent products by the following manufacturers are acceptable:

1. Fortifiber Corporation, Fernley, NV. Tel. (800) 773-4777.
2. Grace Construction Products, Cambridge, MA. Tel: (800) 444-6459 (Basis-of-Design).
3. Griffolyn® Division, Reef Industries, Inc., Houston, TX. Tel: (800) 231-6074.

- B. Alternate Manufacturers: Products produced by other manufacturers that fully meet or exceed the specified requirements may be considered under provisions of Section 01 25 00- Substitution Procedures and Section 01 60 00-Products Requirements.



## 2.02 SELF-ADHEVEISE FLASHING

- A. Membrane shall be a self-adhering type equal to Grace Perm-A-Barrier Detail Membrane or Perm-A-Barrier Aluminum Flashing as manufactured by Grace Construction Products.
- B. Prefabricated Corners for Windows and Doors: Shall be equal to VYCORner as manufactured by Grace Construction Products.

## 2.03 WATERPROOF MEMBRANE FLASHING

- A. Grace PERM-A-BARRIER Wall Flashing system consists of a membrane component, a surface conditioner and mastic. It is designed to be used with Bituthene Mastic and Perma-A-Barrier Surface conditioner and Bituthene Prime 82 when needed.
  - 1. Wall flashing is a 40 mil self-adhesive, cold applied sheet consisting of 32 mil of rubberized asphalt integrally bonded to an 8 mil, high density, and cross-laminated polyethylene film. The rolls are interwound with a disposable silicone-coated release sheet
  - 2. Bituthene Mastic is rubberized, asphalt base mastic designed to be used at all laps, seams, top edges and cuts in the flashing, and around oil penetrations through the flashing. Bituthene Mastic should not be used in applications where it will be covered by wall flashing.
  - 3. Surface Conditioner is a water based formula designed to prepare substrates for PERM-A-BARRIER Wall Flashing. Surface Conditioner is packaged ready-to-use and imparts an aggressive, high tack finish to the treated substrate. It is recommended when the flashing does not adhere to the substrate.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Visually determine that Project is ready to receive the work of this Section; beginning work indicates acceptance of conditions.
  - 1. Verify items that penetrate surfaces to receive flashing are rigidly installed.
  - 2. Do not apply flashing to damp, frozen, dirty, dusty, or other surfaces unacceptable to manufacturer.

### 3.02 PREPARATION

- A. Protect adjacent surfaces not designated to receive flashing.
  - 1. Seal cracks and joints with recommended material and sealant. Remove projections.
  - 2. Clean surfaces of foreign matter detrimental to installation of flashing.
  - 3. Apply surface primer and adhesive in locations and at a rate recommended by manufacturer.
- B. Whenever wall flashing is to be applied, the surface shall be smooth, clean, dry and free of voids, spalled areas, loose substrate, loose nails, sharp protrusions, or other matter that will hinder the adhesion or uniformity of the wall flashing installation. Clean loose dust or dirt from the surface by wiping with a clean dry cloth or a brush.

- C. Manufacturer's Instructions: In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for phases of Work, including preparing substrate, applying materials, and protecting installed flashing.
- D. Application to In-Place Construction: Provide accessory materials where necessary to secure sheet flashing assemblies to in-place construction.

3.03 INSTALLATION

- A. Self-adhesive Flashing: Grace Perm-A-Barrier Detail Membrane or Perm-A-Barrier Aluminum Flashing, VYCORner and Grace PERM-A-BARRIER Wall flashing shall comply with manufacturers recommended installation instructions.
- B. Apply Wall Flashing and accessories only in fair weather when air and surface temperatures are above 25 degrees F.
- C. Pre-cut wall flashing to easily handled lengths. Peel release paper from roll to expose rubberized asphalt, then carefully position flashing to substrate. Press firmly into place with a steel hand roller or the back of a utility knife as soon as possible, fully adhering the flashing to the substrate to prevent water from migrating under the wall flashing. Form end dams at horizontal flashing terminations to prevent water entry. Overlap adjacent pieces 2 inches and roll overlap with a steel hand roller.
- D. Cutting, Fitting, and Placement: Perform cutting and fitting required to properly install wall flashing adjoining finished surfaces measured from established lines and levels. Securely attach flashing in place with required accessories. Trim bottom edge 1/2 inch back from exposed face of wall and install metal drip with hemmed edge set in sealant.

3.04 CLEANING

- A. Inspect membrane and substrate thoroughly and keep clean. Remove dirt, oils, mud, debris, etc. prior to installation.

END OF SECTION

SECTION 07 84 00 FIRESTOPPING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Penetrations in fire-resistance-rated walls.
2. Penetrations in horizontal assemblies.
3. Penetrations in smoke barriers.
4. Joints in or between fire-resistance-rated constructions.
5. Joints in smoke barriers.

1.02 ACTION SUBMITTALS

- A. Product Data: Submit manufacturer's product data, specifications and installation procedures for each type of firestopping and accessory required. Submit detailed location where each will be used. Submit UL data for assemblies where shown on the Drawings.
- B. Product Schedule: For each firestopping system. Include location and design designation of qualified testing and inspecting agency.
1. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular firestopping condition, submit illustration, with modifications marked, approved by firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.03 INFORMATIONAL SUBMITTALS

- A. Installer Certificates: From Installer indicating firestopping has been installed in compliance with requirements and manufacturer's written recommendations.
- B. Product test reports.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."
- B. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:
1. Penetration and fire-resistive joint system firestopping tests are performed by UL, Intertek ETL SEMKO, or FM Global.
    - a. Qualified testing agency shall be acceptable to authorities having jurisdiction.

- 2. Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems bearing marking of qualified testing and inspection agency.
- C. Preinstallation Conference: Conduct conference at Project site.

PART 2 - PRODUCTS

2.01 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. Hilti, Inc. Tulsa, OK. Tel. (800) 879-8000.,
  - 2. 3M Fire Protection Products, Saint Paul, MN. Tel. (800) 328-1687.
  - 3. USG Corporation, Chicago, IL. Tel. (880) 874-4968.

2.02 PENETRATION FIRESTOPPING

- A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
- B. Penetrations in Fire-Resistance-Rated Walls: Ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
  - 1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Penetrations in Horizontal Assemblies: Ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
  - 1. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
  - 2. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
- D. Penetrations in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.
  - 1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at 0.30-inch wg at both ambient and elevated temperatures.
- E. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

- F. VOC Content: Penetration firestopping sealants and sealant primers shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
1. Sealants: 250 g/L.
  2. Sealant Primers for Nonporous Substrates: 250 g/L.
  3. Sealant Primers for Porous Substrates: 775 g/L.

- G. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.

### 2.03 FIRE- RESISTIVE JOINT SYSTEMS

- A. Where required, provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which fire-resistive joint systems are installed. Fire-resistive joint systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.
- B. Joints in or between Fire-Resistance-Rated Construction: Ratings determined per ASTM E 1966 or UL 2079:
1. Fire - Resistance Rating: Equal to or exceeding the fire-resistance rating of construction they will join.
- C. Joints at Exterior Curtain-Wall/Floor Intersections: Rating determined by ASTM E 119 based on testing at a positive pressure differential of 0.01-inch wg or ASTM E 2307.
1. Fire - Resistance Rating: Equal to or exceeding the fire-resistance rating of the floor assembly.
- D. Joints in Smoke Barriers: Ratings determined per UL 2079.
1. L- Rating: Not exceeding 5.0 cfm/ft of joint at 0.30 inch wg at both ambient and elevated temperatures.
- E. Exposed Fire-Resistive Joint Systems: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- F. VOC Content: Fire-resistive joint system sealants shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
1. Architectural Sealants: 250 g/L.
  2. Sealant Primers for Nonporous Substrates: 250 g/L.
  3. Sealant Primers for Porous Substrates: 775 g/L.

- G. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials that are needed to install fill materials and to maintain ratings required. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing agency for systems indicated.

## 2.04 FINISHES

- A. Concealed locations: Manufacturer's Standards.
- B. Exposed to View Locations: "Custom" Colors as selected by Project Engineer / MDOT Architect unless Manufacturer's Standards closely matches finish of penetrated surfaces.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, Joint configurations, substrates, and other conditions affecting performance of the Work.
- B. Verify application required and location for each type of firestopping to be used and install firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.
- C. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
  - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.
- D. Install fill materials for firestopping by proven techniques to produce the following results:
  - 1. Fill voids and cavities formed by openings, forming materials, accessories, joints and penetrating items as required to achieve fire-resistance ratings indicated.
  - 2. Apply materials so they contact and adhere to substrates formed by openings, joints and penetrating items.
  - 3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.
- E. Install approved metal sleeves with fireproof sealant at all communication and control wiring passing through rated walls throughout the entire project.
- F. After installation of all Work, including but not limited to ductwork, fire and smoke dampers, communication cabling, electrical conduit, etc., properly seal all openings, cracks, crevices and penetrations throughout the entire project, to maintain fire ratings shown.

3.02 IDENTIFICATION

- A. Identify firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestopping. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
  - 1. The words "Warning - Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
  - 2. Contractor's name, address, and phone number.
  - 3. Designation of applicable testing and inspecting agency.
  - 4. Date of installation.
  - 5. Manufacturer's name.
  - 6. Installer's name.

3.03 FIELD QUALITY CONTROL

- A. Owner will engage a qualified testing agency to perform tests and inspections.
- B. Where deficiencies are found or firestopping is damaged or removed because of testing, repair or replace firestopping to comply with requirements.
- C. Proceed with enclosing firestopping with other construction only after inspection reports are issued and installations comply with requirements.

3.04 FIRESTOPPING SCHEDULE

- A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHEZ, Category XHBN or Category XHDG
- B. Where Intertek ETL SEMKO-listed systems are indicated, they refer to design numbers in Intertek ETL SEMKO's "Directory of Listed Building Products" under "Firestop Systems."
- C. Where FM Global-approved systems are indicated, they refer to design numbers listed in FM Global's "Building Materials Approval Guide" under "Wall and Floor Penetration Fire Stops."
- D. Sealants: Equal to Hilti, Inc. FS-One.
- E. Caulking and Putty: Equal to 3M Brand Fire Barrier CP- 25 Caulk and Putty 303.
- F. Penetration Sealants: Equal to 3M Fire Barrier Penetration Sealing Systems 7902 and 7904 series as required.
- G. Insulation: Equal to United States Gypsum Company "Thermafiber" Safing Insulation, 4 pcf density, unfaced.
- H. Intumescent Firestopping: Equal to Hilti, Inc. FS-One, CP 642 and FS 657 Fire Block as required.

END OF SECTION



SECTION 07 92 00 JOINT SEALANTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Preparation of substrate surfaces to receive materials.
- B. Sealant and joint backing (backer rod) materials and installation in the following general locations (even though not shown on the Drawings):
  - 1. Exterior and interior wall joints, including control / expansion joints and abutting like or similar materials (in walls, ceilings, and roof construction) that have spaces between in excess of 3/16 inch (except where less restrictive tolerances are indicated or where the condition is specifically the responsibility of others).
  - 2. Abutting dissimilar materials, exterior and interior.
  - 3. Interior acoustical joints in vertical surfaces and horizontal nontraffic surfaces.
  - 4. Exterior and interior wall openings (including at perimeter doors, exterior thresholds, windows, louvers, and penetrations required by piping, ducts, and other service and equipment, except for sealants provided by Section 07 84 00-Firestopping).
  - 5. Joints in pavement and walks.
  - 6. Other locations, not included above but, specifically required by manufacturers of installed materials / products (except that sealing materials for glazing are under provision of other Section.).
- C. Accessories: Including, but not limited to, primer, cleaner, backer rod, bond breaker, and masking tape.

1.02 RELATED SECTIONS

- A. Section 01 33 00 – Submittal Procedures and Section 09 05 15 – Color Design.

1.03 DEFINITIONS

- A. Whenever the words "caulk" or "seal" occur, they shall be interpreted to mean "effectively seal the indicated joint with a material to render it air and watertight." "Caulk" shall indicate the use of the interior materials specified hereinafter and "Seal" shall indicate the use of the exterior materials.

1.04 PRECONSTRUCTION TESTING

- A. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates. Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

1.05 WORK OF OTHER SECTIONS

- A. Caulking and sealing may be performed as Work of other Sections when specified. However, all Work shall conform to the requirements of this Section.

1.06 ACTION SUBMITTALS

- A. Product Data: Submit manufacturer's product data and installation instructions for each type of sealant required. Product data shall include chemical characteristics, limitations, and color availability.
- B. Samples: For each kind and color of joint sealant required.
- C. Joint-Sealant Schedule: Include the following information:
  - 1. Joint-sealant application, joint location, and designation.
  - 2. Joint-sealant manufacturer and product name.
  - 3. Joint-sealant formulation.
  - 4. Joint-sealant color.

1.07 INFORMATIONAL SUBMITTALS

- A. Manufacturer's Certificate.
- B. Applicator's experience documentation.
- C. Product test reports.
- D. Preconstruction field-adhesion test reports.
- E. Field-adhesion test reports.
- F. Warranties.

1.08 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.
- B. Manufacturer's Certificate: Provide manufacturer's letter of certification that products meet or exceed specified requirements and are appropriate for uses indicated.
- C. Applicator: Company specializing in the work of this Section with minimum 3 years documented satisfactory experience.
- D. Preinstallation Conference: Conduct conference at Project site.

1.09 DELIVERY, STORAGE AND HANDLING

- A. Deliver caulking and sealant material to the site in original unopened packages with manufacturer's labels, instructions and product identification and lot numbers intact and legible.

- B. Store materials under cover, protected from inclement weather and adverse temperature extremes, in original containers or unopened packages, in accordance with manufacturer's instructions.

1.10 WARRANTY

- A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

- 1. Warranty Period: Two years from date of Completion.

- B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

- 1. Warranty Period: Five years from date of Completion.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Drawings and Specifications are based on products manufactured by Pecora Corporation, 165 Wambold Road, Harleysville, PA 19438. Tel: (800) 523-6688.

- B. Equivalent products by the following manufacturers are acceptable:

- 1. BASF Construction Chemicals, LLC, Building Systems. Shakopee, MN. Tel: (800) 243-6739.
  - 2. Dow Corning Corporation, Midland, MI. Tel: (800) 322-8723.
  - 3. GE Silicones, Waterford, NY. Tel: (518) 233-2639.
  - 4. Tremco, Inc., Beachwood, OH. Tel: (800) 562-2728.

- C. Alternate manufacturers: Products produced by other manufacturers that fully meet or exceed the specified requirements may be considered under provisions of Section 01 25 00-Substitution Procedures and Section 01 60 00-Products Requirements.

2.02 MATERIALS, GENERAL

- A. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

- 1. Architectural Sealants: 250 g/L.
  - 2. Sealant Primers for Nonporous Substrates: 250 g/L.
  - 3. Sealant Primers for Porous Substrates: 775 g/L.

- B. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
  - 1. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.
- C. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- D. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

#### 2.03 SILICONE JOINT SEALANTS

- A. Silicone Joint Sealant: ASTM C 920.

#### 2.04 URETHANE JOINT SEALANTS

- A. Urethane Joint Sealant: ASTM C 920.

#### 2.05 LATEX JOINT SEALANTS

- A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

#### 2.06 PREFORMED JOINT SEALANTS

- A. Preformed Foam Joint Sealant: Manufacturer's standard preformed, precompressed, open-cell foam sealant manufactured from urethane foam with minimum density of 10 lb/cu. ft. and impregnated with a nondrying, water-repellent agent. Factory produce in precompressed sizes in roll or stick form to fit joint widths indicated; coated on one side with a pressure-sensitive adhesive and covered with protective wrapping.

#### 2.07 ACOUSTICAL JOINT SEALANTS

- A. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

#### 2.08 JOINT SEALANT BACKING

- A. Cylindrical Sealant Backings: ASTM C 1330, [Type C (closed-cell material with a surface skin)] [Type O (open-cell material)] [Type B (bicellular material with a surface skin)] [or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated], and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

- B. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer.

## 2.09 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

## PART 3 - EXECUTION

### 3.01 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.
  - 1. Remove laitance and form-release agents from concrete.
  - 2. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

### 3.02 INSTALLATION

- A. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- B. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
  - 1. Do not leave gaps between ends of sealant backings.
  - 2. Do not stretch, twist, puncture, or tear sealant backings.
  - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

- C. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
  - 1. Place sealants so they directly contact and fully wet joint substrates.
  - 2. Completely fill recesses in each joint configuration.
  - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
  - 1. Remove excess sealant from surfaces adjacent to joints.
  - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
  - 3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
- F. Acoustical Sealant Installation: Comply with ASTM C 919 and with manufacturer's written recommendations.
- G. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

### 3.03 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
  - 1. Extent of Testing: Test completed and cured sealant joints as follows:
    - a. Perform 5 tests for the first 500 feet of joint length for each kind of sealant and joint substrate.
    - b. Perform 1 test for each 1000 feet of joint length thereafter or 1 test per each floor per elevation.
  - 2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
- B. Evaluation of Field-Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.04 CURE AND PROTECTION

- A. Cure sealant and caulking compounds in compliance with manufacturer's instructions and recommendations, to obtain high early bond strength, internal cohesive strength and surface durability.
- B. Sealant Supplier / Applicator shall advise Contractor of procedures required for cure and protection of joint sealers during construction period, so that they will be without deterioration or damage (other than normal wear and weathering) at Time of Completion

3.05 JOINT-SEALANT SCHEDULE

- A. Type 1: Use for interior locations, sealing around windows, doors, louvers, drywall and other locations to be painted and where joints are less than 1/8 inch with none to slight movement anticipated: Pecora AC-20 + Silicone (Acrylic Latex Caulking Compound).
- B. Type 2: Use for sealing nonporous interior surfaces where conditions of high humidity and temperature extremes exist, including at and in conjunction with toilet fixtures, counters, vanities, thresholds and joints in tile finishes: Pecora 898 (Silicone Sanitary Sealant).
- C. Type 3: Use for horizontal floor and pavement joints: Pecora Urexpan NR-200 (two-part, self-leveling, traffic-bearing, polyurethane sealant).
- D. Type 4: Use for exterior sealing at door, louver, and window frames at masonry, and other materials: Pecora 890NST (one-part Architectural Silicone Sealant). Color(s) to be selected by the Project Engineer / MDOT Architect from manufacturer's full range of standard Architectural colors.
- E. Type 5: Use for Interior acoustical joints in vertical surfaces and horizontal nontraffic surfaces. Pecora AC – 20 FTR.

END OF SECTION

SECTION 08 11 13

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes hollow-metal work, including but not limited to, the following:
  - 1. Interior and exterior hollow metal doors and frames; rated and non-rated.
  - 2. Trimmed openings.
  - 3. Preparation of metal doors and bucks to receive finish hardware, including reinforcements, drilling and tapping necessary.
  - 4. Preparation of hollow metal door to receive glazing (where required).
  - 5. Factory prime painting of Work in this Section.
  
- B. Related sections:
  - 1. Section 06 10 00 - Rough Carpentry.
  - 2. Section 08 14 00 - Wood Doors.
  - 3. Section 08 71 00 - Door Hardware.
  - 4. Section 08 80 00 - Glazing.
  - 5. Section 09 05 15 - Color Design.
  - 6. Section 09 90 00 - Painting and Coatings.

1.02 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product, including schedule and manufacturer's technical product data / literature.
  
- B. Shop Drawings: Include elevations, door edge details, frame profiles, metal thicknesses, preparations for hardware, glazing, anchor types and spacing, reinforcement, and other details.
  
- C. Samples (not required for named products):
  - 1. Submit hollow metal frame, corner section of typical frame, of sufficient size to show corner joint, hinge reinforcement, dust cover boxes, anchors, and floor anchors.
  - 2. Submit hollow metal door section of typical door, of sufficient size to show edge, top and bottom construction, insulation, hinge reinforcement, face stiffening, corner of vision opening construction, and glazing beads.
  
- D. Schedule: Prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings.



1.04 INFORMATIONAL SUBMITTALS

- A. Product test reports.

1.05 QUALITY ASSURANCE

- A. In addition to complying with all pertinent codes and regulations, manufacture labeled doors in accordance with specifications and procedures of Underwriters' Laboratories, Inc. In guarantee and shop drawings, comply with nomenclature established in American National Standards Institute publication A123.1, latest edition, "Nomenclature for Steel Doors and Steel Door Frames".
- B. Work is subject to applicable portions of the following standards:
  - 1. ANSI A115 "Door and Frame Preparation for Door Locks and Flush Bolts", American National Standards Institute.
  - 2. ANSI A123.1 "Nomenclature for Steel Doors and Steel Door Frames", American National Standards Institute.
  - 3. NFPA 80 "Fire Doors and Windows", National Fire Protection Association.
  - 4. NFPA 101 "Life Safety Code", National Fire Protection Association.
- C. Hollow metal doors and frames shall comply with the specifications for Custom Hollow Metal Doors and Frames, National Assoc. of Architectural Metal Manufacturers (NAAMM) Standard CHM 1-74, and the Steel Door Institute, SDI 100-80.

1.06 PRODUCT IDENTIFICATION

- A. Deliver doors and frames and other work of this section properly tagged and identified.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and handle all metal doors and frames in a manner to prevent damage and deterioration.
- B. Provide packaging, separators, banding, spreaders, and individual wrappings as required to completely protect all metal doors and frames during transportation and storage.
- C. Store doors upright, in a protected dry area, at least 4 inches off the ground and with at least 1/4 inch air space between individual pieces, protect all pre-finished and hardware surfaces.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Drawings and Specifications are based on products manufactured by Steelcraft Manufacturing Company, 9017 Blue Ash Road, Cincinnati, OH 45242 Tel. (513) 745-6400.

- B. Equivalent products by the following manufacturers are acceptable:
1. Amweld Building Products, Inc., Garrettsville, OH. Tel. (330) 527-4385.
  2. Ceco Door Products, Brentwood, TN. Tel. (615) 661-5030.
  3. Curries Co., Mason City, IA. Tel. (641) 423-1334.
  4. Republic Builders Products, McKenzie, TN. Tel. (901) 352-3383.
- C. Substitutions shall fully comply with specified requirements and Section 01 25 00-Substitution Procedures and Section 01 60 00-Product Requirements.

## 2.02 REGULATORY REQUIREMENTS

- A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings[ indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.
- B. Fire-Rated, Borrowed-Light Assemblies: Complying with NFPA 80 and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

## 2.03 FABRICATION

- A. Fabricate hollow metal units rigid, neat in appearance and free from defects, warp or buckle. Accurately form metal to required sizes and profiles. Weld exposed joints continuously, grind, dress, and make smooth, flush and invisible. Metallic filler to conceal manufacturing defects is not acceptable. Unless otherwise indicated, provide countersunk flat Philips or Jackson heads for exposed screws and bolts.
- B. Prepare hollow metal units to receive finish hardware, including cutouts, reinforcing, drilling and tapping per final Finish Hardware Schedule and templates provided by hardware supplier. Comply with applicable requirements of ANSI A115 "Specifications for Door and Frame Preparation for Hardware".
- C. Locate finish hardware in accordance with approved shop drawings.

## 2.04 FRAMES

- A. Frames Types:
1. Exterior Openings: Frames shall be made of commercial grade 14 gage minimum cold rolled steel conforming to ASTM A366-68 with a zinc coating conforming to ASTM A653, with a coating designation of A60 or G60 and a minimum coating thickness of 0.60 oz. per sq. ft. minimum.
  2. Interior Openings: Frames shall be commercial grade cold rolled steel conforming to ASTM A366-68 or commercial grade hot rolled and pickled steel conforming to ASTM A569-66T. Metal thickness shall be 16 gage for frames in openings 4 feet or less in width; 14 gage for frames in openings over 4 feet in width.

- B. Design and Construction: Frames shall be custom made welded units with integral trim, of the sizes and shapes shown on approved shop drawings. Knocked-down frames WILL NOT be accepted. Finished work shall be strong, rigid, and neat in appearance, square, true and free of defects, warp or buckle. Molded members shall be clean cut, straight and of uniform profile throughout their lengths. Jamb depths, trim, profile and backbends shall be as shown on Drawings. Corner joints shall have contact edges closed tight, with trim faces mitered and continuously welded, and stops mitered. The use of gussets will not be permitted.
1. Stops shall be 5/8 inch deep. Cut-off (sanitary or hospital type) stops, where scheduled, shall be capped at 45 degrees at heights shown on Drawings, and all jamb joints below cut-off stops shall be ground and filed smooth, making them imperceptible. Do not cut off stops on frames for soundproof, lightproof on lead-lined doors.
  2. When shipping limitations so dictate, frames for large openings shall be designed and fabricated for field splicing by others.
  3. Frames for multiple or special openings shall have mullion and / or rail members which are closed tubular shapes having no visible seams or joints. All joints between faces of abutting members shall be securely welded and finished smooth.
  4. Hardware reinforcements: Frames shall be mortised, reinforced, drilled and tapped at the factory for fully templated mortised hardware only, in accordance with approved hardware schedule and templates provided by the hardware supplier. Where surface-mounted hardware is to be applied, frames shall have reinforcing plates. Frames shall be reinforced for closers. Minimum thickness of hardware reinforcing plates shall be as follows:
    - a. Hinge and pivot reinforcements - 7 gage, 1-1/4 inch by 10 inches minimum.
    - b. Strike reinforcements - 12 gage.
    - c. Flush bolt reinforcements - 12 gage.
    - d. Closer reinforcements - 12 gage.
    - e. Reinforcements for surface-mounted hardware - 12 gage.
  5. Floor anchors: Floor anchors shall be securely welded inside jambs for floor anchorage. Where required, provide adjustable floor anchors, providing not less than 2 inches height adjustment. Floor anchors shall be 14-gage minimum.
- C. Finish: After fabrication, tool marks and surface imperfections shall be removed, and exposed faces of welded joints shall be dressed smooth. Frames shall be chemically treated to insure maximum paint adhesion and coated on accessible surfaces with rust-inhibitive primer complying with FS-TT-P-57 (Type II) or FS-TT-P-659 with 2.0 mils minimum thickness. Fully cure before shipment.

## 2.05 HOLLOW METAL DOORS

- A. General: Doors shall be made of commercially quality, level, cold rolled steel conforming to ASTM A366-68 and free of scale, pitting or other surface defects.
- B. Face Sheets:
1. Exterior Doors: Shall be 16-gage minimum with zinc coating conforming to ASTM A653, with a coating designation of A60 or G60 and a minimum coating thickness of 0.60 oz. per sq. ft. minimum.
  2. Interior Doors: Shall be 18 gage minimum.

- C. Design and Construction: Doors shall be custom made, of the types and sizes shown on the approved shop drawings, and shall be fully welded seamless construction with no visible seams or joints on their faces or vertical edges. Door thickness shall be 1-3/4 inches unless otherwise noted. Doors shall be strong, rigid and neat in appearance, free from warp or buckle. Corner bends shall be true, straight and of minimum radius for the gage of metal used.
- D. Face Sheet Stiffeners: Stiffen with continuous vertical formed steel sections spanning the full thickness of the interior space between door faces. These stiffeners shall be 22 gage minimum, spaced 6 inches apart and securely attached to face sheets by spot welds 5 inches on center. Spaces between stiffeners shall be sound-deadened insulated full height of door with an inorganic non-combustible batt-type material.
- E. Welding: Join door faces at their vertical edges by a continuous weld extending full height of door. Welds shall be ground, filled and dressed smooth to make them invisible and provide a smooth flush surface.
- F. Top and Bottom Edges: Edges of doors shall be closed with a continuous recessed 16 gage minimum steel channel, extending the full width of the door and spot welded to both faces. Exterior doors shall have additional flush closing channel at top edges and, where required for attachment of weather-stripping, a flush closure at bottom edges. Provide openings in bottom closure of exterior doors to permit escape of entrapped moisture.
- G. Edge Profile: Shall be provided on both vertical edges of doors as follows:
1. Single-acting swing doors - beveled 1/8 inch in 2 inches.
  2. Double-acting swing doors - rounded on 2-1/8 inch radius.
- H. Hardware Reinforcements: Doors shall be mortised, reinforced, drilled and tapped at the factory for fully templated hardware only, in accord with the approved hardware schedule and templates provided by the hardware supplier. Where surface-mounted hardware (or hardware, the interrelation of which is to be adjusted upon installation - such as top and bottom pivots, floor closures, etc.) is to be applied, doors shall have reinforcing plates. Minimum gages for hardware reinforcing plates shall be as follows:
1. Hinge and pivot reinforcement - 7 gage.
  2. Reinforcement for lock face, flush bolts, concealed holders, concealed or surface-mounted closers - 12 gage.
  3. Reinforcement for all other surface mounted hardware - 16 gage.
- I. Glass Moldings and Stops:
1. Where specified or scheduled, doors shall be provided with hollow metal moldings to secure glazing by others per glass opening sizes shown on Drawings. Fixed moldings shall be securely welded to door on security side.
  2. Loose stops shall be 20-gage steel, with mitered corner joints, secured to the framed opening by cadmium or zinc-coated countersunk screws spaced 8 inches on center. Snap-On attachments will not be permitted. Stops shall be flush with face of door.

- J. Finish: After fabrication, tool marks and surface imperfections shall be dressed, filled and sanded as required to make all faces and vertical edges smooth, level and free of all irregularities. Doors shall be chemically treated to ensure maximum paint adhesion and shall be coated, on all exposed surfaces, with manufacturer's standard rust-inhibitive primer. Fully cure before shipment.
- K. Flatness: Doors shall maintain a flatness tolerance of 1/16 inch maximum in any direction, including a diagonal direction.

## 2.06 LABELED DOORS & FRAMES

- A. Labeled doors and frames shall be provided for those openings requiring fire protection ratings, and as scheduled on Drawings. Such doors and frames shall be Underwriters' Laboratories, Inc. labeled or other nationally recognized agency having a factory inspection service.
- B. When door or frame specified to be fire-rated cannot qualify for appropriate labeling because of its design, size, hardware or any other reason, the Project Engineer / Architect shall be advised before fabricating work on that item is started.

## 2.07 FABRICATION

- A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Hollow-Metal Doors:
  - 1. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
  - 2. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated.
- C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
  - 1. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
  - 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
  - 3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
  - 4. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.

5. Jamb Anchors: Provide number and spacing of anchors as follows:
    - a. Masonry Type: Locate anchors not more than 16 inches from top and bottom of frame. Space anchors not more than 32 inches o.c., to match coursing, and as follows:
      - 1) Two anchors per jamb up to 60 inches high.
      - 2) Three anchors per jamb from 60 to 90 inches high.
      - 3) Four anchors per jamb from 90 to 120 inches high.
      - 4) Four anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
    - b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches on center and as follows:
      - 1) Three anchors per jamb up to 60 inches high.
      - 2) Four anchors per jamb from 60 to 90 inches high.
      - 3) Five anchors per jamb from 90 to 96 inches high.
      - 4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
    - c. Compression Type: Not less than two anchors in each frame.
    - d. Post installed Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches on center.
  6. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers.
    - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
    - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- D. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
  2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.
- E. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with mitered hairline joints.
1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.
  2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
  3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
  4. Provide loose stops and moldings on inside of hollow-metal work.
  5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

## 2.08 HARDWARE LOCATIONS

### A. Hinges:

1. Top: 9-3/4 inches from head of frame to centerline of top hinge.
2. Bottom: 10-3/8 inches from bottom of frame to centerline of bottom hinge.
3. Intermediate centered between top and bottom hinges on Dutch Doors:
  - a. 9-3/4 inches from head of frame to centerline of hinge.
  - b. 10-3/8 inches from bottom of frame to centerline of bottom hinge.
  - c. 5 inches from split line to top and bottom respectively of lower and upper intermediate hinges.

### B. Locks and Latches:

1. Unit and integral type locks and latches – 3'- 2" to centerline of knob.
2. Deadlocks - 5'- 0" to centerline of cross bar.
3. Roller latches - 3'-9" to centerline.

### C. Panic hardware – 3'-1" to centerline of cross bar.

### D. Pulls and Push Plates:

1. Door pulls – 3'-6" to center of grip.
2. Push-pull bars – 3'-1" to centerline of bar.
3. Arm pulls – 3'-11" to centerline.
4. Push plates – 4'- 0" to centerline of plate.

### E. All of the above dimensions from paragraph 2.08(B) through 2.08(D) are from finished floor and shall comply with ADA and AHJ requirements.

## 2.09 STEEL FINISHES

### A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: SDI A250.10.

## 2.10 CLEARANCES

### A. Edge Clearances:

1. Between doors and frame, at head and jambs - 1/8 inch.
2. Door Sills: where no threshold is used - 1/4 inch maximum above finished floor; where threshold is used - 3/4 inch maximum above finished floor.
3. Between meeting edges of pairs of doors - 1/8 inch.

### B. Finished floor is defined as top surface of floor, except when resilient tile or carpet is used, when it is top of concrete slab. Where carpet is more than 1/2 inch thick, allow 1/4 inch clearance.

## 2.11 PREPARATION FOR FINISH HARDWARE

- A. Hardware supplier shall furnish hollow metal manufacturer approved hardware schedule, hardware templates, and samples of physical hardware where necessary to ensure correct fitting and installation. Include preparation for mortise and concealed hardware.
- B. Provide reinforcements for both concealed and surface applied hardware. Drill and tap mortise reinforcements at factory, using templates. Install reinforcements with concealed connections designed to develop full strength of reinforcements.

## 2.12 REJECTION

- A. Hollow metal frames or doors which are defective, have hardware cutouts of improper size or location, or which prevent proper installation of doors, hardware or work of other trades, shall be removed. Replace rejected materials.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Hollow-Metal Frames: Install hollow-metal frames of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.
  - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
    - a. At fire-rated openings, install frames according to NFPA 80.
    - b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
    - c. Install frames with removable stops located on secure side of opening.
    - d. Install door silencers in frames before grouting.
    - e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
    - f. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
    - g. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.
  - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
    - a. Floor anchors may be set with power-actuated fasteners instead of post-installed expansion anchors if so indicated and approved on shop drawings.
  - 3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
  - 4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
  - 5. Concrete Walls: Solidly fill space between frames and concrete with mineral-fiber insulation.



6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
  7. In-Place Metal or Wood-Stud Partitions: Secure slip-on drywall frames in place according to manufacturer's written instructions.
  8. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
    - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
    - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
- B. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
1. Non-Fire-Rated Steel Doors:
    - a. Between Door and Frame Jambs and Head: 1/8 inch plus or minus 1/32 inch.
    - b. Between Edges of Pairs of Doors: 1/8 inch to 1/4 inch plus or minus 1/32 inch.
    - c. At Bottom of Door:
      - 1) 1/4 inch, where no threshold or carpet.
      - 2) 1/8 inch, where with threshold or carpet.
    - d. Between Door Face and Stop: 1/16 inch to 1/8 inch plus or minus 1/32 inch.
  2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
  3. Smoke-Control Doors: Install doors and gaskets according to NFPA 105.
- C. Glazing: Comply with installation requirements in Section 08 80 00 "Glazing" and with hollow-metal manufacturer's written instructions.
1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

3.02 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow-metal work immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.
- E. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION

SECTION 08 14 29

PREFINISHED WOOD DOORS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Extent and location of each type of wood door is shown on the Drawings and in Schedules. Types of doors required include solid core flush wood doors with veneer faces. Louvers for wood doors, including furnishing and installation, are specified under this Section.
- B. Related Requirements:
  - 1. Section 08 71 00 "Door Hardware" for installation.
  - 2. Section 08 80 00 "Glazing" for glass view panels in flush wood doors.
  - 3. Section 09 05 15 "Color Design" for colors.

1.02 ACTION SUBMITTALS

- A. Product Data: Indicate door core material and construction; veneer species, type and characteristics. Include factory-finishing specifications.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:
  - 1. Dimensions and locations of blocking.
  - 2. Dimensions and locations of mortises and holes for hardware.
  - 3. Dimensions and locations of cutouts.
  - 4. Undercuts.
  - 5. Requirements for veneer matching.
  - 6. Doors to be factory finished and finish requirements.
  - 7. Fire-protection ratings for fire-rated doors.
  - 8. Indicate by transmittal form that copy of each instruction has been transmitted to the installer.
- C. Samples: For factory-finished doors.

1.03 INFORMATIONAL SUBMITTALS

- A. Manufacturer's sample warranty.

1.04 QUALITY ASSURANCE

- A. Comply with the requirements of the following standards unless otherwise indicated:
  - 1. Non-Fire Rated Wood Doors: WDMA I.S.1-A, "Architectural Wood Flush Doors."

## 1.05 DELIVERY, STORAGE AND HANDLING

- A. Protect wood doors during transit, storage and handling to prevent damage, soiling and deterioration. Comply with the on-site care recommendations of AWI "Care & Instruction at Job Site" Section 1300, G-22.

## 1.06 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
    - b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
  - 2. Warranty Period for Solid-Core Interior Doors: Life of installation.

## PART 2 - PRODUCTS

## 2.01 ACCEPTABLE MANUFACTURERS

- A. Drawings and Specifications are based on products manufactured by Graham Manufacturing Corp., P.O. Box 1647, Mason City, IA. Tel. (641) 423-2444.
- B. Equivalent products by the following manufacturers are acceptable:
  - 1. Jeld-Wen Windows and Doors, Klamath Falls, OR. Tel. (541) 885-7412.
  - 2. Marshfield Door Systems, Inc., Marshfield, WI. Tel. (800) 869-3667.
  - 3. TruStile Doors, LLC, Denver, CO. Tel. (888) 286-3931.
  - 4. VT Industries, Inc., Holstein, IA. Tel. (800) 827-1615.
- C. Alternate manufacturers: Products produced by other manufacturers that fully meet or exceed the specified requirements may be considered under provisions of Section 01 25 00 - Substitution Procedures and Section 01 60 00 - Product Requirements.

## 2.02 DOOR CONSTRUCTION, GENERAL

- A. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.
- B. Particleboard-Core Doors:
  - 1. Provide Particleboard: ANSI A208.1, Grade LD-1 or Grade LD-2, made with binder containing no urea-formaldehyde resin.
  - 2. Blocking Provide wood blocking in particleboard-core doors as follows:
    - a. 5-inch top-rail blocking, in doors indicated to have closers.
    - b. 5-inch bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.
  - 3. Provide doors with either glued-wood-stave or better than stave cores instead of particleboard cores for doors indicated to receive exit devices.

## C. Structural- Composite-Lumber-Core Doors:

1. Structural- Composite-Lumber: WDMA I.S.10.
  - a. Screw Withdrawal, Face: 700 lbf.
  - b. Screw Withdrawal, Edge: 400 lbf.

## D. Low-Emitting Materials: Fabricate doors with adhesives and composite wood products that do not contain urea formaldehyde.

## 2.03 VENEER-FACED DOORS FOR TRANSPARENT FINISH

## A. Interior Solid-Core Doors:

1. Grade: Premium, with Grade A faces.
2. Species: SELECT white birch.
3. Cut: Plain sliced (flat sliced).
4. Doors with sharp contrast of shades and/or barber poling SHALL NOT be permitted and will be REJECTED. Provide exposed edges and other exposed solid wood components of same species as face veneers.
5. Match between Veneer Leaves: Slip match.
6. Assembly of Veneer Leaves on Door Faces: Center-balance match.
7. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
8. Room Match: Match door faces within each separate room or area of building. Corridor-door faces do not need to match where they are separated by 20 feet or more.
  - a. Provide door faces of compatible color and grain within each separate room or area of building.
9. Transom Match: Continuous match.
10. Exposed Vertical Edges: Same species as faces or a compatible species.
11. Core Non-rated: Particleboard.
12. Construction: Five plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering.

## B. Light Openings: Factory cut openings. Trim openings for non-fire rated doors with solid wood moldings of manufacturer's standard shape, unless indicated otherwise. Same species as door faces.

## 2.04 FABRICATION

## A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

## B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.

1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
2. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

- C. Transom and Side Panels: Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles.
  - 1. Fabricate door and transom panels with full-width, solid-lumber, rabbeted, meeting rails. Provide factory-installed spring bolts for concealed attachment into jambs of metal door frames.
- D. Openings: Factory cut and trim openings through doors.
  - 1. Light Openings: Trim openings with moldings of material and profile indicated.
  - 2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 08 80 00 "Glazing."

2.05 FACTORY FINISHING

- A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing. Finish faces, all four edges, edges of cutouts, and mortises.
- B. Transparent Finish:
  - 1. Grade: Premium.
  - 2. Finish: WDMA TR-4 conversion varnish or WDMA TR-6 catalyzed polyurethane.
  - 3. Staining: As selected by Architect from manufacturer's full range.
  - 4. Sheen: Gloss, unless indicated otherwise.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Installer: Examine doorframes and verify that frames are correct type and have been installed for proper hanging of corresponding doors. Installer shall notify Contractor in writing of conditions detrimental to proper and timely installation of wood doors; do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Condition doors to average prevailing humidity in installation area prior to hanging.

3.03 INSTALLATION

- A. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
  - 1. Install draft-control doors according to NFPA 105.

- B. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
  - 1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold unless otherwise indicated.
- C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.04 ADJUSTING AND CLEANING

- A. Re-hang or replace doors that do not swing or operate freely. Refinish or replace doors damaged during installation.

3.05 PROTECTION OF COMPLETED WORK

- A. Installer shall advise Contractor of proper procedures required for protection of installed wood doors from damage or deterioration until acceptance of the Work.
- B. Doors damaged before acceptance of the Work shall be repaired or replaced.

END OF SECTION

SECTION 08 31 13 ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes access doors and frames for walls and ceilings.
- B. Related Sections include the following:
  - 1. Division 04 Section "Unit Masonry" for anchoring and grouting access door frames set in masonry construction.
  - 2. Division 08 Section "Door Hardware" for mortise or rim cylinder locks and master keying.
  - 3. Division 09 Section "Gypsum Board" for gypsum board ceilings.
  - 4. Division 23 Section "Duct Accessories" for heating and air-conditioning duct access doors.
- C. References:
  - 1. ITS (DIR) – Directory of Listed Products, Intertek Testing Services NA, Inc. current edition.
  - 2. UL (FRD) – Fire Resistance Directory; Underwriters Laboratories Inc; current edition.
  - 3. Warnock Hersey – Certification Listing.

1.02 COORDINATION

- A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed plumbing, mechanical, or other concealed work, and indicate in the schedule specified in "Submittals" Article.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of access door and frame indicated. Include construction details, fire ratings, materials, individual components and profiles, and finishes.
- B. Shop Drawings: Show fabrication and installation details of access doors and frames for each type of substrate. Include plans, elevations, sections, details, and attachments to other work. .
- C. Samples: For each door face material, at least 3 by 5 inches in size, in specified finish.
- D. Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.



- E. Ceiling Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted items including access doors and frames, lighting fixtures, diffusers, grilles, speakers, sprinklers, and special trim are shown and coordinated with each other.

#### 1.04 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of access door(s) and frame(s) through one source from a single manufacturer.
- B. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

### PART 2 - PRODUCTS

#### 2.01 STEEL MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
  - 1. ASTM A 123/A 123M, for galvanizing steel and iron products.
  - 2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.
- B. Steel Sheet: Electrolytic zinc-coated, ASTM A 591/A 591M with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.
- C. Steel Finishes: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
  - 1. Surface Preparation for Steel Sheet: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
  - 2. Surface Preparation for Metallic-Coated Steel Sheet: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.
    - a. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
  - 3. Factory-Primed Finish: Apply shop primer immediately after cleaning and pretreating.
- D. Drywall Beads: Edge trim formed from 0.0299-inch zinc-coated steel sheet formed to receive joint compound and in size to suit thickness of gypsum board.

## 2.02 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Babcock-Davis; A Cierra Products Co., Minneapolis, MN. Tel. (888) 412-3726.
  2. J. L. Industries, Inc., Bloomington, MN. Tel. (800) 554-6077.
  3. Larsen's Manufacturing Company, Minneapolis, MN. Tel. (800) 527-7367.
  4. Milcor Inc., Lima, OH. Tel. (800) 528-1411.
- B. Source Limitations: Obtain each type of access door and frame from single source from single manufacturer.
- C. Flush Access Doors and Frames with Exposed Trim: Fabricated from metallic-coated steel sheet.
1. Locations: Wall surfaces.
  2. Door: Minimum 0.060-inch thick sheet metal, set flush with exposed face flange of frame.
  3. Frame: Minimum 0.060-inch thick sheet metal with 1-inch wide, surface-mounted trim.
  4. Hinges: Continuous piano.
  5. Latch: Self-latching bolt operated by screwdriver with interior release.
  6. Lock: Mortise cylinder.
    - a. Lock Preparation: Prepare door panel to accept cylinder specified in Division 8 Section "Door Hardware (Scheduled by Describing Products)."
- D. Flush Access Doors and Trimless Frames: Fabricated from steel sheet.
1. Locations: Wall and ceiling surfaces.
  2. Door: Minimum 0.060-inch- thick sheet metal, set flush with surrounding finish surfaces.
  3. Frame: Minimum 0.060-inch- thick sheet metal with drywall bead flange.
  4. Hinges: Continuous piano.
  5. Latch: Self-latching bolt operated by screwdriver with interior release.
  6. Lock: Mortise cylinder.
    - a. Lock Preparation: Prepare door panel to accept cylinder specified in Division 8 Section "Door Hardware (Scheduled by Describing Products)."
- E. Exterior Flush Access Doors and Frames with Exposed Trim: Weatherproof with extruded door gasket.
1. Locations: Wall surfaces.
  2. Door: Minimum 0.040-inch- thick, metallic-coated steel sheet; flush panel construction with manufacturer's standard 2-inch- thick fiberglass insulation.
  3. Frame: Minimum 0.060-inch- thick extruded aluminum.
  4. Hinges: Continuous piano, zinc plated.
  5. Lock: Dual-action handles with key lock.

2.03 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access doors to types of supports indicated.
  - 1. Exposed Flanges: Nominal 1 to 1-1/2 inches wide around perimeter of frame.
  - 2. For trimless frames with drywall bead, provide edge trim for gypsum board securely attached to perimeter of frames.
  - 3. Provide mounting holes in frames for attachment of units to metal or wood framing.
  - 4. Provide mounting holes in frame for attachment of masonry anchors. Furnish adjustable metal masonry anchors.
- D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed. For cylinder lock, furnish two keys per lock and key all locks alike.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.
- B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.
- C. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.02 ADJUSTING

- A. Adjust doors and hardware, after installation, for proper operation.
- B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION

SECTION 08 33 23 OVERHEAD COILING DOORS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes: Extent of overhead coiling doors is shown on the Drawings. Provide complete operating door assemblies including door curtains, guides, and counterbalance mechanism, hardware, operators and installation accessories.
- B. Related Section:
  - 1. Section 05 50 00 "Metal Fabrications" for miscellaneous steel supports
  - 2. Division 09 Section -09 05 15 - Color Design.
  - 3. Division 26 Sections for electrical connections and service for powered door operators.

1.02 REFERENCES

- A. General: Standards listed by reference, including revisions by issuing authority, form a part of this specification section to the extent indicated. Standards listed are identified by issuing authority, authority abbreviation, designation number, title or other designation established by issuing authority. Standards subsequently referenced herein are referred to by issuing authority abbreviation and standard designation.
- B. American Society for Testing and Materials: ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

1.03 PERFORMANCE REQUIREMENTS

- A. Structural Performance, Exterior Doors: Exterior overhead coiling doors shall withstand the wind loads, the effects of gravity loads, and loads and stresses within limits and under conditions indicated according to SEI/ASCE 7.
  - 1. Wind Loads: Uniform pressure (velocity pressure) of 20 lbf/sq. ft. (87 MPH) acting inward and outward in the fully closed position unless otherwise indicated or required by local AHJ.

1.04 ACTION SUBMITTALS

- A. Product Data: Submit manufacturer's product data and installation instructions.
- B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data. 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.

2. Wiring Diagrams: For power, signal, and control wiring.

C. Samples: For each exposed product and for each color and texture specified.

1.05 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For overhead coiling doors, accessories, and components, from manufacturer.

1.06 CLOSEOUT SUBMITTALS

A. Maintenance Data.

B. Warranty Documents.

1.07 QUALITY ASSURANCE

A. Installer Qualifications: Utilize an installer having demonstrated experience on projects of similar size and complexity, and trained and authorized by the door dealer to perform the work of this Section.

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. Regulatory Requirements and Approvals: Comply with IBC 2012 and AHJ requirements.

D. Pre-installation Meeting: Verify project requirements, substrate conditions, manufacturer's installation instructions and manufacturer's warranty requirements. Comply with Division 01 Project Management and Coordination (Project Meetings) Section

1.08 DELIVERY, STORAGE, AND HANDLING

A. General: Comply with Division 01 Product Requirements.

B. Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.

C. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

D. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.

1.09 WARRANTY

- A. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.

1.10 MAINTENANCE

- A. Maintenance Service: Submit for Owner's consideration and acceptance maintenance service agreement for products installed.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Drawings and Specifications are based on products manufactured by Raynor Garage Doors, P.O. Box 448, Dixon, IL 61021. Tel. (800) 472-9667.
- B. Equivalent products by the following manufacturers are acceptable:
  - 1. Overhead Door Corp., Dallas, TX. Tel. (800) 887-3667.
  - 2. Windsor Door, Little Rock, AR. Tel. (800) 946-3767.
- C. Substitutions shall fully comply with specified requirements and Section 01 25 00 - Substitution Procedures and Section 01 60 00 - Product Requirements.

2.02 COILING DOOR

- A. Steel door assembly shall be provided as one complete unit including, but not limited to, sections, brackets, tracks, counterbalance mechanisms and hardware. Equal to DURACOIL STANDARD by Raynor Garage Doors.

2.03 DOOR OPERATORS

- A. Provide doors designed for electric motor operation.
- B. Operators shall comply with UL 325 standards.
- C. Manufacturer Product Designation: Raynor ControlHoist Standard (Model Series CHS).
  - 1. Type: Jackshaft with manual chain hoist.
  - 2. Motor: Horsepower Rating: Continuous Duty-sized by manufacturer's recommendation.
  - 3. Electric Requirements: 115 volt single phase.
  - 4. Duty Cycle: 30 cycles / hour.

5. Control Wiring: Contractor Style Motor starter 24 volt control with provisions for connection of safety edge to reverse and external radio control hook-up. Three button momentary contact "open-close-stop" Solid State motor controller 24 volt control with provisions to select up to 6 standard wiring types plus delay on reverse, mid stop, maximum run timer, and door lock feature

D. Sensing Edge Protection: "Monitored electric safety edges" to reverse.

1. Verify mounting height with Project Engineer / MDOT Architect.

## 2.04 CURTAIN

A. Material: Interlocking steel slats, 22 gage (0.030 inch minimum thickness) roll-formed from commercial quality hot-dipped galvanized (G-90) steel in compliance with ASTM A-653.

1. Slat Type: Flat Slat.
  - a. Insulation: Polyisocyanurate with R-value 6.24 and U-value 0.160.
  - b. Back Covers: Galvanized steel, 24 gage (0.023 inch) minimum thickness.

B. Mounting: Face Mounting: fasten to face of wall on each side of door opening, unless indicated otherwise on Drawings.

C. Color and Finish: One finish coat of ArmorBrite™ Powdercoat applied over one coat of white epoxy primer. Color as selected by MDOT Architect from manufacturer's full selection of standard colors.

D. End-locks: Lateral movement of the slats to be contained by means of zinc-plated malleable end-locks fastened with two zinc-plated steel rivets.

E. Bottom Bar and Seal: Two roll-formed galvanized steel angles, minimum 1-1/2 inches by 1-1/2 inches by 1/8 inch with single-contact type bottom astragal. Structural angle bottom bar to receive one coat of rust-inhibitive primer.

F. Curtain Wear Straps: Polyester.

## 2.05 GUIDES

A. Guide Assemblies: To consist of three structural steel angles, minimum 3 inches by 2 inches by 3/16 inch and fitted with removable curtain stops. Steel guides to be provided with one coat of rust-inhibitive primer.

B. Jamb Construction: Steel Jambs with self-tapping fasteners.

C. Weather Seal: Snap-on vinyl seal.

## 2.06 COUNTERBALANCE SYSTEM

A. Head-plates: 3/16 inch steel plate, attached to wall angle of guide assembly with 1/2 inch diameter class 5 case hardened bolts. Inside of drive bracket fitted with sealed ball bearing. Provide head plates with one coat of rust-inhibitive primer

- B. Barrel: Minimum 4-1/2 inches O.D. and 0.120 inch wall thickness structural steel pipe. Deflection of pipe under full load shall not exceed 0.03 inch per foot of span.
- C. Counterbalance: Provide torsion counterbalance mechanism as follows: Torsion Spring: Oil-tempered, helical torsion springs, grease packed and mounted on a continuous steel torsion shaft.

2.07 ENCLOSURES

- A. Round Hood: 24 gauge steel, finish-painted to match curtain.
- B. Hood Baffle: With EPDM rubber seal to inhibit air infiltration through hood cavity.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Site Verification of Conditions: Verify through direct observation and field measurement that site conditions are acceptable for installation of doors, operators, controls and accessories. Ensure that openings square, flush and plumb.
  - 1. Do not proceed with installation of doors, operators, controls and accessories until unacceptable conditions are corrected.

3.02 INSTALLATION

- A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
- B. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion. Lubricate bearings and sliding parts as recommended by manufacturer. Adjust seals to provide weathertight fit around entire perimeter.

3.03 CLEANING

- A. Remove temporary coverings and protection of adjacent work areas. Repair or replace installed products damaged prior to or during installation.
- B. Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance. Remove and legally dispose of construction debris from project site.

3.04 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION



SECTION 08 51 14

ALUMINUM WINDOWS-HOPPER

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Aluminum windows required include fixed and operable (project in top-hopper) exterior window units complete with hardware and related components.
- B. Related Sections:
  - 1. Section 08 80 00 – Glazing for glazing requirements of aluminum windows, including windows specified herein shall be factory pre-glazed.
  - 2. Section 09 05 15 – Color Design.

1.02 ACTION SUBMITTALS

- A. Product Data: Submit manufacturer's sample warranty, specifications, standard details, and installation recommendations for components of aluminum window units required for project, including independent laboratory certified test reports that products tested comply with performances requirements.
- B. Shop Drawings: Submit shop drawings for fabrication and installation of aluminum windows, including unit elevations, full-or half-scale detail sections of typical composite members. Show anchorage locations and other components not included in manufacturer's standard data. Indicate type glazing, screening and window finish being supplied.
- C. Samples:
  - 1. Two samples of each required aluminum finish, on a three-inch long section of an extruded shape or flat aluminum sheet.
  - 2. Additional samples, if required and as directed by the Project Engineer / MDOT Architect, to show fabrication techniques, workmanship of component parts and design of hardware and other exposed auxiliary items.
- D. Product Schedule: For aluminum windows. Use same designations indicated on Drawings.

1.03 INFORMATIONAL SUBMITTALS

- A. Product test reports.
- B. Sample warranties.

1.04 QUALITY ASSURANCE

- A. Except as otherwise indicated, requirements for aluminum windows, terminology, tolerances, standards of performance, and fabrication workmanship are those specified and recommended in AAMA/NWWDA 101/I.S. 2-97 and applicable general recommendations published by AAMA and AA.
- B. Manufacturer: Provide aluminum window units and framing system produced by a single firm with minimum 5 years successful experience in fabricating types required for this Project.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store and handle windows, mullions, panels, hardware and all appurtenant items in strict compliance with the manufacturer's instructions.
- B. Protect windows and all accessory materials adequately against damage from the elements, construction activities and other hazards before, during and after installation.

1.06 SPECIAL PROJECT WARRANTY

- A. Provide written warranty signed by Manufacturer, Installer, and Contractor, agreeing to replace aluminum windows which fail in materials or workmanship within 3 years of acceptance.
  - 1. Failure of materials or workmanship includes excessive leakage or air infiltration, excessive deflections, faulty operation of sashes, deterioration of finish or construction in excess of normal weathering, and defects in hardware, weather-stripping, and other components of the Work.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Drawings and Specifications are based on Peerless 1911 and 1921 Series as manufactured by Peerless Products, Inc., P.O. Box 431, Fort Scott, KS 66701, Tel. (866) 420-4000.
- B. Equivalent products by the following manufacturers are acceptable:
  - 1. All Seasons Commercial, Bryan, TX. Tel. (800) 444-1444.
  - 2. Winco Window Company, Saint Louis, MO. Tel. (800) 525-8089.
- C. Substitutions shall fully comply with specified requirements and Section 01 25 00 - Substitution Procedures and Section 01 60 00 - Product Requirements.

2.02 WINDOW PERFORMANCE REQUIREMENTS

- A. Product Standard: AAMA/WDMA/CSA 101/I.S.2/A440.
  - 1. Minimum Performance Class: AP-AW
  - 2. Minimum Performance Grade: 100
- B. Performance and Testing:
  - 1. Except as otherwise indicated, comply with air infiltration tests, water resistance tests and applicable load tests in AAMA/WDMA/CSA 101/I.S.2/A440-05 and AAMA 910-93 for type and classification of window units required in each case.
  - 2. Where manufacturer's standard window units comply with requirements and have been tested in accordance with specified tests, provide certification by manufacturer showing compliance with such tests.
- C. Uniform Load Structural Test:
  - 1. With vents closed and locked, test unit in accordance with ASTM E 330 at a positive and negative static air pressure difference of 150 psf.
  - 2. There shall be no glass breakage, permanent damage to fasteners, hardware parts, support arms or actuating mechanisms or any other damage that would cause the window to be inoperable
  - 3. There shall be no permanent deformation of any main frame, vent, panel or vent member in excess of L/175 of its span.
- D. Air Infiltration Test:
  - 1. With vents in a closed and locked position, the window shall be subjected to an air infiltration test in accordance with ASTM E 283 at a static air pressure difference of 6.24 psf.
  - 2. Air infiltration shall not exceed 0.3 cubic feet per minute, per square foot of window area.
- E. Water Resistance Test: No water shall pass the interior face of the window frame and there shall be no leakage as defined in tests methods ASTM E 331 and ASTM E547 at a static air pressure difference of 12.0 psf.
- F. Forced Entry Resistance Test: With vents closed and locked, test unit in accordance with AAMA 1302.5-76. Locks shall provide reasonable security against forced entry.
- G. Field Measurement:
  - 1. Wherever possible, take field measurements prior to preparation of shop drawings and fabrication, to ensure proper fitting of work.
  - 2. However, proceed with fabrication and coordinate installation tolerances as necessary when field measurements might delay the Work.

## 2.03 ALUMINUM WINDOW MATERIALS AND ACCESSORIES

## A. Aluminum Members:

1. Extruded Aluminum Sections: 6063-T5 or T6 alloy and tempered.
2. Alloy and Temper: Recommended by manufacturer for strength, corrosion resistance, and application of required finish; ASTM B 221 for extrusions, ASTM B 209 for sheet/plate.

## B. Hardware:

1. Locking handles shall be cam type and manufactured from a white bronze alloy with a US25D brushed finish.
2. Operating hardware shall be 4-bar stainless steel hinges or equal.

## C. Fasteners:

1. Aluminum, non-magnetic stainless steel, or other materials warranted by manufacturer to be noncorrosive and compatible with aluminum components.
2. Do not use exposed fasteners except where unavoidable for application of hardware.
3. Match finish of adjoining metal. Provide Phillips flat-head machine screws for exposed fasteners.

## D. Weatherstripping: Santoprene® or equal.

## E. Thermal Barrier:

1. Exterior aluminum shall be separated from the interior aluminum by an integrally concealed, low-conductance structural thermal barrier in a manner that eliminates direct metal-to-metal contact.
2. Thermal barrier de-bridge space shall not be less than 1/4 inch.
3. Thermal barrier shall be poured-in-place two-part polyurethane that has been in use on similar units for a period of not less than two years and has been tested to demonstrate:
  - a. Resistance to thermal conductance and condensation.
  - b. Adequate strength and security of glass retention.
4. Thermal barrier cavity shall be of a design to capture the poured-in-place polyurethane material in four raceway cavities.

## F. Hot Melt Silicone and Glazing Beads:

1. Hot Melt Silicone shall conform to AAMA 800 specification.
2. Glazing beads shall be extruded aluminum and shall be of sufficient strength to retain the glass.

## G. Sealant: Non-shrinking, non-migrating elastomeric type conforming to AAMA 803 and AAMA 808.

## H. Glass and Glazing Materials: Provide glass and glazing materials that comply with requirements of Section 08 80 00 of these Specifications.

## I. Screens: Provide manufacturer's standard aluminum screen at operable units.

2.04 FABRICATION

A. General:

1. Units shall be able to be re-glazed without dismantling the master or vent frame.
2. Aluminum frame and vent extrusions shall have a minimum wall thickness of 0.125 inch.
3. Mechanical fasteners, welded components and hardware items shall not bridge thermal barriers.
4. Thermal barriers shall align at all frame and vent corners.

B. Frame:

1. Master frame shall be no less than 4-1/2 inches.
2. Frame components shall be mechanically fastened.

C. Ventilator:

1. Vent frame shall be no less than 2 inches.
2. Vent frame extrusions shall be of tubular design.
3. Vent corners shall be mitered, reinforced with an extruded corner key and hydraulically crimped.
4. Vent frame shall utilize two rows of Santoprene® weatherstrip and shall be pressure equalized.

D. Screens:

1. Extruded aluminum frames.
2. Factor drill mounting holes.
3. Aluminum mesh.

E. Welding: Comply with AWS recommendations to avoid discoloration; grind exposed welds smooth and restore mechanical finish.

F. Reinforcing: Install reinforcing as necessary for performance requirements; separate dissimilar metals with bituminous paint or other separator that will prevent corrosion.

G. Continuity: Maintain accurate relation of planes and angles, with hairline fit of contacting members.

H. Fasteners: Conceal fasteners wherever possible.

2.05 ALUMINUM FINISHES

A. High-Performance Organic Finish (Two-Coat Fluoropolymer): Thermocured system consisting of inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight complying with AAMA 2605.

1. Color and Gloss: Finish to be selected by Project Engineer / MDOT Architect from manufacturer's full range of standard colors available. Refer to Section 09 05 15 – Color Design for selected color.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E 2112.
- B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.
- C. Set sill members and other members in bed of compound as shown, or with joint fillers or gaskets as shown to provide weather-tight construction. Comply with requirements of Section 07 92 00 for caulking and sealant.
- D. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.
- E. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.
- F. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.
- G. Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
- H. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION

SECTION 08 71 00

DOOR HARDWARE

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Hardware as shown on the Drawings and in Schedules. Door hardware is hereby defined to include all items known commercially as builders hardware, as required for swing doors, except special types of unique and non-matching hardware specified in the same section as the door and door frame.
- B. The required types of hardware include (but are not limited to) the following:
  - 1. Butts and hinges
  - 2. Lock cylinders and keys
  - 3. Lock and latch sets
  - 4. Bolts
  - 5. Panic exit devices
  - 6. Push / pull units
  - 7. Closers
  - 8. Door trim units
  - 9. Stripping and seals
  - 10. Thresholds
- C. Items of hardware not definitely specified, but required for the completion and proper operation of the doors, shall be suitable in type, comparable to the type specified for similar openings.
  - 1. Labeled doors shall be fitted with labeled hardware.
- D. Modifications of hardware required by reason of construction characteristics shall provide the proper operation or functional features.
  - 1. Contractor shall be fully responsible for checking all details, such as wall trim clearance, bevels, backsets, proper type strike plates, length of spindles, hands of locks, etc., in order that all items of hardware shall fit properly.
  - 2. Hardware for application to metal shall be made to standard templates.
  - 3. Furnish template information to door and frame fabricators and all other trades requiring same, in order that they may cut, reinforce or otherwise prepare in the shop, materials for reception of hardware.
- E. Hardware shall be free from defects affecting appearance and serviceability.
  - 1. Working parts shall be well fitted and smooth working without unnecessary play.
  - 2. Hardware shall be delivered to the building site in sufficient time in advance of its requirement for use for inspection prior to installation.

## 1.02 REFERENCES

- A. Coordinate with the following Sections for the installation of finish hardware:
1. Section 08 11 13 – Hollow Metal Doors and Frames.
  2. Section 08 14 29 – Pre-finished Wood Doors.
  3. Divisions 26 and 27 Sections for electronic door hardware.

## 1.03 ACTION SUBMITTALS

- A. Product Data: Submit manufacturer's product data, roughing-in diagrams, and Installation instructions for each type of hardware.
1. Include operating instructions, maintenance information and spare part sources.
- B. Shop Drawings: Details of electrified door hardware.
- C. Samples: Submit such samples as required by the Project Engineer / MDOT Architect for approval. Do not deliver hardware until approval is obtained.
- D. Templates: Provide templates and / or physical hardware to trades as required and in sufficient time to prevent delay in the execution of the Work.
- E. Other Action Submittals:
1. Door Hardware Schedule: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
    - a. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
    - b. Content: Include the following information:
      - 1) Identification number, location, hand, fire rating, size, and material of each door and frame.
      - 2) Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
      - 3) Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
      - 4) Description of electrified door hardware sequences of operation and interfaces with other building control systems.
  2. Keying Schedule: Prepared by or under the supervision of Installer, detailing Owner's final keying instructions for locks.
  3. Approval of schedule will not relieve Contractor of responsibility for furnishing all necessary hardware.

## 1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and an Architectural Hardware Consultant who is available during the course of the Work to consult with Contractor, Architect, MDOT Architect and Project Engineer (Owner's Representative) about door hardware and keying.



- B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as follows:
1. For door hardware, an Architectural Hardware Consultant (AHC).
- C. Source Limitations: Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.
- D. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- E. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.
- F. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1
1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
  2. Comply with the following maximum opening-force requirements:
    - a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
    - b. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
  3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.
  4. Adjust door closer sweep periods so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.
- G. Keying Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination."
- 1.05 DELIVERY, STORAGE, AND HANDLING
- A. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.
- B. Packing and Marking: Package each item of hardware and lockset separately in individual containers, complete with screws, keys, instructions and installation template for spotting mortising tools. Mark each container with item number corresponding to number shown on Contractor's hardware schedule.

## 1.06 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
1. Warranty Period: Three years from date of Completion, unless otherwise indicated.
    - a. Electromagnetic Locks: Five years from date of Completion.
    - b. Exit Devices: Two years from date of Completion.
    - c. Manual Closers: 10 years from date of Completion.

## PART 2 - PRODUCTS

## 2.01 ACCEPTABLE MANUFACTURERS

- A. Equivalent products by the following manufacturers are acceptable:
1. Hinges – Hager, Ives, McKinney.
  2. Continuous Hinges – Hager, Ives, Markar.
  3. Cylinders – Best, Corbin/Ruswin, Sargent, Schlage.
  4. Flushbolts and Accessories – Hager, Ives, Rockwood.
  5. Locksets – Baldwin, Corbin/Ruswin, Sargent, Schlage.
  6. Deadbolts – Baldwin, Corbin/Ruswin, Sargent, Schlage.
  7. Exit Devices – Precision, Sargent, Von Duprin.
  8. Door Closers – Corbin/Ruswin (DC3000), LCN (1460), Sargent (1430).
  9. Protective Plates – Hager, Ives, Rockwood.
  10. Door Stops – Hager, Ives, Rockwood.
  11. Overhead Stops / Holders – Glynn Johnson, Rixson, Sargent.
  12. Magnetic Hold Opens – LCN, Rixson, Sargent.
  13. Gasketing and Thresholds – National Guard Products, Pemko, Reese.
  14. Silencers – Hager, Ives, Rockwood.
  15. Power Supplies – Schlage Electronics, Securitron, Von Duprin.
- B. Substitutions: Comply with specified requirements and Section 01 25 00 – Substitution Procedures and Section 01 60 00 – Product Requirements.

## 2.02 SCHEDULED DOOR HARDWARE

- A. Provide door hardware for each door as scheduled **on** Drawings to comply with requirements in this Section.
1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and products equivalent in function and comparable in quality to named products
  2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.

- B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Schedule" Article. Products are identified by using door hardware designations, as follows:
1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Schedule" Article.
  2. References to BHMA Designations: Provide products complying with these designations and requirements for description, quality, and function.

#### 2.03 KEYING

- A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference.
1. Master Key System: Change keys and a master key operate cylinders.
  2. Keyed Alike: Key all cylinders to same change key.
- B. Removable Cores: Furnish all cylinders & locksets with removable type cores. The removable core system shall be one that uses either temporary construction cores or construction keyed cores operated by a construction key until such time the construction key is rendered inactive by the change key or retractor key.
- C. Keys: Brass.
1. Quantity: In addition to one extra key blank for each lock, provide the following:
    - a. Cylinder Change Keys: Three.
    - b. Master Keys: Six.

#### 2.04 ACCESSORIES FOR PAIRS OF DOORS

- A. Coordinators: BHMA A156.3; consisting of active-leaf, hold-open lever and inactive-leaf release trigger; fabricated from steel with nylon-coated strike plates; with built-in, adjustable safety release.
- B. Carry-Open Bars: BHMA A156.3; prevent the inactive leaf from opening before the active leaf; provide polished brass or bronze carry-open bars with strike plate for inactive leaves of pairs of doors unless automatic or self-latching bolts are used.
- C. Astragals: BHMA A156.22.

**2.05 FABRICATION**

- A. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.
1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
  2. Fire-Rated Applications:
    - a. Wood or Machine Screws: For the following:
      - 1) Hinges mortised to doors or frames.
      - 2) Strike plates to frames.
      - 3) Closers to doors and frames.
    - b. Steel Through Bolts: For the following unless door blocking is provided:
      - 1) Surface hinges to doors.
      - 2) Closers to doors and frames.
      - 3) Surface-mounted exit devices.
  3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
  4. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."
  5. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

**2.06 FINISHES**

- A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

**PART 3 - EXECUTION****3.01 INSTALLATION**

- A. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
- B. Wood Doors: Comply with DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."
- C. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.
1. Standard Steel Doors and Frames: ANSI/SDI A250.8.

2. Custom Steel Doors and Frames: HMMA 831.
  3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- D. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.
1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
  2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- E. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- F. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every 30 inches of door height greater than 90 inches.
- G. Lock Cylinders: Install construction cores to secure building and areas during construction period.
1. Replace construction cores with permanent cores as indicated in keying schedule.
  2. Furnish permanent cores to Owner for installation.
- H. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
- I. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room. Verify location with Project Engineer / MDOT Architect.
1. Configuration: Provide [one power supply for each door opening] [least number of power supplies required to adequately serve doors] with electrified door hardware.
- J. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 07 92 00 "Joint Sealants."
1. Cut and fit threshold and floor covers to profile of door frames, with mitered corners and hairline joints.
  2. Screw thresholds to substrate with No. 10 or larger screws, of the proper type for permanent anchorage and of bronze or stainless steel that will not corrode in contact with the threshold metal.
  3. Do not plug drainage holes or block weeps.
  4. Remove excess sealant.

- K. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.
- L. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- M. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- N. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.
- O. Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
  - 1. Lubricate moving parts with type lubrication recommended by manufacturer (graphite-type if no other recommended).

3.02 FIELD QUALITY CONTROL

- A. Independent Architectural Hardware Consultant: Engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.

3.03 DOOR HARDWARE SCHEDULE

**HW1** (For Exterior Hollow Metal Door)

Each Opening Shall Have:

3 – Each Hinges	Hager	BB1279 4 1/2 X 4 1/2 X NRP X 652
1 – Lockset	Schlage	ND50RD Rhodes X US26D
1 – Closer	LCN	P1460/1460 X AL X TBGN
1 – Kickplate	Rockwood	8 X 2 LDW 0.050 X US32D (Mounted push side)
1 – Threshold	Pemko	2005AV
1 – W/Strip	Pemko	303AV
1 – Door Bottom	Pemko	2211DV (for Hollow Metal Doors)
1 – Stop		(As Required)
3 – Silencers		

**HW2** (For Interior Wood Door @ Offices & Corridor)

Each Opening Shall Have:

3 – Each Hinges	Hager	BB1279 4 1/2 X 4 1/2 X 652
1 – Lockset	Schlage	ND50PD Rhodes X US26D
1 – Cylinder	Best	As Required
1 – Closer	LCN	1460 X AL X TBGN At Rated Walls & as indicated
1 – Kickplate	Rockwood	8 X 2 LDW 0.050 X US32D (Mounted push side)
1 – MOP plate	Rockwood	6 X 1 LDW 0.050 X US32D (Mounted pull side)
1 – Stop	Rockwood	440 X US26D
3 – Silencers		

**HW3** (For Interior Wood Doors @ Toilet Rooms)  
 Each Opening Shall Have:

3 – Each Hinges	Hager	BB1279 4 1/2 X 4 1/2 X 652
1 – Privacy	Schlage	ND40S Rhodes X 626
1 – Indicator Bolt	Falcon	D271 X 626
1 – Closer	LCN	1460 AL X TBGN
1 – Kickplate	Rockwood	8 X 2 LDW 0.050 X 630 (Mounted push side)
1 – Mop Plate	Rockwood	6 X 1 LDW 0.050 X 630 (Mounted pull side)
1 – Stop	Rockwood	440 X 626
3 – Silencers		

**HW4** (For Interior Wood Doors @ Crew Room)  
 Each Opening Shall Have:

3 – Each Hinges	Hager	BB1279 4 1/2 X 4 1/2 X 652
1 – Lockset	Schlage	ND10S Rhodes X US26D 613
1 – Closer	LCN	1460 AL X TBGN @ Rated Walls & as indicated
1 – Kickplate	Rockwood	8 X 2 LDW 0.050 X US32D (mounted push side)
1 – Mop Plate	Rockwood	6 X 1 LDW 0.050 X US32D (mounted pull side)
1 – Stop	Rockwood	440 X US26D
3 – Silencers		

END OF SECTION

SECTION 08 80 00                      GLAZING

PART 1 - GENERAL

1.01        SUMMARY

- A.    Section Includes: Glass and glazing for doors, windows and other glazed openings, interior and exterior locations
  
- B.    Related Sections:
  - 1.    Section 08 11 13 - Hollow Metal Doors and Frames.
  - 2.    Section 08 14 29 - Prefinished Wood Doors.
  - 3.    Section 08 51 13 - Aluminum Windows.

1.02        PRECONSTRUCTION TESTING

- A.    Preconstruction Adhesion and Compatibility Testing: Test each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
  - 1.    Testing will not be required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.

1.03        ACTION SUBMITTALS

- A.    Product Data: For each glass product and glazing material indicated.
  
- B.    Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.
  
- C.    Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.04        INFORMATIONAL SUBMITTALS

- A.    Preconstruction adhesion and compatibility test report.

1.05        QUALITY ASSURANCE

- A.    Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
  - 1.    Prime Glass Standard: FS DD-G-45I.
  - 2.    Heat-Treated Glass Standard: FS DD-G-I403.
  - 3.    Safety Glass Standard: CPSC I6 CFR I20I.
  - 4.    GANA Publications: GANA's "Glazing Manual."



- 5. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect glass during transit, storage and handling to prevent scratching or breakage of glass. Replace broken glass.

1.07 PROJECT CONDITIONS

- A. Schedule meeting with Glazier and other trades affected by glass installation, prior to beginning of installation.
  - 1. Do not perform work under adverse weather or job conditions.
  - 2. Install liquid sealant when temperatures are within lower or middle third of temperature range recommended by manufacturer.

1.08 WARRANTY

- A. Manufacturer's Special Warranty on Laminated Glass: Manufacturer's standard form in which laminated-glass manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
  - 1. Warranty Period: 10 years from date of Completion.
- B. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
  - 1. Warranty Period: 10 years from date of Completion.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Equivalent products by the following prime glass manufacturers are acceptable:
  - 1. Arch Aluminum & Glass Co., Inc., Columbus, OH. Tel No. (800) 870-2519.
  - 2. Cardinal Glass Industries, Eden Prairie, MN. Tel. (952) 229-2600.
  - 3. PPG Industries, Inc., Pittsburgh, PA. Tel. (800) 377-5267.
  - 4. Guardian Industries Corp., Carleton, MI. Tel. (800) 521-9040.
  - 5. Safti First, San Francisco, CA. Tel. (888) 653-3333.

6. Viracon, Inc., Owatonna, MN. Tel. (800) 533-2080.
7. Zeledyne Tulsa, OK. Tel. (800) 331-2607.

- B. Substitutions shall fully comply with specified requirements and Section 01 25 00 - Substitution Procedures and Section 01 60 00 - Product Requirements.

## 2.02 GLASS PRODUCTS, GENERAL

- A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.
- B. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.
- C. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
  1. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.
  2. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
  3. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

## 2.03 GLASS PRODUCTS

- A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.
- B. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.

## 2.04 INSULATING GLASS

- A. Material: Organically sealed panes of glass enclosing a hermetically sealed dehydrated air space and complying with ASTM E 774 for performance classification indicated. Unless shown otherwise on Drawings, use this type glass for all exterior applications.
- B. Characteristics: Other requirements specified for glass characteristics, air space, sealing system, sealant spacer material, corner design and desiccant are as follows:
  1. Thickness of Each Pane: 1/4 - inch.
  2. Airspace Thickness: 1/2 - inch.
  3. Sealing System: Manufacturer's standard 1 inch sealing system with Argon.
  4. Spacer Material: Manufacturer's standard metal-white.
  5. Desiccant: Manufacturer's standard, either molecular sieve or silica gel.
  6. Corner Construction: Manufacturer's standard.

7. Exterior Pane: Tinted; color – equal to “Versalux Grey” with MSVD (Sputter) Low-E on 2<sup>nd</sup> (air space) surface by Zeledyne..
8. Interior Pane: Clear.
9. Unit Performance Requirements for “Versalux Grey”
  - a. Light Transmission (visible): 36 percent.
  - b. U-Value, Summer: 0.28.
  - c. U-Value, Winter: 0.29.
  - d. Relative Heat Gain: 73 BTU per Hour Ft<sup>2</sup>.
  - e. Shading Coefficient: 0.35.

#### 2.05 LAMINATED CLEAR SAFETY GLASS

- A. Two layers of 1/8 inch glass Type 1 (transparent glass, flat), Class 1 (clear), Quality q3 (glazing select) with a 0.030 polyvinyl butyryl interlayer. Total thickness, 1/4 inch (plus). Unless shown otherwise on Drawings, use this type glass for all interior applications.

#### 2.06 SETTING MATERIALS

- A. Provide necessary primers, sealants, channels, setting blocks, etc. with items to be glazed. Conform to requirements set forth in FGJA Glazing Manual.

#### 2.07 MISCELLANEOUS GLAZING MATERIALS

- A. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- B. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- C. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- D. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- E. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.
- F. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

## PART 3 - EXECUTION

## 3.01 PREPARATION FOR GLAZING

- A. Clean glazing channel and other framing members to receive glass, immediately before glazing. Remove coatings that are not firmly bonded to substrate. Remove lacquer from metal surfaces where elastomeric sealants are used.
  - 1. Apply primer or sealant to joint surfaces where recommended by sealant manufacturer.

## 3.02 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. Provide spacers for glass lites where length plus width is larger than 50 inches.
- H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- I. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage to ensure that gasket will not "walk" out when installation is subjected to movement. Anchor gasket to stop with matching ribs, or by proven adhesives, including embedment of gasket tail in cured heel-bead.
- J. Tool exposed surfaces of glazing liquids and compounds to provide a substantial "wash" away from glass. Install pressurized tapes and gaskets to protrude slightly out of channel, so as to eliminate dirt and moisture pockets.

### 3.03 GLAZING INSTALLATION

- A. Do not commence glazing Work until the required primers have been applied and have dried. Clean all surfaces to which setting materials are to be applied to assure that the materials properly adhere and seal.
- B. Experienced glaziers having highest quality workmanship shall perform all glazing. Glass shall be set without springing or forcing. Putty, glazing compound, stops and the like shall not project above the sight line. Exposed surfaces of putty and glazing compound shall be left straight, flat and clean. Corners shall be well formed.
- C. Remove and replace glass which is broken, chipped, cracked, abraded or damaged in other ways during construction period, including natural causes, accidents and vandalism.
- D. Apply clear glazing compound around perimeter and at all glass-to-glass connections of butt-glazing system. Compound shall be the type recommended by the glass manufacturer for this particular installation.
- E. Door Lites: Install glass in frames in sizes as shown on the Drawings. Where fire ratings are indicated for doors, frames shall comply with applicable U.L. fire rating standards.

### 3.04 STANDARDS AND PERFORMANCE

- A. Watertight and airtight installation of each glass product is required, except as otherwise shown. Each installation must withstand normal temperature changes, wind loading, impact loading (for operating sash and doors), without failure including loss or breakage of glass, failure of sealant or gaskets to remain watertight and airtight, deterioration of glazing materials and other defects in the Work.
- B. Protect glass from edge damage during handling and installation, and subsequent operation of glazed components of the Work. During installation, discard units with significant edge damage or other imperfections.
- C. Glazing channel dimensions where shown are intended to provide for necessary bite on glass, minimum edge clearance, and adequate sealant thickness, with reasonable tolerances. Adjust as required by job conditions at time of installation.
- D. Comply with combined recommendations and technical reports by manufacturers of glass and glazing products as used in each glazing channel, and with recommendations of Flat Glass Marketing Association "Glazing Manual," except where more stringent requirements are indicated.

3.05 CLEANING AND PROTECTION

- A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.
  - 1. Cure sealant for high early strength and durability.
- B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.
- C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.
- D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

END OF SECTION

SECTION 08 91 19                      FIXED LOUVERS

PART 1 - GENERAL

1.01        SUMMARY

- A.    Section Includes: Extruded aluminum fixed louvers with insect/bird screens and sill extensions as indicated on the Drawings including indications of sizes and locations.
- B.    Related Requirements:
  - 1.    Section 07 92 00 – Sealants (for sealant in connection with installations of louvers).
  - 2.    Section 09 05 15 – Color Design (for color selection).
  - 3.    Divisions 23 and 26 for operable dampers behind louvers where scheduled.

1.02        ACTION SUBMITTALS

- A.    Product Data: For each type of product; Submit manufacturer's specifications; certified test data, where applicable; and installation instructions for required products, including finishes.
  - 1.    For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.
- B.    Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
- C.    Samples: Submit 6-inch square samples of each required finish.
  - 1.    Prepare samples on metal of same gage and alloy to be used in Work.
  - 2.    Where normal color and texture variations are to be expected, include two or more units in each sample showing limits of such variations.
- D.    Delegated-Design Submittal: For louvers indicated to comply with structural and seismic performance requirements, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.03        INFORMATIONAL SUBMITTALS

- A.    Product Test Reports: Based on tests performed according to AMCA 500-L.

1.04        DELIVERY, STORAGE, AND HANDLING

- A.    Deliver materials and products in labeled protective packages. Store and handle in strict compliance with manufacturers' instructions and recommendations. Protect from damage from weather, excessive temperatures and construction operations.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Drawings and Specifications are based on products manufactured by Construction Specialties, Inc., 49 Meeker Ave., Cranford, NJ 07016. Tel. (908) 272-5200.
- B. Equivalent products by the following manufacturers are acceptable:
  - 1. All-Lite Louvers, Mineral Wells, WV. Tel. (304) 489-8113.
  - 2. Ruskin Manufacturing, Kansas City, MO. Tel. (816) 761-7476.
- C. Substitutions shall fully comply with specified requirements and Section 01 25 00 - Substitution Procedures and Section 01 60 00 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design louvers, including comprehensive engineering analysis by a qualified professional engineer, using structural and seismic performance requirements and design criteria indicated.
- B. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.
  - 1. Wind Loads: Determine loads based on pressures as indicated on Drawings.
  - 2. Wind Loads: Determine loads based on a uniform pressure of 20 lbf/sq. ft. acting inward or outward.
- C. Seismic Performance: Louvers, including attachments to other construction, shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
  - 1. Design earthquake spectral response acceleration, short period (Sds) for Project as required by IBC 2012 and AHJ.
  - 2. Component Importance Factor 1.0, unless noted otherwise.
- D. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

2.03 FIXED, EXTRUDED-ALUMINUM LOUVERS

- A. Horizontal, Drainable-Blade Fixed Louver:
  - 1. Manufacturer and Model: Equal to C/S Model A4097.
  - 2. Louver Depth: 4 inches.
  - 3. Frame and Blade Nominal Thickness: Not less than 0.081 inch.



4. Mullion Type: Hidden vertical mullions of type and at spacing indicated but not further apart than recommended by manufacturer or 72 inches on center, whichever is less.
  - a. At horizontal joints between louver units provide horizontal mullions except where continuous vertical assemblies are indicated
5. Louver Performance Ratings:
  - a. Free Area: Not less than 50.44 percent for 48-inch- wide by 48-inch- high louver.
  - b. Air Performance: Not more than 0.14-inch wg static pressure drop at 872-fpm free-area intake velocity.
6. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

#### 2.04 LOUVER SCREENS

- A. Provide removable screens for exterior louvers. Fabricate screen frames of same metal and finish as louver units to which secured, unless otherwise indicated. Provide frames consisting of U-shaped metal for permanently securing screen mesh.
- B. Use insect screens of 18X14 aluminum mesh and additional 1/2-inch sq. mesh, 0.050-inch aluminum wire bird screen. Locate screens on inside face of louvers, unless otherwise indicated. Secure screens to louver frames with machine screws, spaced at each corner and at 12 inches on center between.
- C. Use bird screen only for louvers that are connected to duct work, operable dampers or fans.

#### 2.05 MATERIALS

- A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T2. Blade and frame thickness shall be 0.081 inch minimum.
- B. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Fasteners: Use types and sizes to suit unit installation conditions.
  1. Use Phillips flat-head screws for exposed fasteners unless otherwise indicated.
  2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
  3. For color-finished louvers, use fasteners with heads that match color of louvers.
- D. Anchors and Inserts: Use non-ferrous metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

#### 2.06 FABRICATION

- A. Provide louvers and accessories of design, materials, sizes, depth, arrangement, and metal thickness indicated, or if not indicated, as required for optimum performance with respect to airflow; water penetration; air leakage; strength; durability; and uniform appearance.

- B. Fabricate frames including integral sills to suit adjacent construction with tolerances for installation, including application of sealant in joints between louvers and adjoining Work.
- C. Include supports, anchorage, and accessories required for complete assembly.
- D. Sill Extensions: Loose sills made of same material as louvers, where indicated, or required for drainage to exterior and to prevent water penetrating to interior.
  - 1. Setback dimension is 3-3/4 inches to 6 inches.
- E. Join frame members to one another and to stationary louver blades.
  - 1. Maintain equal blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.

#### 2.07 ALUMINUM FINISHES

- A. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  - 1. Color and Gloss: As selected by Architect from manufacturer's full range of standard and premium colors. Refer to Section 09 05 15 for color.

#### 2.08 SOURCE QUALITY CONTROL

- A. Performance Requirements: Where louvers are indicated to comply with specific performance requirements, provide units whose performance ratings have been determined in compliance with Air Movement and Control Association (AMCA) Standard 500.
- B. SMACNA Recommendations: Comply with SMACNA "Architectural Sheet Metal Manual" recommendations for fabrication, construction details and installation procedures, except as otherwise indicated.
- C. Shop Assembly: Coordinate field measurements and Shop Drawings with fabrication and shop assembly to minimize field adjustments, splicing, mechanical joints and field assembly of units.
  - 1. Pre-assemble units in shop to greatest extent possible and disassemble as necessary for shipping and handling limitations.
  - 2. Clearly mark units for re-assembly and coordinated installation.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- D. Protect unpainted galvanized and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.
- E. Restore louvers damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

END OF SECTION

SECTION 09 05 15 COLOR DESIGN

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: A coordinated comprehensive Color System in which requirements for materials specified in other Sections of this Specification and / or shown on the Drawings are identified for quality, color, finish, texture and pattern.
- B. Related Sections: Section 01 33 00 – Submittal Procedures.

1.02 MANUFACTURER'S TRADE NAMES

- A. Manufacturer's trade names and number designations used herein identify colors, finishes, textures and patterns for materials and products specified in the technical sections of the Specifications. Wherever such products are referred for selection or approval in other sections, such products shall be understood to be referenced to this Section.
- B. If no selection is listed herein for products, the Project Engineer / MDOT Architect shall be contacted for a color selection.
- C. Subject to approval of the Project Engineer / MDOT Architect, products of other manufacturers will be considered, provided they are equivalent to the quality, colors, finishes, textures and patterns listed and meet the requirements of the Specifications and Drawings.

1.03 SAMPLES

- A. Color samples shall be submitted for approval prior to applying or installing finishes or items that are included in this Section. See appropriate technical Sections for submittal requirements. Upon receipt of samples, the Project Engineer / MDOT Architect may make revisions to the Color schedule.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Materials are specified in other Sections of the Specifications. Reference by trade name or manufacturer shall be considered as establishing a standard of quality and shall in no way limit competition.

## 2.02 MANUFACTURERS

A. The following manufacturers were used in preparing the Color Schedule:

SECTION / MATERIALS	MANUFACTURER / NUMBER & COLOR NAME	COLOR DESCRIPTION
• 03 33 00 - Concrete Floor	Anvil – Bermuda Tan	(tan)
• 04 20 00 – Brick (Field)	Boral-Liberty Collection-Battleship	(variegated tan)
• 04 20 00 – Brick (Accent)	Boral-Liberty Collection-Slate	(variegated tan)
• 04 20 00 - Mortar	Gray Mortar	(gray)
• 04 20 00 - Weep Vents	CavClear Match Mortar Color	(gray)
• 05 50 00 - Misc. Steel	S/W #6109 Hopsack	(dark brown)
• 06 40 00 - Arch. Woodwork (Stain)	Match Graham #700 Dark Brown	(brown)
• 06 40 00 - Arch. Woodwork (Paint)	S/W #6108 Latte	(tan)
• 06 40 00 - Plastic Lam Countertop	Formica #7267-58 Concrete Stone	(tan)
• 07 61 00 - Sheet Metal Roofing	Petersen Champagne	(dark tan)
• 07 61 00 - Met Trim, Gutters & DS	Petersen Medium Bronze	(dark brown)
• 07 61 00 - Soffit Panels	Petersen-Sierra Tan	(light tan)
• 07 92 00 - Joint Sealants	Pecora-Match adjacent lighter color	
• 08 11 13 - HM Drs & Frames (Ext)	S/W #6109 Hopsack	(dark brown)
• 08 11 13 - HM Frames (Interior)	S/W #6109 Hopsack	(dark brown)
• 08 14 29 - Prefinished Wood Doors	Graham #700 Dark Brown	(brown)
• 08 41 13 - Alum Fr Ent & Storefront	Kawneer Medium Bronze	(dark brown)
• 08 51 13 - Aluminum Windows	Peerless Medium Bronze	(dark brown)
• 08 71 00 - Door Hardware	Antique Bronze Oiled	(bronze)
• 08 91 19 - Fixed Louvers	C/S Group #43 Medium Bronze	(dark brown)
• 09 29 00 - Gypsum Board(Walls)	S/W #6106 Kilim Beige	(light tan)
• 09 29 00 - Gypsum Board(Ceilings)	S/W #7007 Ceiling Bright White	(white)
• 09 31 13 - Ceramic Tile Floor 'A'	Daltile #CD77 Marrone Cannella	(tan w/ specs)
• 09 31 13 - Ceramic Tile Floor 'B'	Daltile #CD78 Mandorla con Spezia	(tan w/ dk specs)
• 09 31 13 - Ceramic Tile Wall 'A'	Daltile #K165 Almond	(light tan)
• 09 31 13 - Ceramic Tile Wall 'B'	Daltile #0144 Artisan Brown	(dark tan)
• 09 31 13 - Grout (Floors)	Laticrete #30 Sand Beige	(tan)
• 09 31 13 - Grout (Walls)	Laticrete #85 Almond	(tan)
• 09 65 00 - Resilient Floor 'A'	Mannington-Colorpoint-647 Cream Beige	(tan)
• 09 65 00 - Resilient Floor 'B'	Mannington-Colorpoint-637 Tweed	(light tan)
• 09 65 00 - Resilient Floor 'C'	Mannington-Colorpoint-659 Sable	(brown)
• 09 65 00 - Rubber Base	Johnsonite #45 Sandalwood	(brown)

- 10 11 00 - Tackboard Claridge Cork #1110 Fawn (tan)
- 10 14 00 - Signage (Int.) ASI Sign SC-812 Sand & SC-905 Black (tan w/ blk trim)
- 10 14 00 - Signage (Ext.) ASI Sign SC-803 Light Brown (brown)
- 10 21 15 - Toilet Partition Comtec #D406 Sand Castle (tan)
- 10 26 13 - Corner Guards C/S Group #253 Parchment (light tan)
- 10 51 13 - Metal Lockers Penco #012 Tawny Tan (tan)
  
- 11 31 15 - Appliances (Range) GE-White (white)
- 11 31 15 - Appliances (Microwave) GE-White (white)
- 11 31 15 - Appliances (Refrigerator) GE-White (white)
  
- 12 21 13 - Horiz Lvr Blinds (Windows) Hunter Douglas #C270-Linen (off white)
- 12 48 43 - Floor Mats C/S Group-Carpet #7304 Sandstone (tan)
- 12 48 43 - Floor Mats C/S Group-Rails Bronze Anodized (brown)

PART 3 - EXECUTION

3.01 INSTALLATION / APPLICATION, GENERAL

- A. Refer to execution requirements specified in other Sections of this Specification for the specific products listed. Colors, finishes, textures or patterns not included in this Color Design will be selected by the Project Engineer / MDOT Architect upon written notification and subsequent submittals by the Contractor.

END OF SECTION

SECTION 09 29 00

GYPSUM BOARD

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Gypsum board work with a tape-and-compound joint treatment system known as "drywall finishing" work.
- B. The types of Work required include the following:
  - 1. Gypsum board applied to wood framing and furring.
  - 2. Gypsum backing boards for application of other finishes.
  - 3. Drywall finishing (joint tape-and-compound treatment).

1.02 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical product data, installation instructions and recommendations for products specified.

1.03 QUALITY ASSURANCE

- A. Fire Resistance: Where work is indicated for fire resistance ratings, including those required to comply with governing regulations, provide materials and installations identical with applicable assemblies which have been tested and listed by recognized authorities, including UL.
- B. Industry Standard: Comply with applicable requirements of GA-216 "Application and Finishing of Gypsum Board" by the Gypsum Association, except where more detailed or more stringent requirements are indicated including the recommendations of the manufacturer.
- C. Allowable Tolerances: 1/8 inch offsets between planes of board faces, and 1/4 inch in 8 ft. for plumb, level, warp and bow.
- D. Manufacturer: Obtain gypsum boards, framing and fasteners, trim accessories, adhesives and joint treatment products from a single manufacturer, or from manufacturers recommended by the prime manufacturer of gypsum boards.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver gypsum drywall materials in sealed containers and bundles, fully identified with manufacturer's name, brand, type and grade; store in a dry, well ventilated space, protected from the weather, under cover and off the ground.

1.05 PROJECT CONDITIONS

- A. Installer must examine the substrates and the spaces to receive gypsum drywall, and the conditions under which gypsum drywall is to be installed; and shall notify the Contractor, in writing, of conditions detrimental to the proper and timely completion of the work.
  - 1. Do not proceed with the installation until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.
- B. Maintain ambient temperatures at not less than 55 degrees F., for the period of 24 hours before drywall finishing, during installation and until compounds are dry.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Obtain gypsum board, framing and fasteners, trim accessories, adhesives and joint treatment products from one of the following:
  - 1. CertainTeed Corporation, PA Tel: (800) 233-8990.
  - 2. Georgia-Pacific Corp, Atlanta, GA, Tel. (800) 327-2344.
  - 3. National Gypsum Company, Charlotte, NC, Tel. (800) 343-4893.
  - 4. United States Gypsum Company, Chicago, IL, Tel. (800) 874-4968.

2.02 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.03 GYPSUM BOARD PRODUCTS

- A. Furnish gypsum board products in maximum lengths available to minimize end-to-end butt joints. To the extent not otherwise indicated, comply with GA-216, as specified and recommended.
- B. Exposed gypsum board shall be Type X, fire rated type with tapered long edges and as follows:
  - 1. Edge Profile: Special rounded or beveled edge.
  - 2. Sheet Size: Maximum length available that will minimize end joints.
  - 3. Thickness: 5/8 inch, except where otherwise indicated.
  - 4. Water-resistant Type (WR-1): Provide at exterior walls and at "Wet" areas without ceramic tile; equal to 5/8 inch thick DensArmor Plus Fireguard by G-P Gypsum.
  - 5. Cement Board: Provide water-resistant cement based backer board as a base for all ceramic wall tiles, equal to 5/8 inch thick Durock by USG.



2.04 TRIM ACCESSORIES

- A. Manufacturer's standard galvanized steel beaded units with flanges for concealment in joint compound including corner beads, edge trim and control joints; except provide semi-finishing type (flange not concealed) where indicated.
- B. Where metal moldings are specifically called out on the Drawings, provide the appropriate item from below:
  - 1. Edge Trim: USG No. 200-A.
  - 2. Control Joint: USG No. 093.

2.05 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
  - 1. Interior Gypsum Board: Paper, perforated type.
  - 2. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound: On interior work provide chemical hardening type for bedding and filling, ready-mixed vinyl-type or non-case in-type for topping. On exterior work provide water-resistant type.

2.06 MISCELLANEOUS MATERIALS

- A. Provide auxiliary materials for gypsum drywall work of the type and grade recommended by the manufacturer of the gypsum board. Gypsum board fasteners shall comply with GA-216. Provide anti-corrosive type at exterior applications.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Install supplementary framing, runners, furring, blocking and bracing at opening and terminations in the Work, and at locations required to support fixtures, equipment, services, heavy trim, furnishings and similar work which cannot be adequately supported directly on gypsum board alone.

3.02 GENERAL GYPSUM BOARD INSTALLATION REQUIREMENTS

- A. Meet at the project site with the installers of related work and review the coordination and sequencing of work to ensure that everything to be concealed by gypsum drywall has been accomplished, and that chases, access panels, openings, supplementary framing and blocking and similar provisions have been completed. In addition to compliance with GA-216 and ASTM C 840, comply with manufacturer's instructions and requirements for fire resistance ratings (if any), whichever is most stringent.

- B. Install wall / partition boards vertically to avoid end- butt joints wherever possible. At stairwells and similar high walls, install boards horizontally with end joints staggered over studs. Form control joints and expansion joints with space between edges of boards, prepared to receive trim accessories.
- C. Install sound attenuation blankets and insulation as indicated, prior to gypsum board unless readily installed after board has been installed.
- D. Floating Construction: Where feasible, including where recommended by manufacturer, install gypsum board with "floating" internal corner construction, unless isolation of the intersecting boards is indicated or unless control or expansion joints are indicated.
- E. Space fasteners in gypsum boards in accordance with manufacturer's recommendations.

### 3.03 SPECIAL GYPSUM BOARD APPLICATIONS

- A. Where drywall is base for thin set ceramic tile and similar rigid applied wall finishes, install water-resistant cement based backing board.
- B. At toilets, showers, labs, janitor closets, drinking fountains and similar "wet" areas without ceramic tile, install water-resistant gypsum board.
- C. Apply with uncut long edge at bottom of work, and space 1/4 inch above fixture lips. Seal ends, cut-edges and penetrations of each piece with water-resistant sealant before installation.

### 3.04 INSTALLATION OF DRYWALL TRIM ACCESSORIES

- A. Where feasible, use the same fasteners to anchor trim accessory flanges as required to fasten gypsum board to the supports. Otherwise, fasten flanges by nailing or stapling in accordance with manufacturer's instructions and recommendations.
- B. Install metal corner beads at external corners of drywall work.
- C. Install metal edge trim whenever edge of gypsum board would otherwise be exposed or semi-exposed. Provide type with face flange to receive joint compound except where semi-finishing type is indicated. Install L-type trim where work is tightly abutted to other work, and install special kerf-type where other work is kerfed to receive long leg of L-type trim. Install U- type trim where edge is exposed, revealed, gasketed, or sealant-filled (including expansion joints.) Install metal control joint (beaded type) where indicated or required for proper installation.

3.05 INSTALLATION OF DRYWALL FINISHING

- A. Apply treatment at gypsum board joints (both directions), flanges of trim accessories, penetrations, fastener heads, surface defects and elsewhere as required to prepare Work for decoration. Pre-fill open joints and rounded or beveled edges, using type of compound specified herein and recommended by manufacturer.
- B. Apply joint tape at joints between gypsum boards, except where a trim accessory is indicated.
- C. Apply joint compound in 3 coats (not including pre-fill of openings in base), and sand between last 2 coats and after last coat.
- D. Base for Ceramic Tile: Do not install drywall finishing where ceramic tile and similar rigid applied finishes are indicated.
- E. Unless otherwise indicated, install drywall finishing at all gypsum board exposed to view and to receive finishes as specified. Where not exposed to view and above ceilings, sanding is not required.
- F. Finishing Gypsum Board Assemblies: Level 4 finish, unless otherwise indicated; Level 1 finish for concealed areas, unless a higher level of finish is required for fire-resistance-rated assemblies and Level 2 finish where panels form substrates for tile, Level 5 finish is required in areas with a gloss or epoxy finished coating.

3.06 PROTECTION OF WORK

- A. Installer shall advise Contractor of required procedures for protection of the gypsum drywall Work from damage and deterioration during the remainder of the construction period.

END OF SECTION

SECTION 09 31 13 THIN-SET CERAMIC TILING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Thin-set ceramic mosaic floor tile, glazed cove base, wall tile and accessories.
- B. Related Sections:
  - 1. Section 07 26 00 - Vapor Retarders (for floor protection paper).
  - 2. Section 09 29 00 - Gypsum Board (for cement based backer board).
  - 3. Section 09 05 15 - Color Design (for color selections).

1.02 ACTION SUBMITTALS

- A. Product Data: Manufacturer's product data and written instructions for recommended installation and maintenance practices for each type of product indicated.
- B. Samples:
  - 1. Two samples of each type and composition of tile and for each color and finish required.
  - 2. Assembled samples, with grouted joints, for each type and composition of tile and for each color and finish required.
    - a. Mount on 24 Inches square plywood or hardboard backing.
  - 3. Stone thresholds in 6-inch lengths.
- C. Contract Closeout: Provide Maintenance Data and Manufacturer's recommendations on cleaning.

1.03 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering and identified with labels describing contents.
  - 1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.

1.04 QUALITY ASSURANCE

- A. Furnish tile conforming to the Standard Grade Requirements of ANSI A137.1.
  - 1. Coefficient of Friction: Slip resistant in accordance with the Ceramic Tile Institute, i.e. a static coefficient of friction of not less than 0.60 when tested in accordance with ASTM C 1028-89 as modified by the Ceramic Tile Institute

- B. Provide materials obtained from only one source for each type of tile, grout and color to minimize variations in appearance and quality.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver packaged materials and store in original containers with seals unbroken and labels intact until time of use, in accordance with manufacturer's directions.

1.06 PROJECT CONDITIONS

- A. Continuously heat areas to receive tile to 50 degrees F. for at least 48 hours prior to installation, when project conditions are such that heating is required.
  - 1. Maintain 50 degrees F. temperature continuously during and after installation as recommended by tile manufacturer but not less than 7 days.
- B. Maintain a minimum lighting level of 50 fc during installation.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Equivalent tile products by the following manufacturers are acceptable:
  - 1. American Olean Tile Company, Lansdale, Pennsylvania.
  - 2. Dal-Tile Corporation, Dallas, Texas.
  - 3. Floor Gres Ceramiche, Italy.
  - 4. Florida Tile Industries, Lakeland, Florida.
  - 5. Lone Star Porcelain Mosaic Tile, Dallas, Texas.
  - 6. United States Ceramic Tile Co., East Spatra, Ohio.
- B. Alternate manufacturers: Products produced by other manufacturers that fully meet or exceed the specified requirements may be considered under provisions of Section 01 25 00 - Substitution Procedures and Section 01 60 00 - Product Requirements.

2.02 MATERIALS

- A. General: Comply with ANSI standard referenced with products and materials indicated for setting and grouting.
- B. Ceramic Floor Tile: 12 inches by 12 inches by 5/16 inch, cushioned edge, unglazed, color to be selected from standard colors available.
- C. Ceramic Base Tile: 6 inches by 6 inches by 5/16 inch, cushioned edge, bright glaze, cove base round top, color to be selected from standard colors available.
- D. Glazed Wall Tile: Size 6 inches by 6 inches by 5/16 inch, cushioned edge, bright glaze, colors to be selected from standard colors available.

- E. Trim And Special Shapes: Provide necessary units with rounded internal and external corners, and rounded internal and external corner units of same material and finish as field tile, and as follows:
1. Base: Sanitary cove units.
  2. External Corners: Bullnose shapes, with a radius of not less than 3/4 inch, unless otherwise shown.
  3. Internal Corners: Field-buffed square, except use square corner, combination angle and stretcher type cap.
- F. Marble Thresholds: Provide sound Group "A" marble with an abrasive hardness of not less than 10.0, when tested in accordance with ASTM C 241. Color of marble threshold to be selected by the Project Engineer / MDOT Architect from manufacturer's full range of standard colors.
- G. Adhesive: ANSI A136.1 and ANSI A118.4 when mixed with additive, with Tile Contractor's Association or Adhesive and Sealant Council certification of conformance, for base and wall tile set on each type of substrate. Provide primer-sealer as recommended by adhesive manufacturer. Equal to Laticrete Type 272 Premium or 317 Floor 'N Wall Thin-Set with 333 Super Flex Additive. Equivalent products by Mapei and Bostik are acceptable.
- H. Grout: ANSI A 118.3, with Tile Contractor's Association certification of conformance. Equal to Laticrete Type SpectraLOCK Pro Grout.
1. Equivalent products by Custom Building Products and Mapei are acceptable.
  2. Color of grout to be selected by the MDOT Architect from manufacturer's full range of standard colors.

### PART 3 - EXECUTION

#### 3.01 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
1. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.

#### 3.02 PREPARATION

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with adhesives or thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- B. Blending: For tile exhibiting color variations, use factory blended tile or blend tiles at Project site before installing.

- C. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

### 3.03 INSTALLATION

- A. Comply with the applicable parts of ANSI 108 Series of tile installation standards included under "American National Standard Specifications for the Installation of Ceramic Tile", and the tile and grout manufacturer's printed instructions, and applicable installation specifications of the Tile Council of America's "Handbook for Ceramic Tile Installation", latest edition.
- B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.
- E. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
- F. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
  - 1. Quarry Tile: 1/4 inch.
  - 2. Paver Tile: 1/4 inch.
  - 3. Glazed Wall Tile: 1/16 inch.
  - 4. Decorative Thin Wall Tile: 1/16 inch.
- G. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
- H. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
  - 1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
  - 2. Prepare joints and apply sealants to comply with requirements in Section 07 92 00 "Joint Sealants."

- I. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.
  - 1. At locations where mortar bed (thickset) would otherwise be exposed above adjacent floor finishes, set thresholds in latex-portland cement mortar (thin set).
- J. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated.
- K. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness and bonded securely to substrate.
- L. Color Pattern: A simple color pattern shall be provided with approved color chart and sample submittal to Contractor using 3 or less colors on walls and floors.

3.04 CLEANING AND PROTECTION

- A. Cleaning: Clean grout and setting materials from face of tile while materials are workable. Leave tiles face clean and free of all foreign matter.
  - 1. Unglazed tile may be cleaned with acid solutions only when permitted by the tile and grout manufacturer's printed instructions, but not sooner than 14 days after installation.
  - 2. Protect metal surfaces, cast iron and vitreous plumbing fixtures from effects of acid cleaning.
  - 3. Flush the surface with clean water before and after cleaning.
- B. Finished Tile Work: Leave finished installation clean and free of cracked, chipped, broken, unbonded, or otherwise defective tile Work.
- C. Protection: When recommended by tile manufacturer, apply a protective coat of neutral protective cleaner to completed tile walls and floors.
  - 1. Protect installed tile Work by covering with floor protection paper during the construction period to prevent damage and wear.
  - 2. Prohibit all foot and wheel traffic from using tiled floors for 7 days after installation.
  - 3. Before final inspection, remove protective covering and rinse neutral cleaner from all tile surfaces.

END OF SECTION



SECTION 09 65 00 RESILIENT FLOORING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Vinyl composition floor tile (V.C.T.), vinyl base, and accessories.
- B. Related Sections:
  - 1. Section 07 26 00 – Vapor Retarders (for floor protection paper).
  - 2. Section 09 05 15 – Color Design (for color selection).

1.02 ACTION SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data (Not MSDS) and written instructions for recommended installation and maintenance practices for each type of resilient flooring and accessories.
- B. Shop Drawings: For each type of floor tile. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
  - 1. Show details of special patterns.
- C. Samples: Full-size units of each color and pattern of floor tile required.

1.03 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.04 QUALITY ASSURANCE

- A. Wherever possible, provide resilient flooring, adhesives, cleaners, polishes and accessories produced by a single manufacturer.
- B. Secure the service of an experienced, professional floor service company to provide necessary equipment and manpower to complete the Work.

1.05 PROJECT CONDITIONS

- A. Continuously heat areas to receive flooring to 70 degrees F. for at least 48 hours prior to installation, when project conditions are such that heating is required.
  - 1. Maintain 70 degrees F. temperature continuously during and after installation as recommended by flooring manufacturer but not less than 48 hours.
  - 2. Maintain a minimum lighting level of 50 fc during installation.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Drawings and Specifications are based on products manufactured by Mannington Commercial, P.O. Box 12281, Calhoun, GA 30701, Tel. No. (800) 241-2262.
- B. Equivalent products by the following manufacturers are acceptable:
  - 1. Armstrong Commercial Flooring, Lancaster, PA. Tel. No. (800) 292-6308.
  - 2. Azrock Commercial Flooring, Florence, AL. Tel. No. (800) 558-2240.
  - 3. Johnsonite, Chagrin Falls, OH. Tel. No. (800) 899-8916.
- C. Alternate Manufacturers: Products produced by other manufacturers that fully meet or exceed the specified requirements may be considered under provisions of Section 01 25 00 - Substitution Procedures and Section 01 60 00 - Product Requirements.

2.02 FLOOR TILE

- A. Vinyl Composition Tile: ASTM F 1066: Composition 1, Class 2, Premium Visual Tile, as manufactured by Mannington Commercial.
- B. Thickness: 1/8 inch gage.
- C. Size: 12 by 12 inches.
- D. Colors and Patterns: Color to be selected by Project Engineer / MDOT Architect from manufacturer's full range of ColorPoint™ Premium colors. Refer to Drawings for pattern design. Refer to Section 09 05 15 – Color Design for color selection.

2.03 ACCESSORIES

- A. Rubber Base: Comply with ASTM F-1861, Type TP, Group 1 (solid) Standard Specification for Resilient Wall Base, with matching end stops and preformed or molded corner units.
  - 1. Base shall be 4 inches high, 0.125 inch gage, length 120 feet, standard top-set cove.
- B. Resilient Edge Strips: 1/8-inch thick, homogenous vinyl of rubber composition, tapered or bullnose edge, color to match flooring, or as selected by MDOT Architect from standard colors available; not less than 1 inch wide.

2.04 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.

- B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.
  - 1. Adhesives shall comply with the following limits for VOC content:
    - a. Vinyl Composition Tile Adhesives: 50 g/L or less.
    - b. Rubber Floor Adhesives: 60 g/L or less.
- C. Concrete Slab Primer: Non-staining type as recommended by flooring manufacturer.
- D. Floor Polish: Provide protective, liquid floor-polish products recommended by floor tile manufacturer.

### PART 3 - EXECUTION

#### 3.01 EXAMINATION

- A. Installer shall examine the areas and conditions under which resilient flooring and accessories are to be installed and notify the Contractor in writing of conditions detrimental to the proper and timely completion of the Work.
  - 1. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

#### 3.02 PREPARATION

- A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare according to ASTM F 710.
  - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
  - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
  - 3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
  - 4. Moisture Testing: Proceed with installation only after substrates pass testing according to floor tile manufacturer's written recommendations, but not less stringent than the following:
    - a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
    - b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level.
  - 5. Apply concrete slab primer, if recommended by flooring manufacturer, prior to application of adhesive.

- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install floor tiles until they are the same temperature as the space where they are to be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

### 3.03 FLOOR TILE INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor tile.
- B. Install flooring after finishing operations, including painting, have been completed and permanent-heating system is operating. Moisture content of concrete slabs, building air temperature and relative humidity must be within limits recommended by flooring manufacturer.
- C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
  - 1. Lay tiles with Grain Running In One Direction.
- D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.
- G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.
- H. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

### 3.04 ACCESSORIES INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilaster, casework and other permanent fixtures in rooms or areas where base is required. Install base in as long lengths as practicable (continuous between openings and wall to wall), with preformed corner units.

- C. Tightly bond base to backing throughout the length of each piece, with continuous contact at horizontal and vertical surfaces.
- D. Place resilient edge strips tightly butted to flooring and secure with adhesive. Install edging strips at all unprotected edges of flooring, unless otherwise shown.

3.05 PATTERN

- A. A simple color pattern shall be provided to Contractor with approved color chart and sample submittal using 3 or less colors.

3.06 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.
- B. Initial Cleaning: Remove excess adhesive or other surface blemishes, using neutral type cleaners as recommended by flooring manufacturer.
- C. Maintenance Immediately After Installation:
  - 1. Do not wash or scrub the floor for 5 days after installation to allow the floor tiles to bond to the underlayment / subfloor.
  - 2. Keep heavy furniture and equipment off the floor at least 48 hours to allow the adhesive to set.
  - 3. Sweep or vacuum thoroughly, and remove residual adhesive with a clean white cloth dampened with cleaners as recommended by flooring manufacturer.
  - 4. Apply 3 coats of manufacturers recommended high-quality cross-linked acrylic floor polish, allowing 60 minutes drying time between applications.
- D. Protection: Protect installed flooring from damage by covering with floor protection paper.
- E. Finishing: After completion of project and just prior to final inspection of Work, scrub the floor using a good quality non-alkaline cleaner and a floor machine of 170-250 rpm equipped with a green or blue scrubbing pad.
  - 1. Thoroughly rinse the floor (avoid flooding the floor) and allow the floor to dry completely.
  - 2. Apply 3 coats of manufacturers recommended high-quality, cross-linked acrylic floor polish, allowing 60 minutes between applications.
  - 3. After polish is completely dry, spray buff using a diluted (7 - 8 percent solids) floor polish. Before the liquid is dry, buff with a floor machine equipped with a white or tan buffing pad or a soft brush at 170-700 rpm. Buff until the liquid is dry and a thin glossy film remains.
  - 4. Protect completed Work from traffic and damage until acceptance by the Owner.

END OF SECTION

## SECTION 09 90 00

## PAINTS AND COATINGS

## PART 1 - GENERAL

## 1.01 SUMMARY

- A. Painting and finishing of exterior and interior exposed items and surfaces throughout the project, except as otherwise indicated. Surface preparation, priming and finish coats specified in this Section are in addition to shop priming and surface treatment specified under other Sections of the Work.
1. The Work includes field painting of exposed bare and covered pipes and ducts (including color coding), and of hangers, exposed steel and iron work, and primed metal surfaces of equipment installed under the mechanical and electrical Work, except as otherwise indicated.
  2. "Paint" means all coating systems materials, including primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate or finish coats.
  3. Paint all exposed surfaces whether or not colors are designated in "schedules", except where the natural finish of the material is specifically noted as a surface not to be painted. Where items or surfaces are not specifically mentioned, paint these the same as adjacent similar materials or areas. If color or finish is not designated, the Architect will select these from standard colors available for the materials system specified.
- B. Related Sections: Section 09 05 15 – Color Design.

## 1.02 PAINTING NOT INCLUDED

- A. The following categories of Work are not included as parts of the field-applied finish Work, or are included in other Sections of these Specifications.
- B. Shop Priming: Unless otherwise specified, shop priming of ferrous metal items is included under the various Sections for structural steel, miscellaneous metal, hollow metal work, and similar items. Also, for fabricated or factory-built mechanical and electrical equipment or accessories.
- C. Pre-Finished Items: Unless otherwise indicated, do not include painting when factory-finishing or installer finishing is specified for such items as (but not limited to) plastic toilet enclosures, prefinished partition systems, acoustic materials, architectural woodwork and casework, finished mechanical and electrical equipment including light fixture, switch-gear and distribution cabinets, elevator entrance frames, door and equipment.
- D. Concealed Surfaces: Unless otherwise indicated, painting is not required on surfaces such as walls or ceilings in concealed areas and generally inaccessible areas, foundations spaced, furred areas, utility tunnels, pipe spaces, duct shafts and elevator shafts.

- E. Finished Metal surfaces: Metal surfaces of anodized aluminum, stainless steel, chromium plate, copper, bronze and similar finished materials will not require finish painting, unless otherwise indicated.
- F. Operating Parts and Labels: Moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, linkages, sinkages, sensing devices, motor and fan shafts will not require finish painting, unless otherwise indicated. Do not paint over any code-required labels, such as Underwriter's Laboratories and Factory Mutual, or any equipment identification, performance rating, name, or nomenclature plates.

### 1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's technical information including basic materials analysis and application instructions for each coating material specified.
- B. Samples for Initial Selection: For each type of topcoat product indicated. Submit color samples for selection by Architect from manufacturer's full range of colors. Indicate submitted manufacturer's closest STANDARD colors that match colors specified or provide "Custom" color if not match.
- C. Samples for Verification: For each type of paint system and each color and gloss/sheen of topcoat indicated.
  - 1. Submit Samples on rigid backing, 8 inches square.
  - 2. Step coats on Samples to show each coat required for system.
  - 3. Label each coat of each Sample.
  - 4. Label each Sample for location and application area.
- D. Product List: For each product indicated, include the following:
  - 1. Comply with Articles 3.7 and 3.8 indicating each type of primer, intermediate coat and topcoat required for each substrate by product name and number.
  - 2. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
- E. Substitutions for Convenience: Architect will consider formal written requests from Contractor for substitution of products in place of those specified if received within 30 days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect. Substitutions which decrease the film thickness, the number of coats applied, change the generic type of coating or fail to meet the performance criteria of the specified materials WILL NOT be approved. All primers and topcoats plus the seam sealer and pit filler shall be furnished by the same manufacturer to ensure compatibility.

**1.04 QUALITY ASSURANCE**

- A. Mockups: Apply benchmark samples of each paint system indicated and each color and finish selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified.
    - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
    - b. Other Items: Architect will designate items or areas required.
  2. Final approval of color selections will be based on benchmark samples.
    - a. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Architect at no added cost to Owner.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver all materials to the job site in original, new and unopened packages and containers bearing manufacturer's name and label, and the following information:
1. Name or title of material.
  2. Fed. Spec. Number, if applicable.
  3. Manufacturer's stock number and date of manufacturer.
  4. Manufacturer's name.
  5. Contents by volume, for major pigment and vehicle constituents.
  6. Thinning instructions.
  7. Application instructions.
  8. Color name and number.
- B. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
1. Maintain containers in clean condition, free of foreign materials and residue.
  2. Remove rags and waste from storage areas daily.

**1.06 PROJECT CONDITIONS**

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paint in snow, rain, fog or mist; or when the relative humidity exceeds 85 percent; or to damp or wet surfaces; unless otherwise permitted by the paint manufacturer's printed instruction. Painting may be continued during inclement weather only if the areas and surfaces to be painted are enclosed and heated within the temperature limits specified by the paint manufacturer during application and drying periods.



**1.07 EXTRA MATERIALS**

- A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.
1. Quantity: Furnish an additional 5 percent, but not less than 1 gallon of each material and color applied.

**PART 2 - PRODUCTS****2.01 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Benjamin Moore & Company, Montvale, NJ. Tel. (800) 344-0400.
  2. Farrell-Calhoun Paint, Memphis, TN. Tel. (901) 526-2211.
  3. PPG Industries, Inc., Pittsburgh, PA. Tel (412) 434-3131.
  4. Sherwin-Williams Company, Cleveland, OH 44115. Tel. (800) 321-8194.
- B. Substitutions shall fully comply with specified requirements and Section 01 25 00-Substitution Procedures and Section 01 60 00-Product Requirements.

**2.02 COLORS AND FINISHES**

- A. Paint colors, surface treatments, and finishes will be selected from color chips submitted by contractor. Prior to beginning Work, the Architect will select color chips for surfaces to be painted. Use representative colors when preparing samples for review. Final acceptance of colors will be from samples.
- B. Colors Pigments: Pure, non-fading, applicable types to suit the substrates and service indicated. Lead content in the pigment, if any, is limited to contain not more than 0.5 percent lead, as lead metal based on the total non-volatile (dry-film) of the paint by weight.
- C. Paint Coordination: Provide finish coats which are compatible with prime paints used. Review other sections of these Specifications in which prime paints are to be provided to ensure compatibility of total coats system for various substrates. Upon request from other trades, furnish information on characteristics of finish materials provided for use, to ensure compatible prime coats are used. Provide barrier coats over incompatible primer or remove and reprime as required. Notify the Architect in writing of any anticipated problems using specified coating systems with substrates primed by others.

**2.03 MATERIAL QUALITY**

- A. Provide the best quality grade of the various types of coatings as regularly manufactured by acceptable paint materials manufacturers. Materials not displaying the manufacturer's identification as a standard, BEST GRADE product WILL NOT be acceptable. Proprietary names used to designate colors or materials are not intended to imply that products of the named manufacturers are required to the exclusion of equivalent products of other manufacturers.

- B. Provide undercoat paint produced by the same manufacturer as the finish coats. Use only thinners approved by the paint manufacturer, and use only within recommended limits.

### PART 3 - EXECUTION

#### 3.01 EXAMINATION

- A. Applicator must examine the areas and conditions under which painting Work is to be applied and notify the Contractor in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the Applicator. Starting of painting Work will be construed as the Applicator's acceptance of the surfaces and conditions within any particular area.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
  - 1. Concrete: 12 percent.
  - 2. Masonry (Clay and CMU): 12 percent.
  - 3. Wood: 15 percent.
  - 4. Plaster: 12 percent.
  - 5. Gypsum Board: 12 percent.
- C. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to the formation of a durable paint film.

#### 3.02 SURFACE PREPARATION

- A. Perform preparation and cleaning procedures in strict accordance with the paint manufacturer's instructions and as herein specified, for each particular substrate condition. Remove all hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be finish-painted, or provide surface-applied protection prior to surface preparation and painting operations. Remove, if necessary, for the complete painting of the items and adjacent surfaces. Following completion of painting of each space or area, re-install the removed items by workmen skilled in the trades involved. Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease prior to mechanical cleaning. Schedule the cleaning and painting so that contaminants from the cleaning process with not fall onto wet, newly painted surfaces.
- B. Ferrous Metals:
  - 1. Clean ferrous surfaces, which are not galvanized or shop-coated, of oil, grease, dirt, loose mill scale and other foreign substances by solvent or mechanical cleaning.
  - 2. Touch-up shop-applied prime coats wherever damaged or bare. Where required by other Sections of these Specifications, clean and touch-up with the same type shop primer.
- C. Galvanized Surfaces: Clean free of oil and surface contaminants with acceptable non-petroleum based solvent.

- D. Wood: Clean wood surfaces to be painted of all dirt, oil, or other foreign substances with scrapers, mineral spirits, and sandpaper, and dust off. 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.
1. Prime, stain, or seal wood required being job-painted, as soon as practicable upon delivery to job. Prime edges, ends, faces, under sides, and backsides of such wood, including cabinets, counters, cases, paneling, etc. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood-filler. Sandpaper smooth when dry.
  2. When transparent finish is required, use sealer as recommended by manufacturer. Seal tops, bottoms, and cutouts of unprimed wood doors with sealer immediately upon delivery to project.

### 3.03 MATERIALS PREPARATION

- A. Mix and prepare painting materials in accordance with manufacturer's directions. Store materials not in actual use in tightly covered containers. Maintain containers used in storage, mixing and application of paint in a clean condition, free of foreign materials and residue. Stir materials before application to produce a mixture of uniform density, and stir as required during the application of the materials. Do not stir surface film into the material. Remove the film and if necessary, strain the material before using.

### 3.04 APPLICATION

- A. Apply paint in accordance with the manufacturer's directions. Use applications and techniques best suited for the substrate and type of material being applied. Apply additional coats when undercoats, stains or other conditions show through the final coat of paint, until the paint film is of uniform finish, color and appearance. Give special attention to insure that all surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
- B. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Paint surfaces behind permanently fixed equipment or furniture with prime coat only before final installation of equipment. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint. Paint the back-sides of access panels, and removable or hinged covers to match the exposed surfaces.
- C. Finish exterior doors on tops, bottoms and side edges the same as the exterior faces, unless otherwise indicated.
- D. Sand lightly between each succeeding enamel or varnish coat.
- E. Omit the first coat (primer) on metal surfaces that have been shop-primed and touch-up painted, unless otherwise indicated or barrier coat is required for compatibility.
- F. Scheduling Paint: Apply the first-coat material to surfaces that have been cleaned, pretreated or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration. Allow sufficient time between successive coatings to permit proper drying. Do not re-coat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure and the application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.

- G. Minimum Coating Thickness: Apply each material at not less than the manufacturer's recommended spreading rate, to establish a total dry film thickness as indicated or, if not indicated, as recommended by coating manufacturer.
- H. Mechanical and Electrical Work: Painting of mechanical and electrical Work include items exposed to view in mechanical equipment rooms, in occupied spaces and where indicated on Drawings or specified in other Sections. Coordinate with Division 15 and Division 16 Sections.
1. Mechanical items to be painted include, but are not limited to, the following:
    - a. Piping, pipe hangers, and supports.
    - b. Heat exchangers.
    - c. Tanks.
    - d. Ductwork.
    - e. Motor, mechanical equipment and supports.
    - f. Accessory items.
  2. Electrical items to be painted include, but are not limited to, the following:
    - a. Conduit and fittings.
    - b. Switchgear.
- I. Prime Coats: Apply a prime coat of material which is required to be painted or finished, and which has not been prime coated by others. Re-coat primed and sealed surfaces where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn-through or other defects due to insufficient sealing.
- J. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color appearance and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, or other surface imperfections will not be acceptable.
- K. Transparent (Clear) Finishes: Use multiple coats to produce glass-smooth surface film of even luster. Provide a finish free of laps, cloudiness, color irregularity, runs, brush marks, orange peel, nail holes, or other surface imperfections. Provide satin finish for final coats, unless otherwise indicated.
- L. Completed Work: Match approved samples for color, texture and coverage. Remove, refinish or repaint Work not in compliance with specified requirements.

### 3.05 FIELD QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when paints are being applied:
1. Owner will engage the services of a qualified testing agency to sample paint materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
  2. Testing agency will perform tests for compliance of paint materials with product requirements.
  3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements.

4. Contractor shall remove non-complying-paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials.
5. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

### 3.06 CLEANING AND PROTECTION

- A. Cleaning: During the progress of the Work, remove from the site all discarded paint materials, rubbish, cans and rags at the end of each workday.
  1. Upon completion of painting work, clean window glass and other paint-spattered surfaces.
  2. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.
- B. Protection: Protect Work of other trades, whether to be painted or not, against damage by painting and finishing Work. Correct any damage by others for protection of their Work, after completion of painting operations. At the completion of Work of other trades, touch-up and restore all damaged or defaced painted surfaces.

### 3.07 EXTERIOR PAINTING SCHEDULE

- A. Provide the following Benjamin Moore paint systems for the various substrates, as indicated:
  1. Ferrous and Zinc Coated Metal
    - a. Prime Coat: Super Spec HP P04 Acrylic Metal Primer
    - b. Intermediate Coat: Super Spec HP P29 D.T.M. Acrylic Semi-gloss
    - c. Topcoat: Super Spec HP P29 D.T.M. Acrylic Semi-gloss
  2. Steel Shop Primed: (structural steel framing exposed to view including steel lintels)
    - a. Prime Coat: Super Spec HP P04 Acrylic Metal Primer
    - b. Intermediate Coat: Super Spec HP P77 Waterborne Urethane
    - c. Topcoat: Super Spec HP P77 Waterborne Urethane
- B. Provide the following Ferrell-Calhoun paint systems for the various substrates, as indicated:
  1. Ferrous and Zinc Coated Metal
    - a. Prime Coat: F/C #5-56 Waterborne 100% Acrylic All Purpose Metal Primer (1.8 mils DFT)
    - b. Intermediate Coat: F/C Tuff-Boy 8000 Line Waterborne 100% Acrylic DTM (1.7 mils DFT)
    - c. Topcoat: F/C Tuff-Boy 8000 Line Waterborne 100% Acrylic DTM (1.7 mils DFT)

2. Steel Shop Primed: (structural steel framing exposed to view including steel lintels)
    - a. Prime Coat: F/C #5-56 Waterborne 100% Acrylic All Purpose Metal Primer (1.8 mils DFT)
    - b. Intermediate Coat: F/C Tuff-Boy 8000 Line Waterborne 100% Acrylic DTM (1.7 mils DFT)
    - c. Topcoat: F/C Tuff-Boy 8000 Line Waterborne 100% Acrylic DTM (1.7 mils DFT)
- C. Provide the following PPG Industries Inc. paint systems for the various substrates, as indicated:
1. Ferrous and Zinc Coated Metal
    - a. Prime Coat: PPG Pitt Tech DTM Acrylic Primer Finish, 90-712 Series (2.0-3.0 mils dry)
    - b. Intermediate Coat: PPG Pitt Tech DTM Acrylic Gloss Enamel, 90-374 Series (2.0-3.0 mils dry)
    - c. Topcoat: PPG Pitt Tech DTM Acrylic Gloss Enamel, 90-374 Series (2.0-3.0 mils dry)
  2. Steel Shop Primed: (structural steel framing exposed to view including steel lintels)
    - a. Prime Coat: PPG Pitt Tech DTM Acrylic Primer Finish, 90-712 Series (2.0-3.0 mils dry)
    - b. Intermediate Coat: PPG Pitt Tech DTM Acrylic Gloss Enamel, 90-374 Series (2.0-3.0 mils dry)
    - c. Topcoat: PPG Pitt Tech DTM Acrylic Gloss Enamel, 90-374 Series (2.0-3.0 mils dry)
- D. Provide the following Sherwin-Williams paint systems for the various substrates, as indicated:
1. Ferrous and Zinc Coated Metal
    - a. Prime Coat: S-W ProCryl® Universal Primer, B66-310 Series (2.0-4.0 mils dry)
    - b. Intermediate Coat: Sher-Cryl™ HPA Acrylic, B66-350 Series (2.5-4.0 mils dry)
    - c. Topcoat: Sher-Cryl™ HPA Acrylic, B66-350 Series (2.5-4.0 mils dry)
  2. Steel Shop Primed: (structural steel framing exposed to view including steel lintels)
    - a. Prime Coat: S-W ProCryl® Universal Primer, B66-310 Series (2.0-4.0 mils dry)
    - b. Intermediate Coat: S-W Centurion® Water Based Urethane, B65-700 Series (2.0-3.0 mils dry)
    - c. Topcoat: S-W Centurion® Water Based Urethane, B65-700 Series (2.0-3.0 mils dry)

## 3.08 INTERIOR PAINTING SCHEDULE

- A. Provide the following Benjamin Moore paint systems for the various substrates, as indicated:

1. Gypsum Drywall (Semi-Gloss)
  - a. Prime Coat: #372 EcoSpec Interior Latex Primer Sealer
  - b. Intermediate Coat: #376 EcoSpec Interior Latex Semi-gloss Enamel
  - c. Topcoat: #376 EcoSpec Interior Latex Semi-gloss Enamel
2. Gypsum Drywall( Egg Shell)
  - a. Prime Coat: #372 EcoSpec Interior Latex Primer Sealer
  - b. Intermediate Coat: #374 EcoSpec Interior Latex Eggshell Enamel
  - c. Topcoat: #374 EcoSpec Interior Latex Eggshell Enamel
3. Gypsum Drywall (in wet areas)
  - a. Prime Coat: #372 EcoSpec Interior Latex Primer Sealer
  - b. Intermediate Coat: #256 Super Spec Acrylic Epoxy Coating
  - c. Topcoat: #256 Super Spec Acrylic Epoxy Coating
4. Ferrous and Zinc Coated Metal
  - a. Prime Coat: P04 Super Spec HP Acrylic Metal Primer
  - b. Intermediate Coat: #376 Eco Spec Interior Latex Semi-Gloss Enamel
  - c. Topcoat: #376 Eco Spec Interior Latex Semi-Gloss Enamel
5. Exposed Structural steel and Roof Deck (shop primed steel)
  - a. Prime Coat: P04 Super Spec HP Acrylic Metal Primer
  - b. Intermediate Coat: #153 Super Spec Sweep Up Spray Latex Flat
  - c. Topcoat: #153 Super Spec Sweep Up Spray Latex Flat
6. Painted Woodwork
  - a. Prime Coat: #372 Eco Spec Interior Latex Primer Sealer
  - b. Intermediate Coat: #376 Eco Spec Interior Latex Semi-Gloss Enamel
  - c. Topcoat: #376 Eco Spec Interior Latex Semi-Gloss Enamel
7. Stained woodwork
  - a. Prime Coat: Old Masters 240 VOC Stains
  - b. Intermediate Coat: #30531 All Pro Waterborne Polyurethane
  - c. Topcoat: #30531 All Pro Waterborne Polyurethane
8. Concrete Garage Floor Stain & Sealer (Opaque Color)
  - a. Prime Coat: #075 Benjamin Moore Waterproofing Sealer
  - b. Topcoat: #075 Benjamin Moore Waterproofing Sealer; P67 Anti-slip Aggregate added to the prime coat. Note-New concrete must be etched prior to application.

- B. Provide the following Ferrell-Calhoun paint systems for the various substrates, as indicated:

1. Gypsum Drywall (Semi-Gloss)
  - a. Prime Coat: F/C#235 Interior/Exterior 100% Acrylic Latex Undercoater (1.7 mils DFT)
  - b. Intermediate Coat: F/C 3300 Line 100% Acrylic Interior Semi-Gloss Enamel (1.6 mils DFT)
  - c. Topcoat: F/C 3300 Line 100% Acrylic Interior Semi-Gloss Enamel (1.6 mils DFT)

2. Gypsum Drywall( Egg Shell)
  - a. Prime Coat: F/C#235 Interior/Exterior 100% Acrylic Latex Undercoater (1.3 mils DFT)
  - b. Intermediate Coat: F/C 3900 Line Sun-Flo Interior Latex Acrylic Eggshell (1.6 mils DFT)
  - c. Topcoat: F/C 3900 Line Sun-Flo Interior Latex Acrylic Eggshell Enamel (1.9 mils DFT)
3. Gypsum Drywall (in wet areas)
  - a. Prime Coat: F/C#235 Interior/Exterior 100% Acrylic Latex Undercoater (1.7 mils DFT)
  - b. Intermediate Coat: F/C 3300 Line 100% Acrylic Interior Semi-Gloss Enamel (1.6 mils DFT)
  - c. Topcoat: F/C 3300 Line 100% Acrylic Interior Semi-Gloss Enamel (1.6 mils DFT)
4. Ferrous and Zinc Coated Metal
  - a. Prime Coat: F/C #5-56 100% Acrylic All Purpose Metal Primer (1.8 mils DFT)
  - b. Intermediate Coat: F/C 600 Line 100% Acrylic Interior Semi-Gloss Latex Enamel (1.9 mils DFT)
  - c. Topcoat: F/C 600 Line 100% Acrylic Interior Semi-Gloss Latex (1.9 mils DFT)
5. Exposed Structural steel and Roof Deck (shop primed steel)
  - a. Prime Coat: F/C #5-56 100% Acrylic All Purpose Metal Primer (1.8 mils DFT). Spot prime if needed.
  - b. Intermediate Coat: F/C #999 Tuff-Boy Water-Base Dry Fog Flat (3.2 mils DFT)
  - c. Topcoat: F/C #999 Tuff-Boy Water-Base Dry Fog Flat (3.2 mils DFT)
6. Painted Woodwork
  - a. Prime Coat: F/C #699 Waterborne 100% Acrylic Enamel Undercoater (1.6 mils DFT)
  - b. Intermediate Coat: F/C 600 Line 100% Acrylic Interior Semi-Gloss Latex Enamel (1.9 mils DFT)
  - c. Topcoat: F/C 600 Line 100% Acrylic Interior Semi-Gloss Latex Enamel (1.9 mils DFT)
7. Stained Woodwork
  - a. Prime Coat: Minwax 250 VOC Stains
  - b. Intermediate Coat: Minwax Waterbased Polyurethane (0.6 mils dry)
  - c. Topcoat: Minwax Waterbased Polyurethane (0.6 mils dry)
8. Concrete Garage Floor Stain & Sealer (Opaque Color)
  - a. Prime Coat: F/C Anvil #1500 Series Solid Color Acrylic Concrete Stain
  - b. Topcoat: F/C Anvil #1500 Series Solid Color Acrylic Concrete Stain. Skid-Tex Slip Resistant Additive to the topcoat. Note-New concrete must be etched prior to application.



- C. Provide the following PPG Industries, Inc. paint systems for the various substrates, as indicated:
1. Gypsum Drywall (Semi-Gloss)
    - a. Prime Coat: PPG Pure Performance Zero VOC Interior Latex Primer, 9-900 (1.4 mils dry)
    - b. Intermediate Coat: PPG Pure Performance Zero VOC Interior Latex Semi-Gloss, 9-500 (1.4 mils dry)
    - c. Topcoat: PPG Pure Performance Zero VOC Interior Latex Semi-Gloss, 9-500 (1.4 mils dry)
  2. Gypsum Drywall( Egg Shell)
    - a. Prime Coat: PPG Pure Performance Zero VOC Interior Latex Primer, 9-900 (1.4 mils dry)
    - b. Intermediate Coat: PPG Pure Performance Zero VOC Interior Latex Eggshell, 9-300 (1.4 mils dry)
    - c. Topcoat: PPG Pure Performance Zero VOC Interior Latex Eggshell, 9-300 (1.4 mils dry)
  3. Gypsum Drywall (in wet areas)
    - a. Prime Coat: PPG Pure Performance Zero VOC Interior Latex Primer, 9-900 (1.4 mils dry)
    - b. Intermediate Coat: PPG Pitt Glaze Waterborne Acrylic Epoxy, 16-551 Series (2.0-3.0 mils dry)
    - c. Topcoat: PPG Pitt Glaze Waterborne Acrylic Epoxy, 16-551 Series (2.0-3.0 mils dry)
  4. Ferrous and Zinc Coated Metal
    - a. Prime Coat: PPG Pitt-Tech DTM Acrylic Primer Finish, 90-712 (2.0 to 3.0 mils dry)
    - b. Intermediate Coat: PPG Interior Exterior Semi-Gloss Acrylic Metal Finish, 7-374 (1.5 to 2.0 mils dry)
    - c. Topcoat: PPG Interior Exterior Semi-Gloss Acrylic Metal Finish, 7-374 (1.5 to 2.0 mils dry)
  5. Exposed Structural steel and Roof Deck (shop primed steel)
    - a. Prime Coat: PPG Pitt-Tech DTM Acrylic Primer Finish, 90-712 (2.0 to 3.0 mils dry)-Spot prime if needed.
    - b. Intermediate Coat: PPG Super Tech WB Waterborne Acrylic Dry Fall, 6-725XI
    - c. Topcoat: PPG Super Tech WB Waterborne Acrylic Dry Fall, 6-725XI
  6. Painted Woodwork
    - a. Prime Coat: PPG Seal Grip Interior Acrylic Primer Finish, 17-951 (1.2 mils dry)
    - b. Intermediate Coat: PPG Interior Exterior Semi-Gloss Acrylic Metal Finish, 7-374 (1.5 to 2.0 mils dry)
    - c. Topcoat: PPG Interior Exterior Semi-Gloss Acrylic Metal Finish, 7-374 (1.5 to 2.0 mils dry)
  7. Stained woodwork
    - a. Prime Coat: PPG Olympic Interior Oil Based <250 Wood Stain.
    - b. Intermediate Coat: PPG Olympic Interior Water Based Polyurethane Varnish, 42784 (Gloss) 42786 (Satin) (0.8 to 1.1 mils dry)
    - c. Topcoat: PPG Olympic Interior Water Based Polyurethane Varnish, 42784 (Gloss) 42786 (Satin) (0.8 to 1.1 mils dry)

8. Concrete Garage Floor Stain & Sealer Solvent Based(Opaque Color)
    - a. Prime Coat: PPG Color Seal Solvent Based Acrylic Concrete Stain, PP3249.
    - b. Topcoat: PPG Color Seal Solvent Based Acrylic Concrete Stain, PP3249; Anti Slip Additive to the topcoat. Note-New concrete must be etched prior to application.
- D. Provide the following Sherwin-Williams paint systems for the various substrates, as indicated:
1. Gypsum Drywall (Semi-Gloss)
    - a. Prime Coat: S-W Harmony Low Odor Interior Latex Primer, B11W900 (1.3 mils dry)
    - b. Intermediate Coat: S-W Harmony Low Odor Interior Latex Semi-Gloss, B10 Series (1.6 mils dry)
    - c. Topcoat: S-W Harmony Low Odor Interior Latex Semi-Gloss, B10 Series (1.6 mils dry)
  2. Gypsum Drywall( Egg Shell)
    - a. Prime Coat: S-W Harmony Low Odor Interior Latex Primer, B11W900 (1.3 mils dry)
    - b. Intermediate Coat: S-W Harmony Low Odor Interior Latex Eg-Shel, B9 Series (1.6 mils dry)
    - c. Topcoat: S-W Harmony Low Odor Interior Latex Eg-Shel, B9 Series (1.6 mils dry)
  3. Gypsum Drywall (in wet areas)
    - a. Prime Coat: S-W Harmony Low Odor Interior Latex Primer, B11W900 (1.3 mils dry)
    - b. Intermediate Coat: S-W Waterbased Catalyzed Epoxy, B70W211/ B60V25 (2.5-3.0 mils dry)
    - c. Topcoat: S-W Waterbased Catalyzed Epoxy, B70W211/ B60V25 (2.5-3.0 mils dry)
  4. Ferrous and Zinc Coated Metal
    - a. Prime Coat: S-W ProCryl® Universal Primer, B66-310 Series (2.0-4.0 mils dry)
    - b. Intermediate Coat: S-W ProClassic Waterborne Acrylic Semi-Gloss, B31 Series (2.0-3.0 mils dry)
    - c. Topcoat: S-W ProClassic Waterborne Acrylic Semi-Gloss, B31 Series (2.0-3.0 mils dry)
  5. Exposed Structural steel and Roof Deck (shop primed steel)
    - a. Prime Coat: S-W ProCryl® Universal Primer, B66-310 Series (2.0-4.0 mils dry)-Spot prime if needed.
    - b. Intermediate Coat: S-W Waterborne Acrylic Dry Fall, B42W2
    - c. Topcoat: S-W Waterborne Acrylic Dry Fall, B42W2
  6. Painted Woodwork
    - a. Prime Coat: S-W Harmony Low Odor Interior Latex Primer, B11W900 (1.3 mils dry)
    - b. Intermediate Coat: S-W ProClassic Waterborne Acrylic Semi-Gloss, B31 Series (2.4-3.0 mils dry)
    - c. Topcoat: S-W ProClassic Waterborne Acrylic Semi-Gloss, B31 Series (2.4-3.0 mils dry)

7. Stained woodwork
  - a. Prime Coat: S-W Minwax 250 VOC Stains
  - b. Intermediate Coat: S-W WoodClassics Waterborne Polyurethane Varnish, A68 Series (1.0 mils dry)
  - c. Topcoat: S-W WoodClassics Waterborne Polyurethane Varnish, A68 Series (1.0 mils dry)
8. Concrete Garage Floor Stain & Sealer (Opaque Color)
  - a. Prime Coat: H&C Concrete Sealer Solid Color Solvent Based
  - b. Topcoat: H&C Concrete Sealer Solid Color Solvent Based; H&C SharkGrip Slip Resistant Additive to the topcoat. Note-New concrete must be etched prior to application.

END OF SECTION

SECTION 10 11 00 VISUAL DISPLAY UNITS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Markerboards.
2. Tackboards.

B. Related Sections:

1. Section 09 05 15 – Color Design (for color selections).
2. Division 26 Sections (for visual aid board electrical requirements).

1.02 ACTION SUBMITTALS

A. Product Data: For manufacturer's technical data and installation instructions for each material and component parts, including data substantiating materials comply with requirements.

B. Shop Drawings: For visual display surfaces. Include plans, elevations, sections, details, and attachments to other work.

1. Show locations of panel joints.
2. Include sections of typical trim members.

C. Samples: 3 copies of full range of color samples for each exposed product and for each color and texture specified.

1. Furnish 12-inch square samples of sheet materials and 12-inch lengths of trim members for color verification after selections have been made.

1.03 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for surface-burning characteristics of fabrics.

B. Warranties: Sample of special warranties.

1.04 CLOSEOUT SUBMITTALS

A. Maintenance Data: For visual display surfaces to include in maintenance manuals.

1.05 QUALITY ASSURANCE

A. Unless otherwise acceptable to Project Engineer / MDOT Architect, furnish all visual display boards by one manufacturer for entire project.

- B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame-Spread Index: 25 or less.
  - 2. Smoke-Developed Index: 50 or less.

1.06 WARRANTY

- A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer's standard form in which manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Surfaces lose original writing and erasing qualities.
    - b. Surfaces exhibit crazing, cracking, or flaking.
  - 2. Warranty Period: Life of the building.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Drawings and Specifications are based on products manufactured by Claridge Products and Equipment, Inc., P.O. Box 910, Harrison, AR 72602. Tel. (870) 743-2200.
- B. Equivalent products by the following manufacturers are acceptable:
  - 1. Best-Rite Manufacturing, Temple, TX, Tel. (800) 749-2258.
  - 2. Marsh Industries, Inc., New Philadelphia, OH, Tel. (800) 426-4244.
  - 3. PolyVision Corporation, Suwanee, GA, Tel. (800) 620-7659.
- C. Alternate Manufacturers: Products produced by other manufacturers that fully meet or exceed the specified requirements may be considered under provisions of Section 01 25 00 - Substitution Procedures and Section 01 60 00 - Product Requirements.

2.02 MATERIALS

- A. Markerboard: Equal to Claridge Series #LCS-2000-R type "A" factory built marker board with map rail with tan cork insert, jamb trim, and chalk trough with end closures. LCS = porcelain enamel liquid chalk surface on Duracore with 0.002 aluminum foil back approx. 1/2 inch thick overall, color # 32 white.
  - 1. Extruded aluminum trim to have anodized satin finish. Include standard eraser and assorted LCS markers.
  - 2. Size: 4 feet by 6 feet.
  - 3. One unit required unless additional units are indicated on the Drawings.

- B. Tackboard: Equal to Claridge Series # 1 type "CO" factory built tackboard.
  - 1. Tackboard is Claridge 1/4-inch Cork on 1/4 inch Hardboard, color as selected by Project Engineer / MDOT Architect from manufacturer's standards.
  - 2. Size: 4 feet by 6 feet.
  - 3. One unit required unless additional units are indicated on the Drawings.

### PART 3 - EXECUTION

#### 3.01 EXAMINATION

Installer shall examine areas and conditions under which units are to be installed and notify Contractor in writing of conditions detrimental to proper and timely completion of Work. Do not proceed with Work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

#### 3.02 INSTALLATION

- A. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display surfaces and wall surfaces.
- B. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation. Comply with Manufacturer's written installation instructions.
  - 1. If units are not shown on Drawings, install units in location(s) as directed by Project Engineer.

#### 3.03 ADJUSTING AND CLEANING

- A. Clean visual display surfaces according to manufacturer's written instructions. Attach one cleaning label to visual display surface in each room. Cover and protect visual display surfaces.

END OF SECTION

SECTION 10 14 00 SIGNAGE

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Signage for room identification system.
2. Truss emblem signage.

B. Related Sections: Section 09 05 15 – Color Design (for color selection).

1.02 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical data and installation instructions for each type of signage required.

B. Shop Drawings: For dimensional letter signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
3. Show message list, typestyles, graphic elements, and layout for each sign at least half size.

C. Samples: Submit 3 samples of each color and finish of exposed materials and accessories required for specialty signs. Project Engineer / MDOT Architect's review of samples will be for color and texture only.

1. When requested, furnish full-size samples of specialty sign materials.

D. Sign Schedule: Use same designations (Room numbers) specified or indicated on Drawings or in a sign schedule.

1.03 INFORMATIONAL SUBMITTALS

A. Sample warranty.

1.04 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.05 QUALITY ASSURANCE

A. Provide each type of sign as a complete unit produced by a single manufacturer including necessary mounting accessories, fittings and fastenings.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components correctly packed to prevent damage. Store in secure area out of weather. Handle per manufacturer's instructions.

1.07 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: Five years from date of Completion.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Drawings and Specifications for interior and exterior signage are based on products manufactured by ASI Sign Systems, Inc., 3890 W. NW Hwy, Suite 102, Dallas, TX. 75220. Tel. (800) 274-7732. Truss emblem signage (exterior) is based on products manufactured by Mohawk Sign Systems, Inc., Schenectady, NY. Tel. (518) 370-3433.
- B. Equivalent products by the following manufacturers are acceptable:
  - 1. Matthews International Corp., Pittsburgh, PA. Tel. (800) 628-8439.
  - 2. Metal Arts, Mandan, ND. Tel. (701) 663-6535.
  - 3. Mohawk Sign Systems, Inc., Schenectady, NY. Tel. (518) 370-3433.
  - 4. Scott Sign Systems, Inc., Sarasota, FL. Tel. (800) 237-9447.
- C. Alternate Manufacturers: Products produced by other manufacturers that fully meet or exceed the specified requirements may be considered under provisions of Section 01 25 00 - Substitution Procedures and Section 01 60 00 - Product Requirements.

2.02 PERFORMANCE REQUIREMENT SIGN SYSTEM

- A. Exterior Signage: Wall mounted LC Series, Helvetica and Helvetica Medium styles, size and location(s) as shown on Drawings. Text shall be center justified unless shown otherwise.
- B. Interior Signage: Wall or desktop mounted WS Series with rounded corners. Design so that paper insert can be installed from each end. Comply with 2010 ADA requirements.
- C. Truss Emblem Signage (Exterior): Wall mounted, Helvetica Medium styles, size as shown on Drawings.

2.03 COMPONENTS - EXTERIOR SIGNAGE

- A. Materials: Cast aluminum, projected mount with sleeve and stud.
- B. Finish: Baked enamel in manufacturer's standard color.



**2.04 COMPONENTS - TRUSS EMBLEM SIGNAGE (EXTERIOR)**

- A. Material: Emblem shall be made of (0.063) aluminum with a bright reflective paint or applied vinyl surface.
- B. Shape: Emblem shall be in the shape of an isosceles triangle measuring six (6) inches horizontally and three (3) inches vertically.
- C. Lettering: Emblem shall have letters printed in the center of the triangle based on the type of truss construction used in the building being identified by the emblem:
  - 1. "F" signifies floor with truss construction.
  - 2. "R" signifies roof with truss construction.
  - 3. "F/R" signifies both floor and roof with truss construction.
- D. Colors and Graphics:
  - 1. Text Style: Helvetica Medium.
  - 2. Boarder: 3/8 inch wide white boarder on all sides.
  - 3. Center Background Triangle Color: Red.
  - 4. Lettering: 1-1/4 inch tall lettering (F, R, or F/R) shall be white and centered on red background.
  - 5. Along base (6 inch length) of triangle centered on the white border include the following 1/4 inch tall all capital lettering in red:
    - a. Do Not Remove By Order Of the Local Fire Inspector.
- E. Accessories: Provide stainless steel mounting screws appropriate for surface to which sign will be mounted.
- F. See suggested layout at the end of this Section.

**2.05 COMPONENTS – INTERIOR SIGNAGE**

- A. Window Inserts: Laser printed paper insert with MDOT watermark will be furnished by Owner. Text will be left justified unless noted otherwise.
- B. Sign Face: Clear Acrylic, 0.080-inch thick, matte first surface.
- C. Adhesive: Pressure sensitive, adhesive film on second surface.
- D. Insert Guide Rails: 0.040-inch thick vinyl tape.
- E. Tactile Laminate: Polyamid Resin.
- F. Laminating Base: Acrylic, 0.080-inch thick.
- G. Fasteners: 0.030- inch thick, double-face tape.
- H. Stand: Clear Acrylic, 0.080-inch thick.

I. Sizes as Follows:

1. Type No. 1: 10 inches wide by 3 inches high.
2. Type No. 2: 6 inches wide by 9 inches high.

2.06 BRAILLE AND TACTILE COPY

- A. Comply with requirements of the Americans with Disabilities Act 2010. Tactile copy to be raised 1/32-inch minimum from sign first surface by manufacturer's photomechanical stratification processes. Translation of copy into Braille shall be the responsibility of the manufacturer.

2.07 FINISHES – INTERIOR SIGNAGE

- A. Color: Selected by Project Engineer / MDOT Architect from manufacturer's standard.
- B. Surface Texture: Matte.

2.08 FONT

- A. Font Type: Helvetica Medium, unless noted otherwise.

PART 3 - EXECUTION

3.01 EXANIMATION

- A. Contractor, with Installer present, shall examine the substrates and conditions under which the specialty signs are to be installed and notify the Project Engineer / MDOT Architect in writing of conditions detrimental to the proper and timely completion of the Work.
1. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.02 INSTALLATION – GENERAL

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions. Comply with ADA 2010 requirements.
1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
  2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
  3. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

### 3.03 INSTALLATION – INTERIOR SIGNAGE

- A. Install signs using mounting methods indicated and according to manufacturer's written instructions.
  - 1. Install sign units and components at the locations shown or scheduled, securely mounted with concealed theft-resistant fasteners, unless otherwise indicated. Attach signs to substrates in accordance with the manufacturer's instructions, unless otherwise shown.
  - 2. Install level, plumb, and at the proper height. Cooperate with other trades for installation of sign units to finish surfaces. Repair or replace damaged units as directed by the Project Engineer / MDOT Architect.
  - 3. Position sign on wall surface 2 inches from strike side of doorframe. Tactile characters on signs shall be located 48 inches minimum above the finish floor or ground surface, measured from the baseline of the lowest tactile character and 60 inches maximum above the finish floor or ground surface, measured from baseline of the highest tactile character (comply with 2010 ADA requirements).
- B. Mounting Method-Double Sided Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear strips of tape symmetrically to face of substrate. Place sign in position, and push to engage adhesive tape strips.
- C. Mounting Method-Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.

### 3.04 INSTALLATION – EXTERIOR SIGNAGE

- A. Install signs using mounting methods indicated and according to manufacturer's written instructions.
  - 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
  - 2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
- B. Mounting Method - Projected Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
  - 1. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place spacers on studs, place sign in position, and push until spacers are pinched between sign and substrate, embedding the stud ends in holes. Temporarily support sign in position until adhesive fully sets.

### 3.05 INSTALLATION – TRUSS EMBLEM SIGNAGE

- A. Install signs using mounting methods indicated and according to manufacturer's written instructions.

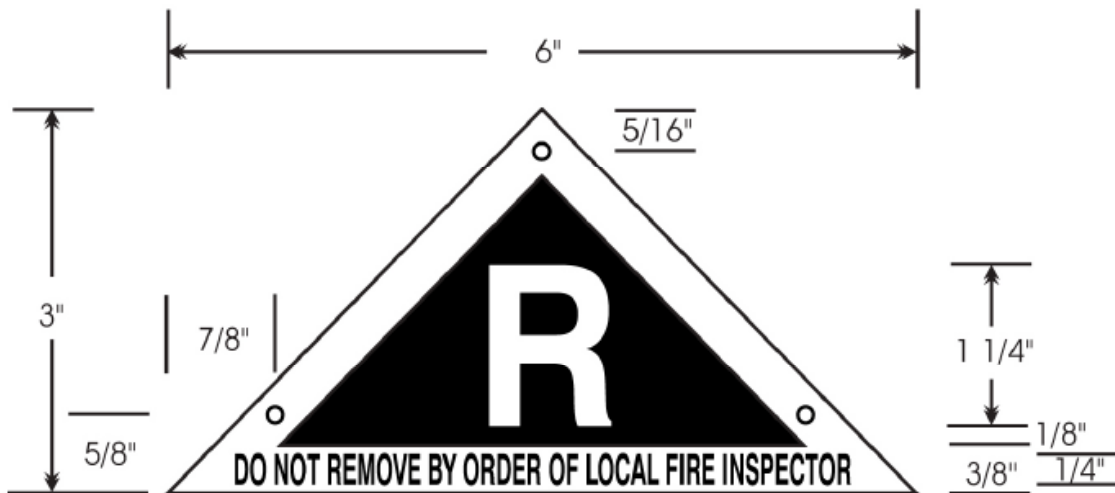
- B. Permanently affix emblem to the exterior of the building to the left of the main entrance door at a height of 5'-0" above the finish floor or grade.
- C. Mounting Method-Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.

3.06 SCHEDULES – INTERIOR SIGNAGE

- A. Sign Type No. 1: Offices, Single Occupant Crew Room
- B. Sign Type No. 2: Toilet Rooms

3.07 SCHEDULES – EXTERIOR SIGNAGE

- A. Building Letters: Flat – Letter style will be determined by Project Engineer / MDOT Architect from all styles available.
  - 1. 12 inches high, 11 Letters: MAINTENANCE
- B. Truss Emblem Signage:



END OF SECTION

SECTION 10 21 15

SOLID PLASTIC TOILET COMPARTMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Solid-plastic (polymer) toilet compartments, floor-mounted and overhead braced.
2. Solid-Plastic wall-hung urinal screens.

B. Related Sections: Section 09 05 15 – Color Design (for color selected).

1.02 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's sample warranty, color charts and detailed technical data for materials, fabrication, and installation, including catalog cuts of anchors, hardware, fastenings, and accessories.

B. Shop Drawings: Submit job-specific shop drawings for fabrication and erection of toilet compartment assemblies not fully described by product drawings, templates, and instructions for installation of anchorage devices built into other Work.

1.03 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.04 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84, or another standard acceptable to authorities having jurisdiction, by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities" and ICC/ANSI A117.1 for toilet compartments designated as accessible.

C. Field Measurements: 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 wherever taking of field measurements before fabrication might delay Work.

D. Coordination: Furnish inserts and anchorage, which must be built into other work for installation of toilet partitions and related work; coordinate delivery with other work to avoid delay.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Upon receipt of toilet partitions and other materials, installer shall examine the shipment for damage and completeness. Materials shall be stored in a clean, dry place. Stack all materials to prevent damage.

1.06 WARRANTY

- A. Manufacturer: Furnish a written warranty covering all plastic components against breakage, warping, corrosion and delamination for a period of 15 years.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Drawings and Specifications are based on products manufactured by Rockville Partitions, P. O. Box 159, Pisgah, AL 35785. Tel. (256) 451-1300.
- B. Equivalent products by the following manufacturers are acceptable:
  - 1. Comtec Industries, Scranton, PA. Tel (800) 445-5148.
  - 2. Knickerbocker Partition Corp, Freeport, NY. Tel. (516) 546-0550.
  - 3. The Mills Company, Willoughby, OH. Tel. (440) 951-8877.
  - 4. Santana Products Co., Inc., Scranton, PA. Tel (510) 343-7921.
- C. Alternate Manufacturers: Products produced by other manufacturers that fully meet or exceed the specified requirements may be considered under provisions of Section 01 25 00 - Substitution Procedures and Section 01 60 00 - Product Requirements.

2.02 MATERIALS

- A. General: Provide materials that have been selected for surface flatness and smoothness. Exposed surfaces that exhibit pitting, seam marks, roller marks, stains, discoloration, telegraphing of core material, or other imperfections on finished units are not acceptable.
- B. Doors, partitions, pilasters and urinal screens shall be fabricated from High Density Polyethylene (HDPE) material manufactured under high pressure forming a single component section which is waterproof, non- absorbent and has a self-lubricating surface that resists marring with pens, pencils or other writing utensils. All to arrive at job site with special protective plastic covering.
- C. Characteristics: Dual component compression molded High Density Polyethylene (HDPE) of solid virgin resin materials in colors that extend throughout the surface; doors, partitions and pilaster shall have (HDPE) as the core material).
  - 1. Doors, partitions, pilasters and urinal screens shall be a minimum of 1 inch thick and all edges machined to a radius of 0.250 inch and all exposed surfaces to be free of saw marks.
  - 2. Doors and dividing panels shall be 55 inches high and mounted 14 inches above the finish floor.

3. Pilasters shall be 82 inches high and fastened into a 3-inch high stainless steel pilaster shoe with a stainless steel, torx head sex bolt.
4. Urinal screens shall be 24 inches wide X 42 inches high with 41 inch continuous aluminum wall brackets.
5. Finish shall be similar and equal to standard color chart selections from Rockville. Color of doors and pilasters to be selected by the Project Engineer / MDOT Architect from Manufacturer's full color range.
6. Aluminum (heat sinc) edging strips to be fastened to the bottom edge of all doors and panels using vandal proof stainless steel fasteners.

## 2.03 HARDWARE

### A. Door Hardware:

1. Hinges: Aluminum continuous for door height.
2. Each door shall be supplied with one coat bumper / hook made of chrome plated zamak. Each handicapped door to include 2 door pulls and one wall stop. (Comply with ADA 2010).
3. Door Strike and Keeper: fabricated from heavy-duty aluminum extrusion (6463-T5 alloy).
  - a. Finish: Clear anodized finish.
  - b. Length of Strike: 6 inches.
  - c. Fasteners: Wrap around flange surface mounted and through bolted to pilaster with one-way sex bolts.
4. Door Latch: Housing: Fabricated from heavy-duty aluminum extrusion (6463-T5 alloy).
  - a. Finish: Clear anodized finish.
  - b. Fasteners: Surface mounted and through bolted to door with one-way sex bolts.
  - c. Slide Bolt and Button: Heavy aluminum with a black anodized finish.

### B. Wall Brackets: Full-length continuous aluminum. Brackets shall be used for all pilasters to pilaster and pilasters to wall connections.

1. Attach brackets to adjacent wall construction with No. 14 by 1-1/2 inch stainless steel Phillips head screws.
2. Anchor screws directly behind the vertical edge of pilasters at 12-inch intervals along the full length of bracket and at each 12-inch interval alternately spaced between anchor connections.

### C. Headrail: Heavy-duty extruded aluminum (6463-T5 alloy) with anti-grip design.

1. Finish: Clear anodized finish.
2. Fasteners: Fastened to the headrail bracket by a stainless steel, torx head sex bolt, and fastened to the tops of pilasters with stainless steel, tamper resistant torx screws.

### D. Handrail Brackets: Headrail brackets shall be 16-gage stainless steel with a satin finish, and secured to the wall with #14 stainless steel screws.

### E. Accessories: Furnish units with chromium-plated finish, unless otherwise indicated.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
- B. Clearances: Maximum 1/2 inch between pilasters and panels; 1 inch between panels and walls. Clearance at vertical edges of doors shall be uniform top to bottom and shall not exceed 1/4 inch.

3.02 ADJUSTING

- A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

3.03 CLEANING

- A. Clean exposed surfaces of partition systems using materials and methods recommended by manufacturer, and provide protection as necessary to prevent damage during remainder of construction period.

END OF SECTION



SECTION 10 28 13 TOILET ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Mirrors
2. Toilet Paper Dispenser
3. Grab Bars
4. Soap Dispensers
5. Paper Towel Dispenser
6. Clothes Hook
7. Mop Holder
8. Under Lavatory Guards (required where hot water line is exposed).

1.02 ACTION SUBMITTALS

- A. Product Data: Manufacturer's product and technical data indicating compliance with these specifications and shop drawings for the fabrication and installation of all toilet accessories. Show all anchorage and other necessary items including mounting heights.
- B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
1. Identify locations using room designations indicated.
  2. Identify products using designations indicated.

1.03 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.04 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.05 QUALITY ASSURANCE

- A. Provide products of the same manufacturer for each type of accessory unit and for units exposed in the same areas, unless otherwise acceptable to the MDOT Architect. Stamped names or labels on exposed faces of units will not be permitted, except where otherwise indicated.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Upon receipt of toilet accessories and other materials, examine the shipment for damage and completeness. Materials shall be stored in a clean, dry place. Stack all materials to prevent damage.

## 1.07 WARRANTY

- A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.
1. Warranty Period: 15 years from date of Completion.

## PART 2 - PRODUCTS

## 2.01 PUBLIC-USE WASHROOM ACCESSORIES

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings (Bradley Washroom Accessories Division, P.O. Box 309, Menomonee Falls, WI 53051. Tel. (414) 354-0100) or comparable product by one of the following:
1. A & J Washroom Accessories, Inc., New Windsor, NY. Tel. (845) 562-3332.
  2. Bobrick Washroom Equipment, Inc., Jackson, TN. Tel. (731) 424-7000.
  3. Plumberex Specialty Prod., Inc. Palm Springs, CA. Tel. (800) 475-8629.
  4. TCI Products. Hillsboro, OR. Tel. (866) 533-4273.
  5. Truebro, Inc., Ellington, CT. Tel. (800) 340-5969.
- B. Mirrors: Provide 1/4 inch polished plate glass, electrolytically plated mirrors with 1/2 inch stainless steel channel frame. Mirrors shall be 24 inches by 36 inches equal to Bradley model 780-2436. Locate at each toilet lavatory mounted in locations shown.
- C. Toilet Paper Dispenser: Provide surface mounted stainless steel multi-roll toilet tissue dispenser equal to Bradley model 5402. Locate at each toilet mounted in locations shown.
- D. Grab Bars: Provide 1-1/2 inch diameter horizontal 2 wall stainless steel grab bars with safety-grip non-slip finish and concealed mounting equal to Bradley model 8122. Locate at toilets where indicated at heights shown. Contractor shall provide at each water closet one 36-inch horizontal grab bar one 42-inch horizontal grab bar and one 18-inch vertical grab bar; installation must meet all ADA requirements.
- E. Soap Dispensers: Provide surface mounted liquid type stainless steel soap dispenser units equal to Bradley model 6542 (Horizontal) or 6562 (Vertical) as indicated on the Drawings. Locate at each lavatory at heights shown.
- F. Paper Towel Dispenser: Provide surface mounted stainless steel paper towel dispensers equal to Bradley model 250-15. Locate at each area with lavatory/sink where shown and at height shown.
- G. Clothes Hook: Provide surface mounted stainless steel hook equal to Bradley model 9135 at each Toilet Room, unless coat hooks are provided with toilet partition doors.

- H. Mop Provide surfaced mounted stainless steel mop and broom holder equal to Bradley model 9933. One piece construction with welded gusset and hooks. Holder consists of spring activated rubber cams on plated steel retainers. Unit measures 14 inches high by 34 inches long, with 4 hooks and 3 holders. Shelf projects 8 inches. Locate at each service sink where shown and at height shown or if not shown then per the Project Engineer's instructions.
- I. Under Lavatory Guard:
  - 1. Description: Insulating pipe covering for supply and drain piping assemblies that prevent direct contact with and burns from piping, and allow service access without removing coverings.
  - 2. Material and Finish: Antimicrobial, molded-plastic, white.

2.02 FABRICATION

- A. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine the areas and conditions under which toilet accessories are to be installed. Do not proceed with the Work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Installation General: Comply with all ADA 2010 requirements including proper mounting heights.
- B. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
  - 1. Use concealed fastenings wherever possible.
  - 2. Provide theft-resistant fasteners for all accessory mountings.
  - 3. Install concealed mounting devices and fasteners fabricated of the same material as the accessories, or of galvanized steel, as recommended by manufacturer.
  - 4. Install exposed mounting devices and fasteners finished to match the accessories.
- C. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F 446.

END OF SECTION

SECTION 10 43 15

DEFIBRILLATORS AND CABINETS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Automated external defibrillator, including cabinet, accessories and mounting brackets

1.02 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical data and installation instructions.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product manufactured / distributed by (J.L. Industries, Inc., 4450 W. 78<sup>th</sup> Street Circle, Bloomington, MN 55435. Tel. (612) 835-6850) or comparable product by one of the following:
  - 1. Philips Healthcare, Andover, MA. Tel. (866) 333-4246.
  - 2. Physio-Control, Inc., Redmond, WA. Tel. (800) 442-1142.
- B. Alternate Manufacturers: Products produced by other manufacturers that fully meet or exceed the specified requirements may be considered under provisions of Section 01 25 00 - Substitution Procedures and Section 01 60 00 - Product Requirements.

2.02 AUTOMATED EXTERNAL DEFIBRILLATOR

- A. Defibrillator: Provide Defibrillator for location(s) as indicated on the Drawings, equal to Medtronic LIFEPAK® CR "plus".
- B. Cabinets: Provide cabinet(s) equal to J.L. Industries stainless steel recessed type cabinet complying with ADA requirements. Provide Fire-FX option where located in a fire rated wall. Cabinet shall accommodate the Medtronic LIFEPAK® CR "plus" Defibrillator. Provide complete unit(s) with Commander Alarm and Saf-T-Lok™ options.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine the areas and conditions under which automated external defibrillator(s) are to be installed. Do not proceed with the Work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Installation General: Comply with all ADA requirements including proper mounting heights.
- B. Install items included in this section in locations and at mounting heights indicated, or if not indicated, at heights to comply with applicable regulations of governing authorities.
- C. Securely fasten mounting brackets to structure, square and plumb, to comply with manufacturer's instructions.
- D. Defibrillator unit(s) shall be mounted in exposed locations as indicated on the Drawings, or if not indicated, as directed by the Project Engineer/ MDOT Architect. A minimum of one unit is required.
- E. Check cabinet(s) for scratched, nicked, and other surface defects. Cabinet(s) with these conditions shall be repaired or replaced.

3.03 CLEANING AND PROTECTION:

- A. At completion of installation, clean surfaces in accordance with manufacturer's instructions.
- B. Protect unit(s) from damage until acceptance by Owner.

END OF SECTION

SECTION 10 44 16 FIRE EXTINGUISHERS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Portable multi-purpose, dry-chemical and class K wet chemical fire extinguishers including cabinets, accessories and mounting brackets.

1.02 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical data and installation instructions for all portable fire extinguishers required.

1.03 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.04 QUALITY ASSURANCE

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
- C. Coordinate type and capacity of fire extinguishers with fire protection cabinets to ensure fit and function.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Drawings and Specifications are based on products manufactured by J.L. Industries, Inc., 4450 W. 78<sup>th</sup> Street Circle, Bloomington, MN 55435. Tel. (612) 835-6850.
- B. Equivalent products by the following manufacturers are acceptable:
  - 1. Amerex Corp., Trussville, AL. Tel. (205) 655-3271.
  - 2. Larsen's Mfg. Co., Minneapolis, MN. Tel. (612) 571-1181.
  - 3. Potter-Roemer, Santa Ana, CA. Tel. (800) 366-3473.
- C. Alternate Manufacturers: Products produced by other manufacturers that fully meet or exceed the specified requirements may be considered under provisions of Section 01 25 00 - Substitution Procedures and Section 01 60 00 - Product Requirements.

2.02 FIRE EXTINGUISHERS

- A. Provide fire extinguishers for each location indicated, in colors and finishes that comply with requirements of governing authorities.
- B. Multi-Purpose Dry Chemical for Cabinet Mounting: Equal to J.L. Industries Cosmic 10E, UL rated 4A-80BC, 10 lb. nominal capacity.
- C. Class K Wet Chemical for Cabinet Mounting: Equal to J.L. Industries Saturn 15, UL rated 2-A: 1-B: C: K, 6 liters nominal capacity.

2.03 MOUNTING BRACKETS

- A. Mounting Brackets: Provide manufacturer's bracket designed to prevent accidental dislodgment of extinguisher, of proper size for type and capacity of extinguisher indicated, in manufacturer's standard plated finish.

2.04 EXTINGUISHER CABINETS

- A. Equal to J.L. Industries Cosmopolitan 1032F17 with ADAC option. Cabinet shall accommodate the Cosmic 10E extinguisher. Provide black die-cut letters, vertical.
- B. Equal to J.L. Industries Cosmopolitan stainless steel cabinet with return trim, rolled edge recessed model 2032F17 including ADAC option with flush pull handle. Cabinet shall accommodate the Saturn 15 extinguisher. Provide black die-cut letters, vertical.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install items included in this section in locations and at mounting heights indicated, or if not indicated, at heights to comply with ADA 2010 and applicable regulations of governing authorities.
- B. Examine fire extinguishers for proper charging and tagging.
  - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- C. Securely fasten mounting brackets to structure, square and plumb, to comply with manufacturer's instructions.
- D. Fire Extinguisher units shall be mounted in exposed locations indicated, or if not indicated, in a manner such that no point in the building will be further than 75 feet from an extinguisher. A minimum of seven (7) units are required unless additional units are indicated otherwise on Drawings. Units shall be required within 20' of all exits. Type K unit shall be required in the Crew Room

END OF SECTION

SECTION 10 51 13 METAL LOCKERS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Locker units with hinged doors, metal bases, tops, filler panels, closed bases, finished end panels, accessories and hardware.

1.02 REFERENCES

- A. ANSI/ASTM A446 – Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.
- B. ANSI/ASTM A526 – Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality.

1.03 ACTION SUBMITTALS

- A. Product Data: Submit manufacturer's installation instructions and product data on locker types, sizes and accessories.
- B. Shop Drawings: Include plans, elevations, sections, details, attachments to other work, and locker identification system and numbering sequence.
- C. Samples: Furnish 3 samples of materials, texture, color and finishes available for Project Engineer / MDOT Architect's selection.

1.04 CLOSEOUT SUBMITTALS

- A. Maintenance data.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Drawings and Specifications are based on products manufactured by Penco Products, Inc., 99 Brower Ave, Oaks, PA 19456. Tel. (800) 562-1000.
- B. Equivalent products by the following manufacturers are acceptable:
  - 1. Art Metal Products, Deerfield, FL. Tel. (800) 252-5633.
  - 2. Lyon Metal Products, Aurora, IL. Tel. (800) 323-0082.
  - 3. Republic Storage System Co, Inc., Canton, OH. Tel. (800) 477-1255.
- C. Alternate Manufacturers: Products produced by other manufacturers that fully meet or exceed the specified requirements may be considered under provisions of Section 01 25 00 - Substitution Procedures and Section 01 60 00 - Product Requirements.



2.02 PERFORMANCE REQUIREMENTS

- A. Accessibility Requirements: For lockers indicated to be accessible, comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC A117.1.

2.03 SELECTED UNIT

- A. Vanguard Model 6175V Single Tier Locker with standard louvered doors. Size: 72 inches overall height by 15 inches width by 21 inches depth. Provide closed bases and finished end panels.

2.04 MATERIALS

- A. All parts shall be made from prime grade mild cold rolled sheet steel free from surface imperfection, and capable of taking a high grade enamel finish.

2.05 ACCESSORIES

- A. Each locker tier shall have chrome plated zinc alloy die-cast case and door handle, door latch channel assembly, polished aluminum number plate (2-1/4 inches wide x 1 inch high with 3/8 inch high black etched numerals), hat shelf approximately 9 inches below top of locker and coat rod.

2.06 FINISHES

- A. Chemically pretreat metal with a six stage cleaning phosphatizing and metal preparation process. Finish coat shall be hot airless electrostatically applied baked on enamel.
- B. Paint lockers in color as selected by the Project Engineer / MDOT Architect from manufacturer's standard range of 17 colors. Refer to Section 09 05 15-Color Design.

2.07 FABRICATION

- A. Fabricate metal lockers square, rigid, without warp, and with metal faces flat and free of dents or distortion. Make exposed metal edges safe to touch and free of sharp edges and burrs.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install metal lockers at location show on Drawings in accordance with manufacturer's instructions for plumb, level, and flush installation.
- B. Secure lockers with anchor devices to suit substrate materials. Minimum pullout force: 100 lbs. Bolt adjoining lockers units together to provide rigid installation.
- C. Install bases, end panels, filler panels and accessories.

3.02 ADJUSTING

- A. Adjust doors and latches to operate without binding. Verify that latches are operating satisfactorily.

3.03 TOUCH-UP PAINT

- A. Touch-up all marred finished with factory supplied paint. Color shall match finished product.

3.04 CLEANING

- A. Clean locker interiors and exterior surfaces. Comply with manufacturer's written instructions.

END OF SECTION

SECTION 10 56 13

METAL STORAGE SHELVING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Metal storage shelving, work benches, and safety cabinets as indicated on the Drawings.

1.02 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical data and installation instructions for each material and component part, including data substantiating that materials comply with requirements.
- B. Color Charts: For (3 copies) each exposed product.

PART 2 - PRODUCTS

2.01 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. Lyon Metal Products, Aurora, IL. Tel. (603) 892-8941.
  - 2. Eagle Manufacturing Company, Wellsburg, WV. Tel. (304) 737-3171.
  - 3. Penco Products Inc., Oaks, PA. Tel. (610) 666-0500.
  - 4. Stanley Storage Systems, Allentown, PA. Tel. (800) 523-9462.
- B. Substitutions that fully meet or exceed the specified requirements may be considered under provisions of Section 01 25 00 - Substitution Procedures and Section 01 60 00 - Product Requirements.

2.02 STORAGE SHELVING, MODULAR WORK BENCHES

- A. Metal Storage Shelving: Equal to Penco Products Open Clipper Heavy Duty Steel Shelving Unit Model No. 1H7026, 36 inches wide, 18 inches deep, and 87 inches high with 6 shelves.
- B. Modular Work Bench: Model No. 32038, Tuff Top™ (Resin Board) top bench, 72 inches wide, 28 inches deep, and 34 inches high with 2 cabinet pedestals and 2 bases. Cabinet pedestals, 15-3/4 inches wide, 20 inches deep and 27 inches high with one adjustable shelf and locking handle with 2 keys.

- C. Finish: Manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
  - 1. Color will be selected from standard color chart by Project Engineer / MDOT Architect. Refer to Section 09 05 15 – Color Design for color selected.

2.03 SAFETY CABINET

- A. Safety Cabinet: Equal to Eagle Manufacturing 90 Gallon Tower™ Safety Cabinet model 1992LEGS. Cabinets shall meet OSHA, NFPA Code 30 and FM approval.
  - 1. Shelves: 2 shelves 30 inches deep.
  - 2. Legs: 4 inches high.
  - 3. Finish Color: Yellow.
  - 4. Dimensions: 43 inches wide by 34 inches deep by 69 inches high.
  - 5. Door Style: 2 manual close.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install units plumb and level, in locations and with mountings as indicated.
- B. Securely attach all components together in accordance with manufacturer's installation instructions.
  - 1. Securely fasten units to adjacent units and to wall as required so that units will not move or fall.

3.02 CLEANING AND PROTECTION

- A. At completion of installation, clean surfaces in accordance with manufacturer's instructions.
- B. Protect units from damage until acceptance by Owner.

END OF SECTION

SECTION 10 57 13

HAT AND COAT RACKS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Wall mounted tubular steel hat and coat racks.
- B. Related Sections: Section 06 10 00 – Rough Carpentry (for wall blocking).

1.02 ACTION SUBMITTALS

- A. Product Data: Submit manufacturer's product data and installation instructions.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Drawings and Specifications are based on products manufactured by Raymond Engineering, Inc., 704 Vandalia Street, St. Paul, MN 55114. Tel. (800) 365-5770.
- B. Equivalent products by the following manufacturers are acceptable:
  - 1. A.J. Binns Ltd., South Burlington, VT. Tel: (802) 655-7502.
  - 2. Magnuson Group Inc., Woodridge, IL. Tel: (800) 342-5725.
- C. Substitutions shall fully comply with specified requirements and Section 01 25 00 - Substitution Procedures and Section 01 60 00 - Product Requirements.

2.02 COAT RACK

- A. Equal to Rigid – Rak Model 315.

2.03 MATERIALS

- A. Brackets: (3 req'd per rack) are 1-1/8 inch sq. tubing with mitered angle and hidden weld.
- B. Shelf Tubes: (3 required per rack) are 3/4 inch round steel tube.
- C. Accessories: Model 913 hooks (12 required per rack) mounted on alternate tubes.
- D. Finish: Bright commercial nickel chrome.
- E. Size: 5 feet long by 12 -1/4 inches deep.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install unit(s) plumb and level, at location(s) shown on Drawings or if not shown, as directed by the Project Engineer. A minimum of one unit is required, unless additional units are indicated on the Drawings. Securely attach to supporting structure, in accordance with manufacturer's installation instructions.

3.02 CLEANING AND PROTECTION

- A. At completion of installation, clean surfaces in accordance with manufacturer's instructions. Protect units from damage.

END OF SECTION

SECTION 10 73 16                      CANOPIES

PART 1 - GENERAL

1.01        SUMMARY

- A.    Section Includes: Extruded aluminum wall-supported canopies as shown on the Drawings and specified herein.
- B.    Related Sections:
  - 1.    Section 07 92 00 – Joint Sealants.
  - 2.    Section 09 05 15 – Color Design.
  - 3.    Section 13 34 19 – Metal Building Systems.

1.02        ACTION SUBMITTALS

- A.    Product Data: For each type of product.
- B.    Shop Drawings: Showing fabrication and installation of canopies including plans, elevations and details of components and attachments to other units of work. Indicate materials, profiles of each metalwork member and fitting, joinery, finishes, fasteners, anchorage and accessory items.
- C.    Samples: Samples for initial selection purposes (3 required) in form of manufacturer's color charts consisting of actual units or sections of units showing full range of colors and other finish characteristics available for each item indicated below:
  - 1.    Include 6-inch long samples of linear shapes.
  - 2.    Include 6-inch square samples of plates.
  - 3.    Include full-size samples of castings and forgings.

1.03        DELIVERY, STORAGE AND HANDLING

- A.    Store materials in clean, dry location, away from polyethylene sheeting in a manner that permits air circulation within covering. Handle metalwork on site to a minimum; exercise care to avoid damaging metal finishes.

PART 2 - PRODUCTS

2.01        PERFORMANCE REQUIREMENTS

- A.    Installed products shall comply with the International Building Code, include structural computations, material properties, and other information needed for structural analysis which has been prepared by, or under the supervision of, a qualified professional engineer registered in the State of Mississippi.

2.02 ACCEPTABLE MANUFACTURERS

- A. Drawings and Specifications are based on products manufactured by Mapes Industries, Inc., 2929 Cornhuskers Hwy, Lincoln, NE 68504. Tel. (800) 228-2391.
- B. Equivalent products by the following manufacturers are acceptable:
  - 1. E.L. Burns Co., Inc., Shreveport, LA 71149. Tel. (318) 636-2722.
  - 2. Dittmer Arch. Alum., Winter Springs, FL. Tel (800) 822-1755.
  - 3. Mason - Florida, LLC, Leesburg, FL. Tel. (877) 577-0300.
  - 4. Peachtree Protective Covers, Inc., Hiram, GA. Tel. (800) 341-3325.
- C. Substitutions shall fully comply with specified requirements and Section 01 25 00 - Substitution Procedures and Section 01 60 00 - Product Requirements.

2.03 MATERIALS

- A. Canopy sections shall consist of 3003-H14 or 5005-H14 roll-formed aluminum, combined with 6063-T6 extruded aluminum intermediate supports. Fasteners shall be stainless steel or cadmium plated as provided by the manufacturer.
- B. Roof deck shall be roll-formed interlocking self-flashing .032 inch thick aluminum of "W" profile.
  - 1. Deck sections shall be designed to the proper length to withstand the design load as determined by the local code.
  - 2. Deck width shall be 12 inches on center and 2-1/2 inches deep.
- C. Hanger rods shall be galvanized steel pipe with cast and cadmium-plated clevis and reducers at ends for attachment to the wall eyebolts and canopy decking.
- D. Water drainage shall be accomplished as a spill out on the front corners.

2.04 MANUFACTURED UNITS

- A. Equal to "Lumishade" all weather aluminum hangar rod canopy with roll-formed interlocking deck members and style "J", 1/8 inch thick by 8 inches high heavy extruded aluminum, fascia.

2.05 FINISHES

- A. Powder Coated Finish: Color to be selected by the Project Engineer / MDOT Architect from manufacturer's complete selection of standard colors. Refer to Section 09 05 15 – Color Design for color selected.



PART 3 - EXECUTION

3.01 INSTALLATION

- A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible, to ensure proper fitting of metalwork. Do not delay job progress; allow for adjustments and fitting where taking of field measurements before fabrication might delay work.
- B. Installation:
  - 1. Installation shall comply with manufacturer's instructions.
  - 2. Contractor: Coordinate with metal building manufacturer to provide secondary framing as required to support canopies.
  - 3. Installer: Erection shall be performed by the manufacturer or manufacturer's approved installer.
  - 4. Care: Extreme care shall be taken to prevent damage or scratching. All workmanship must be of the very best with neat miters and fitted joints.

3.02 REPAIR AND PROTECTION

- A. Protect existing materials from damage during the installation process. When installation is complete, repair or replace damaged items. Replacement items are to match the original.

3.03 CLEAN-UP

- A. After work is complete, remove all waste materials and dispose of it off the owner's property.

END OF SECTION

SECTION 10 75 00 FLAGPOLES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Aluminum flagpoles, ground mount, halyards and accessories.
- B. Related Sections: Section 03 30 00 Cast-in-Place Concrete: Concrete base construction.

1.02 REFERENCES

- A. AASHTO M-36 - Corrugated Metal Culvert Pipe.
- B. ANSI/ASTM B221 – Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube.

1.03 SYSTEM DESCRIPTION

- A. Type: Ground set fixed type.
- B. Pole Design: Cone tapered.
- C. Nominal Height: 30 feet measured from ground (Single section pole).

1.04 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Pole without flag: Resistant without permanent deformation, 90 miles per hour wind velocity, non-resonant, safety design factor of 2.5.

1.05 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated (pole, accessories, and configurations).
- B. Shop Drawings: Indicate detailed dimensions, base details, anchor requirements, imposed loads, and manufacturer's installation instructions.

1.06 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For flagpoles to include in operation and maintenance manuals.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Spiral wrap flagpole with protective covering and pack in protective shipping tubes or containers.
- B. Protect flagpole and accessories on site from damage or moisture.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Drawings and Specifications are based on products manufactured by American Flagpole, P.O. Box 547, Abingdon, VA 24210. Tel. (540) 628-4188.
- B. Equivalent products by the following manufacturers are acceptable:
  - 1. Concord Industries, Inc., Addison, TX. Tel. (972) 380-8186.
  - 2. Eder Flag Mfg., Oak Creek, WI. Tel. (414) 764-3522.
  - 3. Morgan-Francis Flagpoles, Arlington, IN. Tel. (800) 814-9568.
  - 4. Pole-Tech, Flagpoles, Arlington, IN. Tel. (800) 633-6733.
- C. Substitutions shall fully comply with specified requirements and Section 01 25 00 - Substitution Procedures and Section 01 60 00 - Product Requirements.

2.02 POLE MATERIALS

- A. Aluminum; ANSI / ASTM B221; 6063 alloy, T6 temper.

2.03 COMPONENTS AND ACCESSORIES

- A. Finial Ball: Aluminum; 6 inches diameter.
- B. Trunk Assembly: Cast aluminum; double revolving; stainless steel ball bearings, non-fouling.
- C. Cleats: Two 9-inch size, cast aluminum, each attached with two 5/16-inch stainless steel screws.
- D. Halyard: 5/16-inch diameter polypropylene, braided, white.
- E. Connecting Sleeves for Multiple Section Pole: Aluminum, 6063 alloy, T6 temper, precision fit for field assembly of pole, concealed fasteners.
- F. Primer: Zinc chromate type.

2.04 MOUNTING COMPONENTS

- A. Foundation Tube Sleeve: AASHTO M-36, corrugated 16-gage steel, galvanized, depth as indicated.
- B. Pole Base Attachment: Tube; with base cover.
- C. Lightning Ground Rod: 18-inch long rod, 3/4-inch diameter.
- D. Lightning Ground Cable: Copper No. 6 AWG, soft drawn.

2.05 POLE FABRICATION

- A. Outside Butt Diameter: 6 inches.
- B. Outside Tip Diameter: 3-1/2 inches.
- C. Nominal Thickness: 0.188 inches.

2.06 FINISHES

- A. Metal Surfaces in Contact with Concrete: Asphaltic paint.
- B. Concealed Steel Surfaces: Prime paint.
- C. Exposed to view Steel Surfaces: Galvanized to 2.0 oz. per sq. ft.
- D. Aluminum: Clear anodized.
- E. Finial: Gold anodized finish.

PART 3 - EXECUTION

3.01 FLAGPOLE INSTALLATION

- A. General: Install flagpoles plumb and level, at location(s) shown on Drawings or if not shown, as directed by the Project Engineer. A minimum of one unit is required, unless additional units are indicated on the Drawings.
  - 1. Installation shall comply with manufacturer's written instructions.
  - 2. Tolerances: Maximum Variation from Plumb; One inch.
- B. Ground Set: Place foundation tube, center, and brace to prevent displacement during concreting. Install flagpole, plumb, in foundation tube. Place tube seated on bottom plate between steel centering wedges and install hardwood wedges to secure flagpole in place. Place and compact sand in foundation tube and remove hardwood wedges. Seal top of foundation tube with a 2-inch layer of elastomeric joint sealant and cover with flashing collar.
  - 1. Electrically ground flagpole installation.

3.02 ADJUSTIONG AND CLEANING

- A. Adjust operating devices so that halyard functions smoothly.
- B. After installation is complete, clean surfaces.

END OF SECTION

SECTION 11 31 15

RESIDENTIAL APPLIANCES AND EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Electric Range.
2. Refrigerator.
3. Microwave.
4. Overhead Exhaust Hood
5. Ice Machine.

1.02 ACTION SUBMITTALS

- A. Product Data: Manufacturer's brochures, technical data, installation, maintenance and operating instructions for each item and component part specified, including data substantiating that materials comply with requirements.

1.03 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

PART 2 - PRODUCTS

2.01 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. General Electric Company (GE), Louisville, KY. Tel. (800) 626-2000.
2. Ice-O-Matic, Denver, CO. Tel. (303) 371-3737.
3. Magic Chef Co., Cleveland, TN. Tel. (423) 472-3371.
4. Manitowoc Ice, Inc., Manitowoc, WI. Tel. (800) 545-5720.
5. Scotsman Ice System, Vernon Hills, IL. Tel. (847) 215-4500
6. Sears Brands LLC (Kenmore). Hoffman Estates, IL. Tel. (847) 286-2994.
7. Whirlpool Corporation, Benton, MI, Tel. (800) 253-1301.

- B. Substitutions shall fully comply with specified requirements and Section 01 25 00 - Substitution Procedures and Section 01 60 00 - Product Requirements.

2.02 APPLIANCES

- A. Electric Range: 30 inch slide-in electric range equal to GE® Model JSP39DNCC, with Optional Backguard JXS32CC Bisque. Approx. Dimensions (HxWxD) 36-1/4 inches by 31-1/4 inches by 26-5/8 inches.

- B. Refrigerator: 25.3 cu. ft. capacity Side-By-Side with Dispenser equal to GE® Model GSH25JFXCC with factory-installed icemaker, Bisque. Approx. Dimensions (HxWxD) 69-3/4 inches by 35-3/4 inches by 33-5/8 inches.
- C. Microwave: 2.0 cu. ft. oven capacity, 1200 watts countertop type, equal to GE® Model PEB2060DMCC, Bisque, with GE Deluxe built-in trim kit Model JX2030DMCC. Approx. Dimensions (HxWxD) 13-25/32 inches by 24 inches by 19-13/32 inches.
- D. Overhead Exhaust Hood: 30" Deluxe Range Hood equal to GE® JV347HCC, Bisque, complete with 120V, 2.5 amp power/rating, convertible venting type, incandescent cooktop lighting, removable grease filter, single mesh and carbon, JXHC1 Cord Kit, optional power supply connection. Fan and light controls shall be ADA compliant. Approx. Dimensions (HxWxD) 5-1/2 inches by 29-7/8 inches by 17-1/2 inches.
- E. Ice Machine: Equal to Model ICE 1406 AF by Ice-O-Matic. Power supply shall be 208-230/60/1. Ice Storage Bin Model B100PS – 670 lbs. ARI Bin storage capacity.

### PART 3 - EXECUTION

#### 3.01 PREPARATION AND COORDINATION

- A. Verify and provide all plumbing and electrical hook-ups, drains and electrical outlets required for proper operation by the appliances specified prior to rough-in. Coordinate with Electrical and Plumbing subcontractors.

#### 3.02 INSTALLATION, GENERAL

- A. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and that rough openings are completely concealed.
- B. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.
- C. Range Anti-Tip Device: Install at each range according to manufacturer's written instructions.
- D. Utilities: Comply with plumbing and electrical requirements.

#### 3.03 INSTALLATION

- A. Install units plumb and level, in locations and with mountings as shown. Securely attach to supporting structure with concealed fasteners, and in accordance with manufacturer's installation instructions.
- B. Remove shipping packaging and install components as per manufacturer's instructions.

3.04 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. Perform visual, mechanical, and electrical inspection and testing for each appliance according to manufacturers' written recommendations. Certify compliance with each manufacturer's appliance-performance parameters.
2. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After installation, start units to confirm proper operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and components.

C. Prepare test and inspection reports.

3.05 CLEANING AND PROTECTION

- A. At completion of installation, clean surfaces in accordance with manufacturer's instructions. Protect units from damage until acceptance by Owner.

END OF SECTION

SECTION 12 21 13 - HORIZONTAL LOUVER BLINDS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Horizontal louver blinds with aluminum slats at windows.

1.02 ACTION SUBMITTALS

- A. Product Data: Submit manufacturer's specifications and installation instructions for each type of blind unit required. Include methods of installation for each type of opening and supporting structure. Transmit copy of instructions and recommendations to the installer.
- B. Samples: Submit (3 copies) samples of each exposed metal finish, cords, tapes and tassels required. Architect's review of samples will be for design, color, and finish only. Compliance with all other requirements is the exclusive responsibility of the Contractor.

1.03 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.04 QUALITY ASSURANCE

- A. Provide each blind as a complete unit produced by one manufacturer, including hardware, accessory items, mounting brackets, and fastenings. Unless otherwise acceptable to the Project Engineer / MDOT Architect, furnish all blind units by one manufacturer for the entire project.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Drawings and Specifications are based on products manufactured by Hunter Douglas, Inc., 2 Park Way, Upper Saddle River, NJ 07458. Tel. (800) 727-8953.
- B. Equivalent products by the following manufacturers are acceptable:
  - 1. Levolor Home Fashions Contract Division, High Point, NC. Tel. (336) 812-8181.
  - 2. Springs Window Fashions Division, Inc., Montgomery, PA. Tel. (570) 547-6671.
- C. Substitutions shall fully comply with specified requirements and Section 01 25 00 - Substitution Procedures and Section 01 60 00 - Product Requirements.



## 2.02 HORIZONTAL LOUVER BLINDS

- A. Manufacturer: Hunter Douglas Commercial Lightlines Aluminum Blinds 1" de-Light Model DL88. Color to be selected by the Project Engineer / MDOT Architect from manufacturers' full line of standard colors. Refer to Section 09 05 15 – Color Design for color selected.

## 2.03 MATERIALS AND COMPONENTS

- A. Product Safety Standard: Fabricate horizontal louver blinds to comply with WCMA A 100.1 including requirements for corded, flexible, looped devices; lead content of components; and warning labels.
- B. Standard head rail, channel-shaped section fabricated from minimum 0.040 inch thick aluminum. Increase metal thickness as recommended by the manufacturer for large blind units. Cross-brace for extra rigidity. Furnish complete with tilting mechanism, top and end brace, top cradle, cord lock, and accessory items required for the type of blind and installation indicated.
- C. Bottom Rail: Standard tubular steel bottom rail designed to withstand twisting or sagging. Contour top surface to match slat curvature, with flat or slightly curved bottom. Close ends with manufacturer's standard metal or plastic end caps of the same color as rail. Finish rails the same color as slats, unless otherwise indicated.
- D. Slats: Standard, spring tempered aluminum slats not less than 0.008 inches thick. Provide 1 inch narrow slats, with other components sized to suit.
- E. Braided Ladders: Standard polyester support cords with integrally braided ladder rungs. Provide cord size and rung spacing as required for each type of blind shown.
- F. Tilter: Standard enclosed, lubricated, tilting mechanism which will tilt and securely hold the tilting rod, slats and bottom rail at any set angle. Furnish wand (or rod) type tilter consisting of standard tilter mechanism adopted for rotating wand operation. Furnish manufacturer's standard plastic or aluminum rod of proper length to suit blind installation.
- G. Cords: Standard braided polyester cord, sized to suit blind type, equipped with soft-molded plastic rubber or composition tassels securely attached to each cord end.
  - 1. Cord Locks: Provide manufacturer's standard cord locks for each type of blind.
  - 2. Cord Equalizers: Nylon, self-aligning type, designed to maintain horizontal blind position.
- H. Hardware: Furnish standard brackets, supports and internal reinforcement as required to suit blind type and size. Finish exposed hardware and accessories to match rail color.
- I. Finish: Prime aluminum slats with chromate conversion coating, followed by manufacturer's standard glass-smooth, baked-on synthetic resin enamel finish. Refer to Section 09 05 15 – Color Design for color selection.

## 2.04 FABRICATION AND OPERATION

- A. Prior to fabrication, verify actual opening dimensions by accurate site measurements. Adjust blind dimensions for proper fit in all openings. Fabricate components of blinds from non-corrosive, non-staining, non-fading materials which are completely compatible with each other, and which do not require lubrication during normal expected life.
- B. Fabricate blind units to completely fill the openings as indicated, from head to sill and jamb to jamb. Space supporting tapes or cords in accordance with manufacturer's standards, unless otherwise indicated. Space louver blades (slats) to provide overlap for light exclusion when in the fully closed position.
- C. Equip blind units, unless otherwise indicated, for the following operation:
  - 1. Full-tilting operation with slats rotating approximately 180 degrees. Place tilt operation controls on left-hand side of blind units.
  - 2. Full-Height raising, to manufacturer's minimum stacking dimension with lifting cord locks for stopping blinds at any point of ascending or descending travel. Place pull cords on right-hand side of blind units.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Install horizontal louver blinds level and plumb, aligned and centered on openings, and aligned with adjacent units according to manufacturer's written instructions.
  - 1. Locate so exterior slat edges are not closer than 1 inch from interior faces of glass and not closer than 1/2 inch from interior faces of glazing frames through full operating ranges of blinds.
  - 2. Install mounting and intermediate brackets to prevent deflection of headrails.
  - 3. Install with clearances that prevent interference with adjacent blinds, adjacent construction, and operating hardware of glazed openings, other window treatments, and similar building components and furnishings.
- C. Adjust horizontal louver blinds to operate free of binding or malfunction through full operating ranges.
- D. Clean horizontal louver blind surfaces after installation according to manufacturer's written instructions.

END OF SECTION

SECTION 12 48 13 FLOOR MATS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Metal-rails, tapered vinyl-frame, surfaced mounted, removable, carpeted floor roll-up mats for Building Entrances.
- B. Related Sections: Section 09 05 15 – Color Design (for color selection).

1.02 ACTION SUBMITTALS

- A. Product Data: For manufacturers' product and technical data indicating compliance with these specifications and recommended maintenance practices.
- B. Shop Drawings: Materials description, component dimensions and details. Show plan view that clearly indicates traffic direction and size of mat.
- C. Samples: Submit 3 samples of manufacturer's full range of available colors (minimum 20 for carpet) and finishes for materials exposed to view.

1.03 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.04 QUALITY ASSURANCE

- A. Single Source: All floor mats required by this Section shall be products of only one manufacturer.
- B. Manufacturer: Company regularly engaged in producing types of floor mats required by this Section and with minimum 10 years documented satisfactory experience

PART 2 - PRODUCTS

2.01 ENTRANCE FLOOR MATS AND FRAMES, GENERAL

- A. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1.

2.02 ACCEPTACLE 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. Arden Architectural Specialties, Inc., Saint Paul, MN. Tel. (651) 631-1607.

- 2. C/S Group, Muncy, PA. Tel. (888) 834-4455. (Basis-of-Design)
- 3. J. L. Industries, Inc. Bloomington, MN. Tel. (612) 835-6850.,
- 4. Musson Rubber Company, Akron, OH. Tel. (330) 773-7651.

B. Substitutions shall fully comply with specified requirements and Section 01 25 00 - Substitution Procedures and Section 01 60 00 - Product Requirements.

2.03 ROLL-UP RAIL MATS

A. Roll-up, Aluminum-Rail Hinged Mats: Equal to C/S Group "Pedimat" Surface-Mounted Floor Mat, Model M1-D-HD-SM.

- 1. Carpet Tread Inserts: Colorfast, solution dyed nylon tread, in color selected by Project Engineer / MDOT Architect, fusion bonded to rigid two-ply backing supplied in continuous splice-free lengths. Anti-static carpet fiber shall contain an antimicrobial additive and "Scotchgard" soil reducing treatment.
- 2. Carpet Colors: As selected by Project Engineer / MDOT Architect from full range of manufacturer's 25 standard colors.
- 3. Rails: Extruded aluminum 6063-T52 as selected by Project Engineer / MDOT Architect from full range of manufacturer's 7 optional anodized colors.
- 4. Surface-Mounted Frames: Tapered vinyl with mitered corners. Color as selected by Project Engineer / MDOT Architect from full range of manufacturer's six standard colors.
- 5. Mat Size: 6 feet wide by 4 feet deep (traffic direction) at double doors; 4 feet wide by 4 feet deep (traffic direction) at single doors.

2.04 FABRICATION

A. Floor Mats: Shop fabricate units in sizes indicated. Unless otherwise indicated, provide single unit for each mat installation. Miter corner joints in framing elements with hairline joints or provide prefabricated corner units without joints.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install surface-type units to comply with manufacturer's written instructions at locations indicated; coordinate with entrance locations and traffic patterns.

- 1. Install mats after Final Cleaning of Project Floor.

3.02 CLEANING AND PROTECTION

A. At Project Completion, clean surfaces in accordance with manufacturer's instructions. Protect units from damage until acceptance by Owner.

END OF SECTION

## SECTION 13 34 18

## METAL BUILDING SHED

## PART 1 - GENERAL

## 1.01 SUMMARY

## A. Section Includes:

1. Building Type: The building is a single-story, single-span, rigid-frame-type pre-engineered metal building of the nominal length, width eave height, and roof pitch indicated on the Drawings.
2. Exterior Walls: Field assembled, un-insulated panels attached to framing.
3. Roof system: Standing-seam roof with thermal insulation blankets (at enclosed bay), concealed clips and factory-applied sealant.
4. Components and Accessories: Manufacturer's standard building components and accessories may be used, provided components, accessories, and complete structure conform to design indicated and specified requirements.

## B. Related sections:

1. Plywood wainscot is specified in Section 06 10 00.
2. Personnel doors and frames and finish hardware are specified in Sections 08 11 13 and 08 71 00.
3. Overhead service doors, including operators, are specified in Sections 08 33 23.
4. Colors are specified in Section 09 05 15 - Color Design.
5. Painting for ferrous metal exposed to view is specified in Section 09 90 00 - Painting and Coating.
6. Canopies are specified in Section 10 73 16.

## 1.02 STRUCTURAL FRAMING AND ROOF AND SIDING PANELS

- A. Design anchor bolts, structural members, and exterior covering for applicable loads and combinations of loads in accordance with the MBMA's "Design Practices Manual."
- B. Structural Steel: Comply with AISC's "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings" for design requirements and allowable stresses.
- C. Light Gage Steel: Comply with AISI's "Specification for the Design of Cold-Formed Steel Structural Members" and "Design of Light Gage Steel Diaphragms" for design requirements and allowable stresses.
- D. Welded Connections: Comply with AWS's "Standard Code for Arc and Gas Welding in Building Construction" for welding procedures.
- E. Metal Roofing: Comply with SMACNA Architectural Sheet Metal Manual.

**1.03 ACTION SUBMITTALS**

- A. Product Data: Submit manufacturer's sample warranty and product information for building components, accessories and color chart.
- B. Shop Drawings: Submit Shop Drawings for anchor bolts, structural framing system, roofing and siding panels, and components and accessories not fully detailed or dimensioned in manufacturer's product data.
  - 1. Structural Framing: Furnish erection drawings. Include fabrication and assembly details. Show anchor bolts' settings and sidewall, end-wall, and roof framing.
  - 2. Wall Panels: Provide panel layouts and details of edge conditions, joints, corners, custom profiles, supports, anchorage, trim, flashing, closures, and special details.
  - 3. Roof Panels and Sheet Metal Accessories: 1/4-inch-scale layouts and 1-1/2-inch-scale details of accessories; show profiles, methods of joining to system components and dissimilar building materials, flashing of each condition for roof penetrations, and anchorage.
- C. Certification prepared, signed, and sealed by a Professional Engineer registered in the State of Mississippi, verifying that anchor bolts, structural framing and covering panels meet loading requirements and codes (IBC 2012), including design calculations.
- D. Installer certificates signed by Contractor certifying that welders comply with requirements specified under "Quality Assurance" article.
- E. Submit sample copies of the Paint Finish Guarantee and Weather Tightness Warranty prior to fabrication and installation for MDOT Architect's approval. DO NOT start roofing installation without MDOT Architect's approval of Guarantee and Warranty. Refer to Division 00 Sections for State of Mississippi requirements.

**1.04 CLOSEOUT SUBMITTALS**

- A. Maintenance data.
- B. Executed copies of Paint Finish Guarantee and Weather Tightness Warranty.

**1.05 EXTRA MATERIALS**

- A. Furnish 5 percent excess over required amount of nuts, bolts, screws, washers, and other required fasteners for each building. Pack in cartons labeled to identify contents and store on site where directed.

**1.06 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Provide buildings manufactured by a firm with ten (10) years experience in manufacturing buildings similar to those indicated.
  - 1. The manufacturer shall be IAS Accredited (Class MB).
  - 2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

- B. Erector Qualifications: An experienced erector, with five (5) years minimum experience, who specializes in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.
- C. Welding Qualifications: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
  - 2. AWS D1.3, "Structural Welding Code - Sheet Steel."
- D. Structural Steel: Comply with AISC 360, "Specification for Structural Steel Buildings," for design requirements and allowable stresses.
- E. Cold-Formed Steel: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" for design requirements and allowable stresses.
- F. Preinstallation Conference: Conduct conference at Project site.

#### 1.07 WARRANTY

- A. Special Warranty on Metal Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
  - 1. Finish Warranty Period: Twenty (20) years from date of Completion.
- B. Special Weathertightness Warranty for Standing-Seam Metal Roof Panels:
  - 1. The entire installation (sub-framing, clips, panels, fasteners, rakes, eaves, ridge/valley flashing conditions, roof to wall conditions as well as all materials specified as supplied by the manufacturer) shall be guaranteed weather tight for a minimum of twenty (20) YEARS.
  - 2. This warranty shall be identified as neither Non-Depreciating, Non-prorated nor have exclusions that identify, valleys, curbs, and flashings.
  - 3. Provide written warranty, signed by the manufacturer and his authorized installer / dealer, agreeing to replace / repair defective materials and workmanship with NO COST (NDL) to the Owner during the warranty period.
  - 4. Warranty period begins at the Date of Completion as determined by MDOT.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

- A. Drawings and Specifications are based on products manufactured by Ceko Building Division, P. O. Box 6500, Columbus, MS 39703. Tel. (662) 328-6722.
- B. Comparable product by one of the following manufacturers are acceptable:
  - 1. ACI Building Systems, Inc., Batesville, MS Tel. 662-563-4574.
  - 2. Gulf States Manufacturers, Inc.; Starkville, MS. Tel.: (662) 323-8021.
  - 3. VP Buildings; a United Dominion company.

- C. Substitutions shall fully comply with specified requirements in Section 01 25 00 - Substitution Procedures and Section 01 60 00 - Product Requirements.

## 2.02 METAL BUILDING SYSTEM PERFORMANCE

- A. Delegated Design: Design metal building system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Metal building systems shall be designed according to procedures in MBMA's "Metal Building Systems Manual."
1. Design Loads: As required by MBMA's "Metal Building Systems Manual" and ASCE/SEI 7.
  2. Deflection Limits: Design metal building system assemblies to withstand design loads.
  3. Drift Limits: Engineer building structure to withstand design loads with drift limits.
  4. Metal panel assemblies shall withstand the effects of gravity loads and loads and stresses within limits and under conditions indicated according to ASTM E 1592.
- C. Seismic Performance: Metal building systems shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- D. Thermal Movements: Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F material surfaces.
- E. Air Infiltration for Metal Roof and Wall Panels: Air leakage through assembly of not more than 0.06 cfm/sq. ft. of roof area when tested according to ASTM E 1680 at negative test-pressure difference of 1.57 lbf/sq. ft.
- F. Water Penetration for Metal Roof and Wall Panels: No water penetration when tested according to ASTM E 1646 at test-pressure difference of 2.86 lbf/sq. ft.
- G. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for Class 90.

## 2.03 STRUCTURAL-STEEL FRAMING

- A. Primary Framing: Manufacturer's standard primary-framing system, designed to withstand required loads and specified requirements. Primary framing includes transverse and lean-to frames; rafters, rake, and canopy beams; sidewall, intermediate, end-wall, and corner columns; and wind bracing.
1. General: Provide frames with attachment plates, bearing plates, and splice members. Factory drill for field-bolted assembly.
  2. Frame Configuration: Single gable.



3. Exterior Column Type: Tapered.
  4. Rafter Type: Tapered.
- B. End-Wall Framing: Manufacturer's standard primary end-wall framing fabricated for field-bolted assembly.
  - C. Secondary Framing: Manufacturer's standard secondary framing, including purlins, girts, eave struts, flange bracing, base members, gable angles, clips, headers, jambs, and other miscellaneous structural members. Unless otherwise indicated, fabricate framing from either cold-formed, structural-steel sheet or roll-formed, metallic-coated steel sheet, prepainted with coil coating.
  - D. Bolts: Provide plain-finish bolts for structural-framing components that are primed or finish painted. Provide zinc-plated or hot-dip galvanized bolts for structural-framing components that are galvanized.
  - E. Finish: Factory primed. Apply specified primer immediately after cleaning and pretreating.

#### 2.04 METAL ROOF AND SIDING PANELS

- A. Standing-Seam Metal Roof Panels: Double-Lok Standing Seam Panel, 3 inches high with 24 inches wide coverage, 24 gage, Galvalume.
- B. Wall Panel: MAP Ribbed-type panel, 1-1/2 inches deep with 36 inches wide coverage and rib spacing at 12 inches on center, 26-gage, Galvalume with Kynar 500 (70 percent PVDF) finish. Standard colors from manufacturer's full range of colors to be selected by Project Engineer / MDOT Architect.

#### 2.05 THERMAL INSULATION (Enclosed Bay)

- A. Glass-fiber blanket: Comply with ASTM C 167, 0.8 lb. per cubic foot density, 4 inches thickness, R 13, with UL flame spread classification of 25 or less, and 2-inch wide continuous vapor tight edge tabs.
- B. Vapor Barrier: Facing shall be equal to Lamtec Corporation model WMP-50. Facing shall be composed of 0.0015 inch white polypropylene film, 5 by 5 tri-directional scrim reinforcing layer, and 0.0005 inch metallized polyester film backing layer. The facing shall have a water vapor transmission rate of 0.02 US perm (ASTM E96, Procedure A), a beach puncture of 125 scale units and a mullen burst of 120 psi. Tensile strength shall be 65 lbs/inch width in the machine direction and 60 lbs/inch width in the cross-machine direction.
- C. Retainer Strips: 26 gage (0.0179-inch) formed galvanized steel retainer clips colored to match insulation facing.

## 2.06 ACCESSORIES

- A. General: Provide accessories as standard with metal building system manufacturer and as specified. Fabricate and finish accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional and structural requirements.
1. Form exposed sheet metal accessories that are without excessive oil-canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
- B. Roof Panel Accessories: Provide components required for a complete metal roof panel assembly including fasciae, corner units, ridge closures, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.
- C. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including copings, fasciae, mullions, sills, corner units, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels unless otherwise indicated.
- D. Flashing and Trim: Formed from 24 gage nominal-thickness, zinc-coated steel sheet (galvanized G-90) or aluminum-zinc alloy-coated steel sheet prepainted with coil coating (Kynar 500 with 70 percent PVDF); finished to match adjacent metal panels, unless indicated otherwise.
- E. Gutters: Formed from 24 gage nominal-thickness, zinc-coated (galvanized G-90) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating (Kynar 500 with 70 percent PVDF); finished to match roof fascia and rake trim. Box-shaped profile, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 20'-0" long sections, sized according to SMACNA's "Architectural Sheet Metal Manual."
1. Gutter Supports: Fabricated from same material and finish as gutters
    - a. Provide supports spaced at maximum of 4'-0" on center.
  2. Strainers: Aluminum wire ball type at outlets.
- F. Downspouts: Formed from 24 gage nominal-thickness (smooth, not corrugated), zinc-coated (galvanized G90) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating (Kynar 500 with 70 percent PVDF). Fabricate in full-length long sections (rectangular-shaped), complete with formed elbows and offsets.
1. Mounting Straps: Fabricated from same material and finish as gutters.
    - a. Straps shall be spaced 5'-0" on center maximum (minimum of 3 required per downspout).
    - b. Strap edges shall be rolled or smooth.

## 2.07 FABRICATION

- A. General: Design components and field connections required for erection to permit easy assembly.
  - 1. Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.
  - 2. Fabricate structural framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Members shall be free of cracks, tears, and ruptures.
- B. Tolerances: Comply with MBMA's "Metal Building Systems Manual" for fabrication and erection tolerances.
- C. Primary Framing: Shop fabricate framing components to size and section, with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.
- D. Secondary Framing: Shop fabricate framing components to size and section by roll-forming or break-forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.
- E. Metal Panels: Fabricate and finish metal panels at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.

## PART 3 - EXECUTION

### 3.01 ERECTION OF STRUCTURAL FRAMING

- A. Erect metal building system according to manufacturer's written erection instructions and erection drawings.
- B. Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer.
- C. Set structural framing accurately in locations and to elevations indicated, according to AISC specifications referenced in this Section. Maintain structural stability of frame during erection.
- D. Base and Bearing Plates: Clean concrete-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
  - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
  - 2. Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
  - 3. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

- E. Align and adjust structural framing before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
1. Level and plumb individual members of structure.
  2. Make allowances for difference between temperature at time of erection and mean temperature when structure will be completed and in service.
- F. Primary Framing and End Walls: Erect framing level, plumb, rigid, secure, and true to line. Level baseplates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use grout to obtain uniform bearing and to maintain a level base-line elevation. Moist-cure grout for not less than seven days after placement.
1. Make field connections using high-strength bolts installed according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for bolt type and joint type specified.
    - a. Joint Type: Snug tightened or pretensioned.
- G. Secondary Framing: Erect framing level, plumb, rigid, secure, and true to line. Field bolt secondary framing to clips attached to primary framing.
1. Provide rake or gable purlins with tight-fitting closure channels and fasciae.
  2. Locate and space wall girts to suit openings such as doors and windows.
  3. Locate canopy framing as indicated.
  4. Provide supplemental framing at entire perimeter of openings, including doors, windows, louvers, ventilators, and other penetrations of roof and walls.
- H. Bracing: Install bracing in roof and sidewalls where indicated on erection drawings.
1. Tighten rod and cable bracing to avoid sag.
  2. Locate interior end-bay bracing only where indicated.
- I. Framing for Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to structural framing.
- J. Erection Tolerances: Maintain erection tolerances of structural framing within AISC 303.

### 3.02 METAL PANEL INSTALLATION, GENERAL

- A. General: Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
1. Field cut metal panels as required for doors, windows, and other openings. Cut openings as small as possible, neatly to size required, and without damage to adjacent metal panel finishes.
    - a. Field cutting of metal panels by torch is not permitted.
  2. Install metal panels perpendicular to structural supports unless otherwise indicated.

3. Flash and seal metal panels with weather closures at perimeter of openings and similar elements. Fasten with self-tapping screws.
  4. Locate and space fastenings in uniform vertical and horizontal alignment.
  5. Locate metal panel splices over, but not attached to, structural supports with end laps in alignment.
  6. Lap metal flashing over metal panels to allow moisture to run over and off the material.
- B. Lap-Seam Metal Panels: Install screw fasteners using power tools with controlled torque adjusted to compress EPDM washers tightly without damage to washers, screw threads, or metal panels. Install screws in predrilled holes.
1. Arrange and nest side-lap joints so prevailing winds blow over, not into, lapped joints. Lap ribbed or fluted sheets one full rib corrugation. Apply metal panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
- C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.
- D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal panel assemblies. Provide types of gaskets, fillers, and sealants recommended by metal panel manufacturer.
1. Seal metal panel end laps with double beads of tape or sealant the full width of panel. Seal side joints where recommended by metal panel manufacturer.
  2. Prepare joints and apply sealants to comply with requirements in Section 07 92 00 "Joint Sealants."

### 3.03 METAL ROOF PANEL INSTALLATION

- A. General: Provide metal roof panels of full length from eave to ridge unless otherwise indicated or restricted by shipping limitations.
1. Install ridge caps as metal roof panel work proceeds.
  2. Flash and seal metal roof panels with weather closures at eaves and rakes. Fasten with self-tapping screws.
- B. Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each standing-seam joint, at location and spacing and with fasteners recommended by manufacturer.
1. Install clips to supports with self-drilling or self-tapping fasteners.
  2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
  3. Seamed Joint: Crimp standing seams with manufacturer-approved motorized seamer tool so that clip, metal roof panel, and factory-applied sealant are completely engaged.
  4. Rigidly fasten eave end of metal roof panels and allow ridge end free movement due to thermal expansion and contraction. Predrill panels for fasteners.
  5. Provide metal closures at rake edges and each side of ridge caps.

- C. Metal Fascia Panels: Align bottom of metal panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws. Flash and seal metal panels with weather closures where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.

### 3.04 METAL WALL PANEL INSTALLATION

- A. General: Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts, extending full height of building, unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Unless otherwise indicated, begin metal panel installation at corners with center of rib lined up with line of framing.
2. Shim or otherwise plumb substrates receiving metal wall panels.
3. When two rows of metal panels are required, lap panels 4 inches minimum.
4. When building height requires two rows of metal panels at gable ends, align lap of gable panels over metal wall panels at eave height.
5. Rigidly fasten base end of metal wall panels and allow eave end free movement due to thermal expansion and contraction. Predrill panels.
6. Flash and seal metal wall panels with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws.
7. Install screw fasteners in predrilled holes.
8. Install flashing and trim as metal wall panel work proceeds.
9. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated; or, if not indicated, as necessary for waterproofing.
10. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws.
11. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.

- B. Metal Wall Panels: Install metal wall panels on exterior side of girts. Attach metal wall panels to supports with fasteners as recommended by manufacturer.

### 3.05 THERMAL INSULATION INSTALLATION

- A. General: Install insulation concurrently with metal panel installation, in thickness indicated to cover entire surface, according to manufacturer's written instructions.

1. Set vapor-retarder-faced units with vapor retarder toward warm side of construction unless otherwise indicated.
2. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to the surrounding construction to ensure airtight installation.
3. Install factory-laminated, vapor-retarder-faced blankets straight and true in one-piece lengths, with both sets of facing tabs sealed, to provide a complete vapor retarder.

- B. Blanket Roof Insulation (at Enclosed Bay): Comply with the following installation method:
1. Over-Purlin-with-Spacer-Block Installation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing. Install layer of filler insulation over first layer to fill space formed by metal roof panel standoffs. Hold in place by panels fastened to standoffs.
    - a. Thermal Spacer Blocks: Where metal roof panels attach directly to purlins, install thermal spacer blocks.
  2. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.
- C. Blanket Wall Insulation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing. Hold in place by metal wall panels fastened to secondary framing.
1. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.

### 3.06 DOOR AND FRAME INSTALLATION

- A. General: Install doors and frames plumb, rigid, properly aligned, and securely fastened in place according to manufacturers' written instructions. Coordinate installation with wall flashings and other components. Seal perimeter of each door frame with elastomeric sealant used for metal wall panels.
- B. Personnel Doors and Frames: Install doors and frames according to SDI A250.8.
- C. Door Hardware: Mount units at heights indicated in DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
1. Install surface-mounted items after finishes have been completed on substrates involved.
  2. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
  3. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
  4. Set thresholds for exterior doors in full bed of butyl-rubber sealant complying with requirements specified in Section 07 92 00 "Joint Sealants."

### 3.07 WINDOW INSTALLATION

- A. General: Install windows plumb, rigid, properly aligned, without warp or rack of frames or sash, and securely fasten in place according to manufacturer's written instructions. Coordinate installation with wall flashings and other components. Seal perimeter of each window frame with elastomeric sealant used for metal wall panels.
1. Separate dissimilar materials from sources of corrosion or electrolytic action at points of contact with other materials by complying with requirements specified in AAMA/WDMA/CSA 101/I.S.2/A440.
- B. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction.

- C. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.
- D. Mount screens directly to frames with tapped screw clips.
- E. Field Glazing: Comply with installation requirements in Section 08 80 00 "Glazing."

### 3.08 ACCESSORY INSTALLATION

- A. General: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
  - 1. Install components required for a complete metal roof panel assembly, including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
  - 2. Install components for a complete metal wall panel assembly, including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
  - 3. Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by manufacturer.
- B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
  - 1. Install exposed flashing and trim that is without excessive oil-canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
  - 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).
- C. Gutters: Join sections with riveted-and-soldered or lapped-and-sealed joints. Attach gutters to eave with gutter hangers spaced as required for gutter size, but not more than 36 inches on center using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.
- D. Downspouts: Join sections with 1-1/2-inch telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches on center in between.
  - 1. Provide elbows at base of downspouts to direct water away from building.



3.09 FIELD QUALITY CONTROL

- A. Special Inspections: Engage a qualified special inspector to perform special inspections.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- C. Tests and Inspections:
  - 1. High-Strength, Field-Bolted Connections: Connections shall be tested and inspected during installation according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
  - 2. Welded Connections: In addition to visual inspection, field-welded connections shall be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at inspector's option:
    - a. Liquid Penetrant Inspection: ASTM E 165.
    - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
    - c. Ultrasonic Inspection: ASTM E 164.
    - d. Radiographic Inspection: ASTM E 94.
- D. Product will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

END OF SECTION

## SECTION 13 34 19

## METAL BUILDING SYSTEMS

## PART 1 - GENERAL

## 1.01 SUMMARY

## A. Section Includes:

1. Building Type: The building is a single-story, single-span, rigid-frame-type pre-engineered metal building of the nominal length, width eave height, and roof pitch indicated on the Drawings.
2. Exterior Walls: Field assembled, un-insulated panels attached to framing.
3. Roof system: Standing-seam roof with thermal insulation blankets, concealed clips and factory-applied sealant.
4. Components and Accessories: Manufacturer's standard building components and accessories may be used, provided components, accessories, and complete structure conform to design indicated and specified requirements.

## B. Related sections:

1. Plywood wainscot is specified in Section 06 10 00.
2. Cellulose thermal insulation is specified in Section 07 21 28.
3. Personnel doors and frames and finish hardware are specified in Sections 08 11 13 and 08 71 00.
4. Overhead service doors, including operators, are specified in Sections 08 33 23.
5. Colors are specified in Section 09 05 15 - Color Design.
6. Painting for ferrous metal exposed to view is specified in Section 09 90 00 - Painting and Coating.
7. Canopies are specified in Section 10 73 16.

## 1.02 STRUCTURAL FRAMING AND ROOF AND SIDING PANELS

- A. Design anchor bolts, structural members, and exterior covering for applicable loads and combinations of loads in accordance with the MBMA's "Design Practices Manual."
- B. Structural Steel: Comply with AISC's "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings" for design requirements and allowable stresses.
- C. Light Gage Steel: Comply with AISI's "Specification for the Design of Cold-Formed Steel Structural Members" and "Design of Light Gage Steel Diaphragms" for design requirements and allowable stresses.
- D. Welded Connections: Comply with AWS's "Standard Code for Arc and Gas Welding in Building Construction" for welding procedures.
- E. Metal Roofing: Comply with SMACNA Architectural Sheet Metal Manual.

**1.03 ACTION SUBMITTALS**

- A. Product Data: Submit manufacturer's sample warranty and product information for building components, accessories and color chart.
- B. Shop Drawings: Submit Shop Drawings for anchor bolts, structural framing system, roofing and siding panels, and components and accessories not fully detailed or dimensioned in manufacturer's product data.
  - 1. Structural Framing: Furnish erection drawings. Include fabrication and assembly details. Show anchor bolts' settings and sidewall, end-wall, and roof framing.
  - 2. Wall Panels: Provide panel layouts and details of edge conditions, joints, corners, custom profiles, supports, anchorage, trim, flashing, closures, and special details.
  - 3. Roof Panels and Sheet Metal Accessories: 1/4-inch-scale layouts and 1-1/2-inch-scale details of accessories; show profiles, methods of joining to system components and dissimilar building materials, flashing of each condition for roof penetrations, and anchorage.
- C. Certification prepared, signed, and sealed by a Professional Engineer registered in the State of Mississippi, verifying that anchor bolts, structural framing and covering panels meet loading requirements and codes (IBC 2012), including design calculations.
- D. Installer certificates signed by Contractor certifying that welders comply with requirements specified under "Quality Assurance" article.
- E. Submit sample copies of the Paint Finish Guarantee and Weather Tightness Warranty prior to fabrication and installation for MDOT Architect's approval. DO NOT start roofing installation without MDOT Architect's approval of Guarantee and Warranty. Refer to Division 00 Sections for State of Mississippi requirements.

**1.04 CLOSEOUT SUBMITTALS**

- A. Maintenance data.
- B. Executed copies of Paint Finish Guarantee and Weather Tightness Warranty.

**1.05 EXTRA MATERIALS**

- A. Furnish 5 percent excess over required amount of nuts, bolts, screws, washers, and other required fasteners for each building. Pack in cartons labeled to identify contents and store on site where directed.

**1.06 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Provide buildings manufactured by a firm with 10 years experience in manufacturing buildings similar to those indicated.
  - 1. The manufacturer shall be IAS Accredited (Class MB).
  - 2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

- B. Erector Qualifications: An experienced erector, with five (5) years minimum experience, who specializes in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.
- C. Welding Qualifications: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
  - 2. AWS D1.3, "Structural Welding Code - Sheet Steel."
- D. Structural Steel: Comply with AISC 360, "Specification for Structural Steel Buildings," for design requirements and allowable stresses.
- E. Cold-Formed Steel: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" for design requirements and allowable stresses.
- F. Preinstallation Conference: Conduct conference at Project site.

#### 1.07 WARRANTY

- A. Special Warranty on Metal Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
  - 1. Finish Warranty Period: Twenty (20) years from date of Completion.
- B. Special Weathertightness Warranty for Standing-Seam Metal Roof Panels:
  - 1. The entire installation (sub-framing, clips, panels, fasteners, rakes, eaves, ridge/valley flashing conditions, roof to wall conditions as well as all materials specified as supplied by the manufacturer) shall be guaranteed weather tight for a minimum of twenty (20) YEARS.
  - 2. This warranty shall be identified as neither Non-Depreciating, Non-prorated nor have exclusions that identify, valleys, curbs, and flashings.
  - 3. Provide written warranty, signed by the manufacturer and his authorized installer / dealer, agreeing to replace / repair defective materials and workmanship with NO COST (NDL) to the Owner during the warranty period.
  - 4. Warranty period begins at the Date of Completion as determined by MDOT

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

- A. Drawings and Specifications are based on products manufactured by Ceko Building Division, P. O. Box 6500, Columbus, MS 39703. Tel. (662) 328-6722.
- B. Comparable product by one of the following manufacturers are acceptable:
  - 1. ACI Building Systems, Inc., Batesville, MS Tel. 662-563-4574.
  - 2. Gulf States Manufacturers, Inc.; Starkville, MS. Tel.: (662) 323-8021.
  - 3. VP Buildings; a United Dominion company.

- C. Substitutions shall fully comply with specified requirements in Section 01 25 00 - Substitution Procedures and Section 01 60 00 - Product Requirements.

## 2.02 METAL BUILDING SYSTEM PERFORMANCE

- A. Delegated Design: Design metal building system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Metal building systems shall be designed according to procedures in MBMA's "Metal Building Systems Manual."
  - 1. Design Loads: As required by MBMA's "Metal Building Systems Manual" and ASCE/SEI 7.
  - 2. Deflection Limits: Design metal building system assemblies to withstand design loads.
  - 3. Drift Limits: Engineer building structure to withstand design loads with drift limits.
  - 4. Metal panel assemblies shall withstand the effects of gravity loads and loads and stresses within limits and under conditions indicated according to ASTM E 1592.
- C. Seismic Performance: Metal building systems shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- D. Thermal Movements: Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F material surfaces.
- E. Air Infiltration for Metal Roof and Wall Panels: Air leakage through assembly of not more than 0.06 cfm/sq. ft. of roof area when tested according to ASTM E 1680 at negative test-pressure difference of 1.57 lbf/sq. ft.
- F. Water Penetration for Metal Roof and Wall Panels: No water penetration when tested according to ASTM E 1646 at test-pressure difference of 2.86 lbf/sq. ft.
- G. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for Class 90.
- H. Solar Reflectance Index: Not less than 78 when calculated according to ASTM E 1980 based on testing identical products by a qualified testing agency.
- I. Energy Performance: Provide roof panels that are listed on the DOE's ENERGY STAR Roof Products Qualified Product List for low-slope roof products.

## 2.03 STRUCTURAL-STEEL FRAMING

- A. Primary Framing: Manufacturer's standard primary-framing system, designed to withstand required loads and specified requirements. Primary framing includes transverse and lean-to frames; rafters, rake, and canopy beams; sidewall, intermediate, end-wall, and corner columns; and wind bracing.
1. General: Provide frames with attachment plates, bearing plates, and splice members. Factory drill for field-bolted assembly.
  2. Frame Configuration: Single gable
  3. Exterior Column Type: Uniform depth (straight).
  4. Rafter Type: Tapered.
- B. End-Wall Framing: Manufacturer's standard primary end-wall framing fabricated for field-bolted assembly.
- C. Secondary Framing: Manufacturer's standard secondary framing, including purlins, girts, eave struts, flange bracing, base members, gable angles, clips, headers, jambs, and other miscellaneous structural members. Unless otherwise indicated, fabricate framing from either cold-formed, structural-steel sheet or roll-formed, metallic-coated steel sheet, prepainted with coil coating.
- D. Bolts: Provide plain-finish bolts for structural-framing components that are primed or finish painted. Provide zinc-plated or hot-dip galvanized bolts for structural-framing components that are galvanized.
- E. Finish: Factory primed. Apply specified primer immediately after cleaning and pretreating.

## 2.04 METAL ROOF AND SIDING PANELS

- A. Standing-Seam Metal Roof Panels: Double-Lok Standing Seam Panel, 3 inches high with 24 inches wide coverage, 24 gage, Galvalume. Roof shall have a Kynar 500 (70 percent PVDF) color coating finish. Standard colors from manufacturer's full range of colors to be selected by Project Engineer / MDOT Architect.
- B. Wall Panel: MAP Ribbed-type panel, 1-1/2 inches deep with 36 inches wide coverage and rib spacing at 12 inches on center, 26-gage, Galvalume with Kynar 500 (70 percent PVDF) finish. Standard colors from manufacturer's full range of colors to be selected by Project Engineer / MDOT Architect.

## 2.05 THERMAL INSULATION (Metal Building)

- A. Glass-fiber blanket: Comply with ASTM C 167, 0.8 lb. per cubic foot density, 4 inches thickness, R 13, with UL flame spread classification of 25 or less, and 2-inch wide continuous vapor tight edge tabs.

- B. Vapor Barrier: Facing shall be equal to Lamtec Corporation model WMP-50. Facing shall be composed of 0.0015 inch white polypropylene film, 5 by 5 tri-directional scrim reinforcing layer, and 0.0005 inch metallized polyester film backing layer. The facing shall have a water vapor transmission rate of 0.02 US perm (ASTM E96, Procedure A), a beach puncture of 125 scale units and a mullen burst of 120 psi. Tensile strength shall be 65 lbs/inch width in the machine direction and 60 lbs/inch width in the cross-machine direction.
- C. Retainer Strips: 26 gage (0.0179-inch) formed galvanized steel retainer clips colored to match insulation facing.

## 2.06 ACCESSORIES

- A. General: Provide accessories as standard with metal building system manufacturer and as specified. Fabricate and finish accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional and structural requirements.
  - 1. Form exposed sheet metal accessories that are without excessive oil-canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
- B. Roof Panel Accessories: Provide components required for a complete metal roof panel assembly including copings, fasciae, corner units, ridge closures, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.
- C. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including copings, fasciae, mullions, sills, corner units, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels unless otherwise indicated.
- D. Flashing and Trim: Formed from 24 gage nominal-thickness, zinc-coated steel sheet (galvanized G-90) or aluminum-zinc alloy-coated steel sheet prepainted with coil coating (Kynar 500 with 70 percent PVDF); finished to match adjacent metal panels, unless indicated otherwise.
- E. Gutters: Formed from 24 gage nominal-thickness, zinc-coated (galvanized G-90) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating (Kynar 500 with 70 percent PVDF) ; finished to match roof fascia and rake trim. Box-shaped profile, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 20'-0" long sections, sized according to SMACNA's "Architectural Sheet Metal Manual."
  - 1. Gutter Supports: Fabricated from same material and finish as gutters
    - a. Provide supports spaced at maximum of 4'-0" on center.
  - 2. Strainers: Aluminum wire ball type at outlets.

- F. Downspouts: Formed from 24 gage nominal-thickness (smooth, not corrugated), zinc-coated (galvanized G90) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating (Kynar 500 with 70 percent PVDF). Fabricate in full-length long sections (rectangular-shaped), complete with formed elbows and offsets.
1. Mounting Straps: Fabricated from same material and finish as gutters.
    - a. Straps shall be spaced 5'-0" on center maximum (minimum of 3 required per downspout).
    - b. Strap edges shall be rolled or smooth.
- G. Roof Curbs (for equipment): Fabricated from minimum 18 gage nominal-thickness, zinc-coated steel sheet (galvanized G-90) or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match metal roof panels; capable of withstanding loads of size and height indicated.
1. Fully mitered and welded corners. Integral base plates and water cricket or diverter.
  2. Internally reinforced with steel angle on curbs on sides longer than 3'-0".
  3. Factory insulated curbs with 1-1/2 inches thick, 3 pounds density fiberglass insulation.
  4. Minimum height of curb shall be 8 inches above finished roof.
  5. Slope roof curb to match roof pitch and provide a level top.
- H. Pipe Flashing: Premolded, EPDM pipe collar with flexible aluminum ring bonded to base.
- 2.07 FABRICATION
- A. General: Design components and field connections required for erection to permit easy assembly.
1. Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.
  2. Fabricate structural framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Members shall be free of cracks, tears, and ruptures.
- B. Tolerances: Comply with MBMA's "Metal Building Systems Manual" for fabrication and erection tolerances.
- C. Primary Framing: Shop fabricate framing components to size and section, with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.
- D. Secondary Framing: Shop fabricate framing components to size and section by roll-forming or break-forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.
- E. Metal Panels: Fabricate and finish metal panels at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.



## PART 3 - EXECUTION

## 3.01 ERECTION OF STRUCTURAL FRAMING

- A. Erect metal building system according to manufacturer's written erection instructions and erection drawings.
- B. Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer.
- C. Set structural framing accurately in locations and to elevations indicated, according to AISC specifications referenced in this Section. Maintain structural stability of frame during erection.
- D. Base and Bearing Plates: Clean concrete-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
  - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
  - 2. Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
  - 3. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- E. Align and adjust structural framing before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
  - 1. Level and plumb individual members of structure.
  - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure will be completed and in service.
- F. Primary Framing and End Walls: Erect framing level, plumb, rigid, secure, and true to line. Level baseplates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use grout to obtain uniform bearing and to maintain a level base-line elevation. Moist-cure grout for not less than seven days after placement.
  - 1. Make field connections using high-strength bolts installed according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for bolt type and joint type specified.
    - a. Joint Type: Snug tightened or pretensioned.
- G. Secondary Framing: Erect framing level, plumb, rigid, secure, and true to line. Field bolt secondary framing to clips attached to primary framing.
  - 1. Provide rake or gable purlins with tight-fitting closure channels and fasciae.
  - 2. Locate and space wall girts to suit openings such as doors and windows.
  - 3. Locate canopy framing as indicated.
  - 4. Provide supplemental framing at entire perimeter of openings, including doors, windows, louvers, ventilators, and other penetrations of roof and walls.

- H. Bracing: Install bracing in roof and sidewalls where indicated on erection drawings.
  - 1. Tighten rod and cable bracing to avoid sag.
  - 2. Locate interior end-bay bracing only where indicated.
- I. Framing for Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to structural framing.
- J. Erection Tolerances: Maintain erection tolerances of structural framing within AISC 303.

### 3.02 METAL PANEL INSTALLATION, GENERAL

- A. General: Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
  - 1. Field cut metal panels as required for doors, windows, and other openings. Cut openings as small as possible, neatly to size required, and without damage to adjacent metal panel finishes.
    - a. Field cutting of metal panels by torch is not permitted.
  - 2. Install metal panels perpendicular to structural supports unless otherwise indicated.
  - 3. Flash and seal metal panels with weather closures at perimeter of openings and similar elements. Fasten with self-tapping screws.
  - 4. Locate and space fastenings in uniform vertical and horizontal alignment.
  - 5. Locate metal panel splices over, but not attached to, structural supports with end laps in alignment.
  - 6. Lap metal flashing over metal panels to allow moisture to run over and off the material.
- B. Lap-Seam Metal Panels: Install screw fasteners using power tools with controlled torque adjusted to compress EPDM washers tightly without damage to washers, screw threads, or metal panels. Install screws in predrilled holes.
  - 1. Arrange and nest side-lap joints so prevailing winds blow over, not into, lapped joints. Lap ribbed or fluted sheets one full rib corrugation. Apply metal panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
- C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.
- D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal panel assemblies. Provide types of gaskets, fillers, and sealants recommended by metal panel manufacturer.
  - 1. Seal metal panel end laps with double beads of tape or sealant the full width of panel. Seal side joints where recommended by metal panel manufacturer.

2. Prepare joints and apply sealants to comply with requirements in Section 07 92 00 "Joint Sealants."

### 3.03 METAL ROOF PANEL INSTALLATION

- A. General: Provide metal roof panels of full length from eave to ridge unless otherwise indicated or restricted by shipping limitations.
  1. Install ridge caps as metal roof panel work proceeds.
  2. Flash and seal metal roof panels with weather closures at eaves and rakes. Fasten with self-tapping screws.
- B. Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each standing-seam joint, at location and spacing and with fasteners recommended by manufacturer.
  1. Install clips to supports with self-drilling or self-tapping fasteners.
  2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
  3. Seamed Joint: Crimp standing seams with manufacturer-approved motorized seamer tool so that clip, metal roof panel, and factory-applied sealant are completely engaged.
  3. Rigidly fasten eave end of metal roof panels and allow ridge end free movement due to thermal expansion and contraction. Predrill panels for fasteners.
  4. Provide metal closures at rake edges and each side of ridge caps.
- C. Metal Fascia Panels: Align bottom of metal panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws. Flash and seal metal panels with weather closures where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.

### 3.04 METAL WALL PANEL INSTALLATION

- A. General: Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts, extending full height of building, unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.
  1. Unless otherwise indicated, begin metal panel installation at corners with center of rib lined up with line of framing.
  2. Shim or otherwise plumb substrates receiving metal wall panels.
  3. When two rows of metal panels are required, lap panels **4 inches** minimum.
  4. When building height requires two rows of metal panels at gable ends, align lap of gable panels over metal wall panels at eave height.
  5. Rigidly fasten base end of metal wall panels and allow eave end free movement due to thermal expansion and contraction. Predrill panels.
  6. Flash and seal metal wall panels with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws.
  7. Install screw fasteners in predrilled holes.
  8. Install flashing and trim as metal wall panel work proceeds.
  9. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated; or, if not indicated, as necessary for waterproofing.

10. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws.
11. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.

- B. Metal Wall Panels: Install metal wall panels on exterior side of girts. Attach metal wall panels to supports with fasteners as recommended by manufacturer.

### 3.05 THERMAL INSULATION INSTALLATION

- A. General: Install insulation concurrently with metal panel installation, in thickness indicated to cover entire surface, according to manufacturer's written instructions.

1. Set vapor-retarder-faced units with vapor retarder toward warm side of construction unless otherwise indicated. Do not obstruct ventilation spaces except for firestopping.
2. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to the surrounding construction to ensure airtight installation.
3. Install factory-laminated, vapor-retarder-faced blankets straight and true in one-piece lengths, with both sets of facing tabs sealed, to provide a complete vapor retarder.

- B. Blanket Roof Insulation: Comply with the following installation method:

1. Over-Purlin-with-Spacer-Block Installation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing. Install layer of filler insulation over first layer to fill space formed by metal roof panel standoffs. Hold in place by panels fastened to standoffs.
  - a. Thermal Spacer Blocks: Where metal roof panels attach directly to purlins, install thermal spacer blocks.
2. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.

- C. Blanket Wall Insulation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing. Hold in place by metal wall panels fastened to secondary framing.

1. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.

### 3.06 DOOR AND FRAME INSTALLATION

- A. General: Install doors and frames plumb, rigid, properly aligned, and securely fastened in place according to manufacturers' written instructions. Coordinate installation with wall flashings and other components. Seal perimeter of each door frame with elastomeric sealant used for metal wall panels.

- B. Personnel Doors and Frames: Install doors and frames according to SDI A250.8.

- C. Field Glazing: Comply with installation requirements in Section 08 80 00 "Glazing."

- D. Door Hardware: Mount units at heights indicated in DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
1. Install surface-mounted items after finishes have been completed on substrates involved.
  2. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
  3. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
  4. Set thresholds for exterior doors in full bed of butyl-rubber sealant complying with requirements specified in Section 07 92 00 "Joint Sealants."

### 3.07 WINDOW INSTALLATION

- A. General: Install windows plumb, rigid, properly aligned, without warp or rack of frames or sash, and securely fasten in place according to manufacturer's written instructions. Coordinate installation with wall flashings and other components. Seal perimeter of each window frame with elastomeric sealant used for metal wall panels.
1. Separate dissimilar materials from sources of corrosion or electrolytic action at points of contact with other materials by complying with requirements specified in AAMA/WDMA/CSA 101/I.S.2/A440.
- B. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction.
- C. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.
- D. Mount screens directly to frames with tapped screw clips.
- E. Field Glazing: Comply with installation requirements in Section 08 80 00 "Glazing."

### 3.08 ACCESSORY INSTALLATION

- A. General: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install components required for a complete metal roof panel assembly, including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
  2. Install components for a complete metal wall panel assembly, including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
  3. Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by manufacturer.

- B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
1. Install exposed flashing and trim that is without excessive oil-canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
  2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).
- C. Gutters: Join sections with riveted-and-soldered or lapped-and-sealed joints. Attach gutters to eave with gutter hangers spaced as required for gutter size, but not more than 36 inches on center using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.
- D. Downspouts: Join sections with 1-1/2-inch telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches on center in between.
1. Provide elbows at base of downspouts to direct water away from building.
- E. Roof Curbs: Install curbs at locations indicated on Drawings. Install flashing around bases where they meet metal roof panels.
- F. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to panel as recommended by manufacturer.

3.09 FIELD QUALITY CONTROL

- A. Special Inspections: Engage a qualified special inspector to perform special inspections.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- C. Tests and Inspections:
  - 1. High-Strength, Field-Bolted Connections: Connections shall be tested and inspected during installation according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
  - 2. Welded Connections: In addition to visual inspection, field-welded connections shall be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at inspector's option:
    - a. Liquid Penetrant Inspection: ASTM E 165.
    - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
    - c. Ultrasonic Inspection: ASTM E 164.
    - d. Radiographic Inspection: ASTM E 94.
- D. Product will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

END OF SECTION

SECTION 14 45 00 VEHICLE LIFTS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes: Vehicle lifts including safety equipment, controls and accessories.
- B. Related Sections:
  - 1. Division 22 Section – “General-Service Compressed-Air Piping”.
  - 2. Division 26 Section – “General Electrical Requirements”.

1.02 REFERENCES

- A. ALI: Automotive Lift Institute.
- B. ANSI/ALI/ALCTV: Safety Requirements for the Construction, Testing, and Validation of Automotive Lifts.

1.03 ACTION SUBMITTALS

- A. Product Data: Manufacturer's data sheets on each product to be used, including:
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations.
  - 3. Installation manual.
  - 4. Operations and maintenance manual.
  - 5. Safety manual.
- B. Shop Drawings: Template drawings and load reactions for lift application.

1.04 INFORMATIONAL SUBMITTALS

- A. Sample warranty.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.
- B. Executed warranty.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications:
  - 1. Factory trained authorized company.
  - 2. Company insured for completed operations of installing lift.



- B. In addition to the other requirements outlined herein, the lift or lifts, shall comply with all applicable requirements of ANSI standards. "Safety Requirements for the Construction, Care and Use of Automotive Lifts" as published by the American national Standards Institute. The lift company Quality Management System shall be ISO9001 certified.

#### 1.07 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.

#### 1.08 WARRANTY

- A. Contractor/manufacturer/installer has responsibility for a one year Corrective Period for work of this Section from date of Completion against deficiencies as stated in the manufacturer's standard warranty.
- B. Contractor/manufacturer/installer shall promptly and without inconvenience and cost to Owner correct said deficiencies: Failure due to defective materials and workmanship.
- C. Contractor/manufacturer/installer shall be notified immediately of defective products, and be given a reasonable opportunity to inspect the goods prior to return. Manufacturer will not assume responsibility, or compensation, for unauthorized repairs or labor.

### PART 2 - PRODUCTS

#### 2.01 ACCEPTABLE MANUFACTURERS

- A. Drawings and Specifications are based on products manufactured by Rotary Lift., a Dover Company, 2700 Lanier Drive, Madison, IN 47250. Tel. (800) 640-5438.
- B. Equivalent products by the following manufacturers are acceptable:
  1. Challenger Lifts, Inc., Louisville, KY. Tel: (800) 648-5438.
  2. Mohawk Lifts, Amsterdam, NY. Tel: (800) 833-2006.
- C. Alternate Manufacturers: Products produced by other manufacturers that fully meet or exceed the specified requirements may be considered under provisions of Section 01 25 00-Product Procedures and Section 01 60 00-Product Requirements.

#### 2.02 VEHICLE SERVICE LIFT

- A. 18,000 Lb Four Post Surface Mounted Drive on General Service Lift Sm18l/Sm18el Series
  1. Capacity: 18,000 lbs. (9,000 lbs. per runway).
  2. SM18L/SM18EL Series Single Point Manual Controls - Pneumatic (100 psi - 120 psi Air Required) Lock Release Electric Power Unit, UL201Compliant, Over Hydraulic Cylinder Drive: (All Models Bio-Fluid Compatible)
    - a. 2hp 208-230V 1 phase Motor 60Hz.

3. Minimum Bay Requirements: SM18L; floor space 16 feet by 27 feet.
4. Rise: 68 inches (from floor to top of runway).
5. Overall Length: SM18L; 275-3/16 inches (ramp to runway).
6. Overall Width: 137-3/4 inches.
7. Inside of Columns: 121-1/2 inches.
8. Between Front and Rear Columns: SM18L; 212 inches.
9. Height of Columns: 77-3/4 inches.
10. Width of Runways: 22 inches.
11. Height of Runways: 7-1/2 inches.
12. Width Between Runways: 43 to 46 inches.
13. Maximum Wheelbase: SM18L; 194 inches.
14. Finishes: Blue, Standard RAL5005.
15. Accessories:
  - a. RJ9000: Rolling Jacks 9000 lbs. capacity (ea.) (100 psi minimum - 120 psi maximum required). Two required.
  - b. Internal Air Line Kit (100 psi minimum - 120 psi maximum required).
16. Lift shall be 3rd party certified by ETL testing laboratory and labeled with the ETL/Automotive Lift Institute (ALI) label that affirms the lifts meet conformance to all applicable provisions of American National Standard ANSI/ALI ALCTV-2006 and in compliance with IBC 2003, IBC 2006 chapter 30 section 3001.2.

### PART 3 - EXECUTION

#### 3.01 EXAMINATION

- A. Do not begin installation until supporting structures have been properly prepared.
- B. If supporting structure preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

#### 3.02 INSTALLATION

- A. Install in accordance with manufacturer instructions.

#### 3.03 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lifts. Include a review of emergency systems and emergency procedures to be followed at time of operational failure and other building emergencies.
- B. Check operation of lifts with Owner's personnel present and before date of Substantial Completion. Determine that operating systems and devices are functioning properly.
- C. Check operation of lifts with Owner's personnel present not more than one month before end of warranty period. Determine that operating systems and devices are functioning properly.

3.04 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 22 05 18 - ESCUTCHEONS FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

1.02 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.01 ESCUTCHEONS

- A. One-Piece, Cast-Brass Type: With chrome plated finish and setscrew fastener.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.
- C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

2.02 FLOOR PLATES

- A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
  1. Escutcheons for Piping:
    - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.

- b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
  - c. Insulated Piping: One-piece, stamped-steel type.
  - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
  - e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
  - f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
  - g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type.
  - h. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with rough-brass finish.
  - i. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type.
  - j. Bare Piping in Equipment Rooms: One-piece, cast-brass type with chrome-plated finish.
  - k. Bare Piping in Equipment Rooms: One-piece, stamped-steel type.
- C. Install floor plates for piping penetrations of equipment-room floors.
- D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
- 1. Piping: One-piece, floor-plate type.
- 3.02 FIELD QUALITY CONTROL
- A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION

SECTION 22 05 23

GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
  - 1. Bronze ball valves.
  - 2. Iron swing check valves.
  - 3. Iron gate valves.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of valve indicated.

1.03 QUALITY ASSURANCE

- A. ASME Compliance: ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
- B. NSF Compliance: NSF 61 for valve materials for potable-water service.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to valve schedule articles for applications of valves.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
- D. Valve Actuator Types:
  - 1. Gear Actuator: For quarter-turn valves NPS 8 (DN 200) and larger.
  - 2. Handwheel: For valves other than quarter-turn types.
  - 3. Handlever: For quarter-turn valves NPS 6 (DN 150) and smaller[ except plug valves].
- E. Valves in Insulated Piping: With 2-inch (50-mm) stem extensions and the following features:
  - 1. Gate Valves: With rising stem.
  - 2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

F. Valve-End Connections:

1. Solder Joint: With sockets according to ASME B16.18.
2. Threaded: With threads according to ASME B1.20.1.

2.02 BRONZE BALL VALVES

A. One-Piece, Reduced-Port, Bronze Ball Valves with Brass Trim:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. Watts Regulator Co.; a division of Watts Water technologies, Inc.
- b. Conbraco Industries, Inc.; Apollo Valves.
- c. NIBCO Inc.

2. Description:

- a. Standard: MSS SP-110.
- b. CWP Rating: 400 psig (2760 kPa).
- c. Body Design: One piece.
- d. Body Material: Forged brass.
- e. Ends: Threaded.
- f. Seats: PTFE or TFE.
- g. Stem: Brass.
- h. Ball: Chrome-plated brass.
- i. Port: Reduced.

B. Two-Piece, Full-Port, Bronze Ball Valves with Brass Trim:

1. Manufacturers: Subject to compliance with requirements available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. Crane Co.; Crane Valve Group; Crane Valves.
- b. Milwaukee Valve Company.
- c. NIBCO INC.

2. Description:

- a. Standard: MSS SP-110.
- b. SWP Rating: 150 psig (1035 kPa).
- c. CWP Rating: 600 psig (4140 kPa).
- d. Body Design: Two piece.
- e. Body Material: Forged brass.
- f. Ends: Threaded.
- g. Seats: PTFE or TFE.
- h. Stem: Brass.
- i. Ball: Chrome-plated brass.
- j. Port: Full.

C. Two-Piece, Regular-Port, Brass Ball Valves with Brass Trim:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Hammond Valve.
  - b. Legend Valve.
  - c. Milwaukee Valve Company.
2. Description:
  - a. Standard: MSS SP-110.
  - b. SWP Rating: 150 psig (1035 kPa).
  - c. CWP Rating: 600 psig (4140 kPa).
  - d. Body Design: Two piece.
  - e. Body Material: Forged brass.
  - f. Ends: Threaded.
  - g. Seats: PTFE or TFE.
  - h. Stem: Brass.
  - i. Ball: Chrome-plated brass.
  - j. Port: Regular.

2.03 IRON SWING CHECK VALVES

A. Class 125, Iron Swing Check Valves with Metal Seats:

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. Kitz Corporation.
  - b. NIBCO INC.
  - c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
  - a. Standard: MSS SP-71, Type I.
  - b. CWP Rating: 200 psig (1380 kPa).
  - c. Body Design: Clear or full waterway.
  - d. Body Material: ASTM A 126, gray iron with bolted bonnet.
  - e. Ends: Flanged.
  - f. Trim: Bronze.
  - g. Gasket: Asbestos free.

B. Class 125, Iron Swing Check Valves with Nonmetallic-to-Metal Seats:

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. Kitz Corporation.



- b. NIBCO INC.
- c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

- a. Standard: MSS SP-71, Type I.
- b. CWP Rating: 200 psig (1380 kPa).
- c. Body Design: Clear or full waterway.
- d. Body Material: ASTM A 126, gray iron with bolted bonnet.
- e. Ends: Flanged.
- f. Trim: Composition.
- g. Seat Ring: Bronze.
- h. Disc Holder: Bronze.
- i. Disc: PTFE or TFE.
- j. Gasket: Asbestos free.

2.04 IRON GATE VALVES

A. Class 125, NRS, Iron Gate Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. Crane Co.; Crane Valve Group; Crane Valves.
- b. NIBCO INC.
- c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

- a. Standard: MSS SP-70, Type I.
- b. CWP Rating: 200 psig (1380 kPa).
- c. Body Material: ASTM A 126, gray iron with bolted bonnet.
- d. Ends: Flanged.
- e. Trim: Bronze.
- f. Disc: Solid wedge.
- g. Packing and Gasket: Asbestos free.

B. Class 125, OS&Y, Iron Gate Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. Crane Co.; Crane Valve Group; Crane Valves.
- b. NIBCO INC.
- c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

- a. Standard: MSS SP-70, Type I.

- b. CWP Rating: 200 psig (1380 kPa).
- c. Body Material: ASTM A 126, gray iron with bolted bonnet.
- d. Ends: Flanged.
- e. Trim: Bronze.
- f. Disc: Solid wedge.
- g. Packing and Gasket: Asbestos free.

### PART 3 - EXECUTION

#### 3.01 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.

#### 3.02 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

#### 3.03 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
  - 1. Shutoff Service: Ball or gate valves.
  - 2. Throttling Service: ball valves.
    - a. NPS 2 (DN 50) and Smaller: Bronze swing check valves with bronze or nonmetallic disc.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.
- C. Select valves, except wafer types, with the following end connections:
  - 1. For Copper Tubing, NPS 2 (DN 50) and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.

3.04 LOW-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (150 PSIG (1035 kPa) OR LESS)

A. Pipe NPS 2 (DN 50) and Smaller:

1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
2. Ball Valves: Two piece, full port, brass trim.
3. Bronze Swing Check Valves: Class 125, bronze or nonmetallic disc.
4. Bronze Gate Valves: Class 125, NRS.

3.05 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 (DN 50) and Smaller:

1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
2. Ball Valves: Two piece full port, brass trim.
3. Bronze Swing Check Valves: Class 125 bronze or nonmetallic disc.

END OF SECTION

SECTION 22 05 29

HANGERS AND SUPPORTS FOR PLUMBING  
PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal-hanger shield inserts.
4. Fastener systems.
5. Pipe positioning systems.
6. Equipment supports.

1.02 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.03 ACTION SUBMITTALS

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

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.04 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.05 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.01 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:

- 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
- 2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
- 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
- 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
- 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

- B. Stainless-Steel Pipe Hangers and Supports:

- 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
- 2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
- 3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

2.02 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.03 THERMAL-HANGER SHIELD INSERTS

- A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.
- B. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig or ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.

- C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

#### 2.04 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type, stainless-steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

#### 2.05 PIPE POSITIONING SYSTEMS

- A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

#### 2.06 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

#### 2.07 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
  - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
  - 2. Design Mix: 5000-psi, 28-day compressive strength.

### PART 3 - EXECUTION

#### 3.01 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
  2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- D. Fastener System Installation:
1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
  2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- E. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.
- F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- I. Install lateral bracing with pipe hangers and supports to prevent swaying.
- J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

**M. Insulated Piping:**

1. Attach clamps and spacers to piping.
  - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
  - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
  - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
  - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
  - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
4. Shield Dimensions for Pipe: Not less than the following:
  - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

**3.02 EQUIPMENT SUPPORTS**

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

**3.03 METAL FABRICATIONS**

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
  1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  2. Obtain fusion without undercut or overlap.
  3. Remove welding flux immediately.
  4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.



**3.04 ADJUSTING**

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

**3.05 PAINTING**

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Section 099000 "Painting and Coating."
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

**3.06 HANGER AND SUPPORT SCHEDULE**

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.
- F. Use stainless-steel pipe hangers and stainless-steel or corrosion-resistant attachments for hostile environment applications.
- G. Use padded hangers for piping that is subject to scratching.
- H. Use thermal-hanger shield inserts for insulated piping and tubing.
- I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.

2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
  3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
  4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
  5. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
  6. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
  7. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
  8. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
  9. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
- J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
  2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
  2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
- L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
  2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction, to attach to top flange of structural shape.
  3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
  4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
  5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
  6. C-Clamps (MSS Type 23): For structural shapes.

7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    - a. Light (MSS Type 31): 750 lb.
    - b. Medium (MSS Type 32): 1500 lb.
    - c. Heavy (MSS Type 33): 3000 lb.
  8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
  9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
- M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
  2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
  3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
  2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
  3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
- O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- P. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.
- Q. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION

SECTION 22 05 53 IDENTIFICATION FOR PLUMBING  
PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
  - 1. Equipment labels.
  - 2. Warning signs and labels.
  - 3. Pipe labels.

1.02 ACTION SUBMITTAL

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

PART 2 - PRODUCTS

2.01 EQUIPMENT LABELS

- A. Metal Labels for Equipment:
  - 1. Material and Thickness: Brass, 0.032-inch Stainless steel, 0.025-inch Aluminum, 0.032-inch or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
  - 2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
  - 3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
  - 4. Fasteners: Stainless-steel rivets or self-tapping screws.
  - 5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Plastic Labels for Equipment:
  - 1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inchthick, and having predrilled holes for attachment hardware.
  - 2. Letter Color: Black.
  - 3. Background Color: Yellow.
  - 4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
  - 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

## 2.02 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- B. Letter Color: Black.
- C. Background Color: Yellow.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel rivets or self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information, plus emergency notification instructions.

## 2.03 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
  - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
  - 2. Lettering Size: At least 1-1/2 inches high.

### PART 3 - EXECUTION

#### 3.01 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

#### 3.02 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

#### 3.03 PIPE LABEL INSTALLATION

- A. Piping Color-Coding: Painting of piping is specified in Section 099000 "Painting and Coating."
- B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
  - 1. Near each valve and control device.
  - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
  - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
  - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
  - 5. Near major equipment items and other points of origination and termination.
  - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
  - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

C. Pipe Label Color Schedule:

1. Low-Pressure, Compressed-Air Piping:
  - a. Background Color: Yellow.
  - b. Letter Color: Black.
2. Medium-Pressure, Compressed-Air Piping:
  - a. Background Color: Yellow.
  - b. Letter Color: Black.
3. Domestic Water Piping:
  - a. Background Color: Yellow.
  - b. Letter Color: Black.

END OF SECTION

SECTION 22 07 19

PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes insulating the following plumbing piping services:
  - 1. Domestic hot-water piping.
  - 2. Sanitary waste piping exposed to freezing conditions.
  - 3. Supplies and drains for handicap-accessible lavatories and sinks.

1.02 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.

1.03 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.04 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

### 2.01 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. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. 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. Pittsburgh Corning Corporation; Foamglas.
    - b. Foamglas Building Inc.
    - c. SPI Special Products & Insulation.
  2. Special-Shaped Insulation: ASTM C 552, Type III.
  3. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
  4. Preformed Pipe Insulation with Factory-Applied ASJ-SSL: Comply with ASTM C 552, Type II, Class 2.
  5. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
- G. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Aeroflex USA, Inc.; Aerocel.
    - b. Armacell LLC; AP Armaflex.
    - c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.

## H. 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 Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

## I. Polyolefin: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C 534 or ASTM C 1427, Type I, Grade 1 for tubular materials.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Armacell LLC; Tubolit.
  - b. Nomaco Insulation; IMCOLOCK and NOMALOCK.
  - c. Dritherm International Inc.

## 2.02 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.
  - b. Morgan Advanced materials.
  - c. Amerisafe Inc, Safety and Insulation Supplies & Equipment.

## 2.03 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. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F.

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; 81-84.
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."

- C. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Aeroflex USA, Inc.; Aero seal.
    - b. Armacell LLC; Armaflex 520 Adhesive.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
    - d. K-Flex USA; R-373 Contact 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."
- D. 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."
- E. 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; 85-20.
    - 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."

- F. 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."

#### 2.04 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.
    - c. Mastic coatings, Adhesives and Sealants.
  2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
  3. Service Temperature Range: Minus 20 to plus 180 deg F.
  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. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
    - c. Vimasco Corporation; WC-1/WC-5.
  2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
  3. Service Temperature Range: Minus 20 to plus 180 deg F.
  4. Solids Content: 60 percent by volume and 66 percent by weight.
  5. Color: White.

## 2.05 SEALANTS

## A. Joint Sealants:

1. Joint Sealants for Cellular-Glass 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. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.
  - c. Pittsburgh Corning Corporation; Pittseal 444.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Permanently flexible, elastomeric sealant.
4. Service Temperature Range: Minus 100 to plus 300 deg F.
5. Color: White or gray.
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."

## B. 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. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
  - c. 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.
5. Color: Aluminum.
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."

## C. 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.
  - b. Mastics, Coatings, Adhesives and Sealants.
  - c. Hercules Roof Flashing Sealant, Inc.
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.
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."

## 2.06 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.

## 2.07 FIELD-APPLIED FABRIC-REINFORCING MESH

- A. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., 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.
    - c. Puget Sound Steel, Inc.

## 2.08 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: Color-code jackets based on system.

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.
- C. Aluminum Jacket: Comply with ASTM B 209, 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. 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- thick, heat-bonded polyethylene and kraft paper.
  5. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
  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.
- 2.09 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.
  3. Thickness: 11.5 mils.
  4. Adhesion: 90 ounces force/inch in width.
  5. Elongation: 2 percent.
  6. Tensile Strength: 40 lbf/inch 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.
  3. Thickness: 6.5 mils.
  4. Adhesion: 90 ounces force/inch in width.
  5. Elongation: 2 percent.
  6. Tensile Strength: 40 lbf/inch in width.
  7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. 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.
  3. Thickness: 6 mils.
  4. Adhesion: 64 ounces force/inch in width.
  5. Elongation: 500 percent.
  6. Tensile Strength: 18 lbf/inch in width.
- D. 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.
  3. Thickness: 3.7 mils.
  4. Adhesion: 100 ounces force/inch in width.
  5. Elongation: 5 percent.
  6. Tensile Strength: 34 lbf/inch in width.



## 2.10 SECUREMENTS

- A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed 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.
    - c. MTL Insulation Industry.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
- C. Wire: 0.062-inch soft-annealed, stainless steel.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. C & F Wire.
    - b. Omega.com
    - c. Dupont Wire & Cable Materials.

## 2.11 PROTECTIVE SHIELDING GUARDS

- A. Protective Shielding Pipe Covers:
  - 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. Engineered Brass Company.
    - b. Insul-Tect Products Co.; a subsidiary of MVG Molded Products.
    - c. McGuire Manufacturing.
    - d. Plumberex.
    - e. Truebro; a brand of IPS Corporation.
    - f. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.
  - 2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.
- B. Protective Shielding Piping Enclosures,:

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. Engineered Brass Company.
  - b. Truebro; a brand of IPS Corporation.
  - c. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.
2. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

### PART 3 - EXECUTION

#### 3.01 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

#### 3.02 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- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
  3. Overlap jacket longitudinal seams at least 1-1/2 inches. 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 on center.
    - 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 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.

### 3.03 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
  2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
  4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
  2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
  4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
- F. Insulation Installation at Floor Penetrations:
1. Pipe: Install insulation continuously through floor penetrations.
  2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."
- 3.04 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 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.

### 3.05 INSTALLATION OF CELLULAR-GLASS INSULATION

#### A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

#### B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

#### C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.

2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

### 3.06 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

### 3.07 INSTALLATION OF MINERAL-FIBER PREFORMED PIPE INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.

2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

### 3.08 INSTALLATION OF POLYOLEFIN INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Seal split-tube longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.



3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polyolefin sheet insulation of same thickness as pipe insulation.
  4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
1. Install mitered sections of polyolefin pipe insulation.
  2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:
1. Install cut sections of polyolefin pipe and sheet insulation to valve body.
  2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
  3. Install insulation to flanges as specified for flange insulation application.
  4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- 3.09 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 laps at longitudinal seams and 3-inch- 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 PVC jackets are indicated, install with 1-inch 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.
- C. Where metal jackets are indicated, install with 2-inch 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 o.c. and at end joints.
- 3.10 FINISHES
- A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and 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. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

### 3.11 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 three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged 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.

### 3.12 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. Underground piping.
  2. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

### 3.13 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Hot Water: Insulation shall be one of the following:
  1. Flexible Elastomeric: 3/4 inch thick.
  2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.

3. Polyolefin: 3/4 inch thick.
  4. Flexible Elastomeric: 1 inch thick.
  5. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
  6. Polyolefin: inch thick.
- B. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities: Insulation shall be one of the following:
1. Flexible Elastomeric: 1/2 inch thick.
  2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.
  3. Polyolefin: 1/2 inch thick.

END OF SECTION

SECTION 22 11 16 - DOMESTIC WATER AND COMPRESSED AIR PIPING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes under-building-slab and aboveground domestic water pipes, tubes, and fittings inside buildings.
- B. Related Requirements:
  - 1. Refer to civil engineering drawing sheet C4 for water-service piping and water meters outside the building from source to the point where water-service piping enters the building.

1.02 ACTION SUBMITTALS

- A. Product Data: For transition fittings and dielectric fittings.

1.03 INFORMATIONAL SUBMITTALS

- A. System purging and disinfecting activities report.
- B. Field quality-control reports.

PART 2 - PRODUCTS

2.01 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."

2.02 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.
- B. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
- 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.

## F. Copper Pressure-Seal-Joint Fittings:

1. Fittings for NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
2. Fittings for NPS 2-1/2 to NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber, O-ring seal in each end.

## G. Copper Push-on-Joint Fittings:

1. Cast-copper fitting complying with ASME B16.18 or wrought-copper fitting complying with ASME B 16.22.
2. Stainless-steel teeth and EPDM-rubber, O-ring seal in each end instead of solder-joint ends.

## 2.03 PIPING JOINING MATERIALS

## A. Pipe-Flange Gasket Materials:

1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
2. Full-face or ring type unless otherwise indicated.

## B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

## C. Solder Filler Metals: ASTM B 32, lead-free alloys.

## D. Flux: ASTM B 813, water flushable.

## 2.04 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.

**2.05 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: 125 psig minimum at 180 deg F.
  4. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Nipples:
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. Elster Perfection Corporation.
    - b. Grinnell Mechanical Products; Tyco Fire Products LP.
    - c. Matco-Norca.
    - d. Precision Plumbing Products, Inc.
    - e. Victaulic Company.
  2. Standard: IAPMO PS 66.
  3. Electroplated steel nipple complying with ASTM F 1545.
  4. Pressure Rating and Temperature: 300 psig at 225 deg F.
  5. End Connections: Male threaded or grooved.
  6. Lining: Inert and noncorrosive, propylene.

**PART 3 - EXECUTION****3.01 EARTHWORK**

- A. Comply with requirements in Section 31 23 11 "Excavation, Fill and Grading for Buildings.

## 3.02 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 ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.
- D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance and with requirements for drain valves and strainers in Section 221119 "Domestic Water Piping Specialties."
- E. Install shutoff valve immediately upstream of each dielectric fitting.
- F. Install domestic water piping level with 0.25 percent slope downward toward drain 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 thermometers on inlet and outlet piping from each water heater.

- Q. Install sleeves for piping penetrations of walls, ceilings, and floors.
  - R. Install sleeve seals for piping penetrations of concrete walls and slabs.
  - S. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."
  - T. Compressed air piping shall be kept clean during installation and joints sealed with Teflon tape.
- 3.03 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. 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."
  - E. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.
  - F. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.
- 3.04 TRANSITION FITTING INSTALLATION
- A. Install transition couplings at joints of dissimilar piping.
  - B. Transition Fittings in Underground Domestic Water Piping:
    - 1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
    - 2. Fittings for NPS 2 and Larger: Sleeve-type coupling.
- 3.05 DIELECTRIC FITTING INSTALLATION
- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
  - B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings.



**3.06 HANGER AND SUPPORT INSTALLATION**

- A. Comply with requirements for pipe hanger, support products, and installation in Section 220529 "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 and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
  3. Multiple, Straight, Horizontal Piping Runs 100 Feet 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.
- D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
  2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
  3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
- E. Install supports for vertical copper tubing every 10 feet.
- F. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/4 and Smaller: 84 inches with 3/8-inch rod.
  2. NPS 1-1/2: 108 inches with 3/8-inch rod.
  3. NPS 2: 10 feet with 3/8-inch rod.
- G. maximum horizontal spacing and minimum rod diameters:
1. NPS 1 and Smaller: 36 inches with 3/8-inch rod.
  2. NPS 1-1/4 to NPS 2: 48 inches with 3/8-inch rod.
- H. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

### 3.07 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. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
  - 2. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
  - 3. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection.

### 3.08 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."
- B. Label pressure piping with system operating pressure.

### 3.09 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 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.

### 3.10 ADJUSTING

- A. Perform the following adjustments before operation:
  1. Close drain valves, hydrants, and hose bibbs.
  2. Open shutoff valves to fully open position.
  3. Open throttling valves to proper setting.
  4. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
  5. Remove and clean strainer screens. Close drain valves and replace drain plugs.
  6. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
  7. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.11 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 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 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 and compressed piping system. Remove dirt and debris as work progresses.

END OF SECTION

SECTION 22 11 19 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Vacuum breakers.
2. Backflow preventers.
3. Strainers.
4. Hose bibbs.
5. Wall hydrants.
6. Drain valves.
7. Water-hammer arresters.
8. Trap-seal primer valves.

1.02 ACTION SUBMITTALS

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

1.03 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.04 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

- A. Potable-water piping and components shall comply with NSF 61.

2.02 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.03 VACUUM BREAKERS

- A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:

1. Standard: ASSE 1001.
2. Size: NPS 1/4 to NPS 3, as required to match connected piping.
3. Body: Bronze.
4. Inlet and Outlet Connections: Threaded.
5. Finish: Rough bronze.

## B. Hose-Connection Vacuum Breakers:

1. Standard: ASSE 1011.
2. Body: Bronze, nonremovable, with manual drain.
3. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
4. Finish: Rough bronze.

## 2.04 BACKFLOW PREVENTERS

## A. Intermediate Atmospheric-Vent Backflow Preventers:

1. Standard: ASSE 1012.
2. Operation: Continuous-pressure applications.
3. Size: NPS 3/4.
4. Body: Bronze.
5. End Connections: Union, solder joint.
6. Finish: Rough bronze.

## B. Reduced-Pressure-Principle Backflow Preventers: RPBP-1 See Drawings.

## 2.05 STRAINERS FOR DOMESTIC WATER PIPING

## A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved, epoxy coated and for NPS 2-1/2 and larger.
3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
4. Screen: Stainless steel with round perforations unless otherwise indicated.
5. Perforation Size:
  - a. Strainers NPS 2 and Smaller: 0.020 inch.
  - b. Strainers NPS 2-1/2 to NPS 4: 0.045 inch.
6. Drain: Factory-installed, hose-end drain valve.

## 2.06 HOSE BIBBS:

## A. Hose Bibbs See Drawings.

## 2.07 WALL HYDRANTS: See Drawings.

## A. Vacuum Breaker Wall Hydrants: See Drawings.

## 2.08 DRAIN VALVES

## A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 3/4.
4. Body: Copper alloy.

5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

## 2.09 WATER-HAMMER ARRESTERS

### A. Water-Hammer Arresters:

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. AMTROL, Inc.
  - b. Josam Company.
  - c. MIFAB, Inc.
  - d. Precision Plumbing Products, Inc.
  - e. Sioux Chief Manufacturing Company, Inc.
  - f. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - g. Tyler Pipe; Wade Div.
  - h. Watts Drainage Products.
  - i. Zurn Industries, LLC; Plumbing Products Group; Specification Drainage Products.
2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

## 2.10 TRAP-SEAL PRIMER DEVICE

### A. Supply-Type, Trap-Seal Primer Device:

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. MIFAB, Inc.
  - b. Precision Plumbing Products, Inc.
  - c. Sioux Chief Manufacturing Company, Inc.
  - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - e. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
2. Standard: ASSE 1018.
3. Pressure Rating: 125 psig minimum.
4. Body: Bronze.
5. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
6. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

### PART 3 - EXECUTION

#### 3.01 INSTALLATION

- A. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
  - 1. Locate backflow preventers in same room as connected equipment or system.
  - 2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
  - 3. Do not install bypass piping around backflow preventers.
- B. Install mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.
  - 1. Install cabinet-type units recessed in or surface mounted on wall as specified.
- C. Install Y-pattern strainers for water on supply side of backflow preventer.
- D. Install water-hammer arresters in water piping according to PDI-WH 201.
- E. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

#### 3.02 CONNECTIONS

- A. Comply with requirements for ground equipment in Section 260526 "Grounding and Bonding for Electrical Systems."

#### 3.03 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  - 1. Test each pressure vacuum breaker reduced-pressure-principle backflow preventer according to authorities having jurisdiction and the device's reference standard.
- B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.



3.04 ADJUSTING

- A. Set field-adjustable temperature set points of primary, thermostatic, water mixing valves.

END OF SECTION

SECTION 22 13 16

SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings.
2. Specialty pipe fittings.

B. Related Requirements:

1. Refer to civil engineering Drawing Sheet C4 for water-service piping and water meters outside the building from source to the point where water-service piping enters the building.

1.02 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Soil, waste, and vent piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1.03 ACTION SUBMITTALS

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

1.04 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For waste and vent piping, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Detailed description of piping anchorage devices on which the certification is based and their installation requirements.

- B. Field quality-control reports.

1.05 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

## PART 2 - PRODUCTS

## 2.01 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.

## 2.02 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 74, Service class.
- B. Gaskets: ASTM C 564, rubber.

## 2.03 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. CISPI, Hubless-Piping Couplings:
  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. ANACO-Husky.
    - b. Dallas Specialty & Mfg. Co.
    - c. Fernco Inc.
    - d. Matco-Norca, Inc.
    - e. MIFAB, Inc.
    - f. Mission Rubber Company; a division of MCP Industries, Inc.
    - g. Stant.
    - h. Tyler Pipe.
  2. Standards: ASTM C 1277 and CISPI 310.
  3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.
- C. Heavy-Duty, Hubless-Piping Couplings:
  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. ANACO-Husky.
    - b. Clamp-All Corp.
    - c. Dallas Specialty & Mfg. Co.
    - d. MIFAB, Inc.
    - e. Mission Rubber Company; a division of MCP Industries, Inc.
    - f. Stant.
    - g. Tyler Pipe.
  2. Standards: ASTM C 1277 and ASTM C 1540.
  3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

## 2.04 SPECIALTY PIPE FITTINGS

### A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
3. Unshielded, Nonpressure Transition Couplings:
  - 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) Dallas Specialty & Mfg. Co.
    - 2) Fernco Inc.
    - 3) Mission Rubber Company; a division of MCP Industries, Inc.
    - 4) Plastic Oddities; a division of Diverse Corporate Technologies, Inc.
  - b. Standard: ASTM C 1173.
  - c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
  - d. Sleeve Materials:
    - 1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
    - 2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
    - 3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
4. Shielded, Nonpressure Transition Couplings:
  - 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) Cascade Waterworks Mfg. Co.
    - 2) Mission Rubber Company; a division of MCP Industries, Inc.
  - b. Standard: ASTM C 1460.
  - c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

## PART 3 - EXECUTION

### 3.01 EARTH MOVING

- A. Refer to civil engineering Drawings for requirements of excavating, trenching, and backfilling.

**3.02 PIPING INSTALLATION**

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. 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.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping at indicated slopes.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. 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 two 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.
- I. 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.
- J. Install 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.
- K. Install cast-iron waste piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

## L. Plumbing Specialties:

1. Install backwater valves in sanitary waste gravity-flow piping. Comply with requirements for backwater valves specified in Section 221319 "Sanitary Waste Piping Specialties."
2. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."
3. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."

M. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

N. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 22 05 18 "Escutcheons for Plumbing Piping."

## 3.03 JOINT CONSTRUCTION

- A. Join hub-and-spigot, cast-iron waste piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Join hubless, cast-iron waste piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

## 3.04 SPECIALTY PIPE FITTING INSTALLATION

## A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in OD's.
2. In Drainage Piping: Shielded, nonpressure transition couplings.

## 3.05 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
3. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
4. Vertical Piping: MSS Type 8 or Type 42, clamps.
5. Install individual, straight, horizontal piping runs:
  - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
  - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
  - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

6. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  7. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Support horizontal piping and tubing within 12 inches of each fitting[, valve,] and coupling.
  - C. Support vertical piping and tubing at base and at each floor.
  - D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.
  - E. Install hangers for cast-iron waste piping with the following maximum horizontal spacing and minimum rod diameters:
    1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
    2. NPS 3: 60 inches with 1/2-inch rod.
    3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
  - F. Install supports for vertical cast-iron waste piping every 15 feet.

### 3.06 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect drainage and vent piping to the following:
  1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
  2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
  3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
  4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
- D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

### 3.07 IDENTIFICATION

- A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

### 3.08 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
  - 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 final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
  - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
  - 2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
  - 3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
  - 4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
  - 5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
  - 6. Prepare reports for tests and required corrective action.

### 3.09 CLEANING AND PROTECTION

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.



3.10 PIPING SCHEDULE

- A. Aboveground waste and vent piping NPS 4 and smaller shall be any of the following:
  - 1. Service class, cast-iron waste pipe and fittings; gaskets; and gasketed joints.
  - 2. Hubless, cast-iron waste pipe and fittings; CISPI heavy-duty hubless-piping couplings; and coupled joints.
  - 3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
  
- B. Underground waste and vent piping NPS 4 and smaller shall be any of the following:
  - 1. Service class, cast-iron waste piping; gaskets; and gasketed joints.
  - 2. Hubless, cast-iron waste pipe and fittings; CISPI heavy-duty cast-iron hubless-piping couplings; and coupled joints.
  - 3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
  
- C. Underground waste piping NPS 5 and larger shall be any of the following:
  - 1. Service class, cast-iron waste piping; gaskets; and gasketed joints.
  - 2. Hubless, cast-iron waste pipe and fittings; CISPI heavy-duty cast-iron hubless-piping couplings; coupled joints.
  - 3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

END OF SECTION

## SECTION 22 13 19 - SANITARY WASTE PIPING SPECIALTIES

## PART 1 - GENERAL

## 1.01 SUMMARY

A. This Section includes the following sanitary drainage piping specialties:

1. Cleanouts.
2. Floor drains.
3. Roof flashing assemblies.
4. Miscellaneous sanitary drainage piping specialties.
5. Flashing materials.
6. Oil/Sediment interceptor.

## 1.02 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for interceptors.

## 1.03 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

## PART 2 - PRODUCTS

## 2.01 CLEANOUTS

A. Exposed Cast-Iron Cleanouts <Insert drawing designation if any>:

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. Josam Company; Josam Div.
  - b. MIFAB, Inc.
  - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - d. Tyler Pipe; Wade Div.
  - e. Watts Drainage Products Inc.
  - f. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
3. Size: Same as connected drainage piping
4. Body Material: Hub-and-spigot, cast-iron waste pipe T-branch Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk cast-iron plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

## B. Cast-Iron Floor Cleanouts:

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. Josam Company; Josam Div.
  - b. Oatey.
  - c. Sioux Chief Manufacturing Company, Inc.
  - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - e. Tyler Pipe; Wade Div.
  - f. Watts Drainage Products Inc.
  - g. Zurn Plumbing Products Group; Light Commercial Operation.
  - h. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.36.2M for cast-iron soil pipe with cast-iron ferrule cleanout.
3. Size: Same as connected branch.
4. Type: Cast-iron soil pipe with cast-iron ferrule.
5. Body or Ferrule: Cast iron.
6. Clamping Device: Not required.
7. Outlet Connection: Inside calk.
8. Closure: Cast-iron plug.
9. Adjustable Housing Material: Cast iron.
10. Frame and Cover Material and Finish: Nickel-bronze.
11. Frame and Cover Shape: Square.
12. Top Loading Classification Heavy Duty.
13. Riser: ASTM A 74 Service class, cast-iron drainage pipe fitting and riser to cleanout.

## C. Cast-Iron Wall Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Josam Company; Josam Div.
  - b. MIFAB, Inc.
  - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - d. Tyler Pipe; Wade Div.
  - e. Watts Drainage Products Inc.
  - f. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: [Hub-and-spigot, cast-iron soil pipe T-branch] [Hubless, cast-iron soil pipe test tee] as required to match connected piping.
5. Closure: Raised-head plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Round, stainless-steel cover plate with screw.
8. Wall Access: Round, wall-installation frame and cover.

## 2.02 FLOOR DRAINS

- A. Cast-Iron Floor Drains: See drawings.

**2.03 ROOF FLASHING ASSEMBLIES****A. Roof Flashing Assemblies:**

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. Acorn Engineering Company; Elmdor/Stoneman Div.
  - b. Thaler Metal Industries Ltd.
- B. Description: Manufactured assembly made of 4.0-lb/sq. ft., 0.0625-inch- from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.
  1. Open-Top Vent Cap: Without cap.
  2. Low-Silhouette Vent Cap: With vandal-proof vent cap.
  3. Extended Vent Cap: With field-installed, vandal-proof vent cap.

**2.04 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES****A. Open Drains :**

1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564, rubber gaskets.
2. Size: Same as connected waste piping with increaser fitting of size indicated.

**B. Deep-Seal Traps:**

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
2. Size: Same as connected waste piping.
  - a. NPS 2: 4-inch- minimum water seal.
  - b. NPS 2-1/2 and Larger: 5-inch- minimum water seal.

**C. Floor-Drain, Trap-Seal Primer Fittings:**

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
2. Size: Same as floor drain outlet with NPS 1/2 side inlet.

**D. Air-Gap Fittings:**

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

## E. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device, that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 1 inch above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

## F. Stack Flashing Fittings:

1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

## G. Vent Caps:

1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
2. Size: Same as connected stack vent or vent stack.

## 2.05 FLASHING MATERIALS

## A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:

1. General Use: 4.0-lb/sq. ft., 0.0625-inch thickness.
2. Vent Pipe Flashing: 3.0-lb/sq. ft., 0.0469-inch thickness.
3. Burning: 6-lb/sq. ft., 0.0938-inch thickness.

## B. Fasteners: Metal compatible with material and substrate being fastened.

## C. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

## D. Solder: ASTM B 32, lead-free alloy.

## E. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

## 2.06 OIL/SEDIMENT INTERCEPTOR

## A. Oil/Sediment Interceptor:

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. Applied Chemical Technology, Incorporated.
  - b. Josam Company; Josam Div.
  - c. MIFAB, Inc.
  - d. Rockford Sanitary Systems, Inc.
  - e. Schier Products Company.

- f. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
- g. Tyler Pipe; Wade Div.
- h. Watts Drainage Products Inc.
- i. Zurn Plumbing Products Group; Light Commercial Operation.
- j. Zurn Plumbing Products Group; Specification Drainage Operation.
- k. Ashland Trap Distribution Co.
- l. Bio-Microbics, Inc.
- m. Canplas LLC.
- n. Schier Products Company.
- o. Zurn Plumbing Products Group; Light Commercial Operation.

### PART 3 - EXECUTION

#### 3.01 INSTALLATION

- A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
  - 1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
  - 2. Locate at each change in direction of piping greater than 45 degrees.
  - 3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
  - 4. Locate at base of each vertical soil and waste stack.
- B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- D. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
  - 1. Position floor drains for easy access and maintenance.
  - 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
    - a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
    - b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
    - c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.
  - 3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
  - 4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- E. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.

- F. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.
- G. Assemble open drain fittings and install with top of hub 2 inches above floor.
- H. Install deep-seal traps on floor drains and other waste outlets, if indicated.
- I. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
  - 1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
  - 2. Size: Same as floor drain inlet.
- J. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- K. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.
- L. Install vent caps on each vent pipe passing through roof.
- M. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

### 3.02 CONNECTIONS

- A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.

### 3.03 FLASHING INSTALLATION

- A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
  - 1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.
- B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
  - 1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
  - 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
  - 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.
- C. Set flashing on floors and roofs in solid coating of bituminous cement.

- D. Secure flashing into sleeve and specialty clamping ring or device.
- E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Section 076200 "Sheet Metal Flashing and Trim."
- F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

3.04 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each grease interceptor.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.

3.05 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION



SECTION 22 33 00

ELECTRIC, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Commercial, electric, storage, domestic-water heaters.
2. Domestic-water heater accessories.

1.02 ACTION SUBMITTALS

A. Product Data: For each type and size of domestic-water heater indicated.

B. Shop Drawings:

1. Wiring Diagrams: For power, signal, and control wiring.

1.03 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For commercial domestic-water heaters, accessories, and components, from manufacturer.

B. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

C. Source quality-control reports.

D. Field quality-control reports.

E. Warranty: Sample of special warranty.

1.04 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.05 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/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

C. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61, "Drinking Water System Components - Health Effects."

## 1.06 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric, domestic-water heaters that fail in materials or workmanship within specified warranty period.
1. Warranty Periods: From date of Substantial Completion.
    - a. Commercial, Electric, Storage, Domestic-Water Heaters:
      - 1) Storage Tank: Three years.
      - 2) Controls and Other Components: Three years.
    - b. Compression Tanks: Five years.

## PART 2 - PRODUCTS

## 2.01 COMMERCIAL, ELECTRIC, domestic-WATER HEATERS

- A. Commercial, Electric, Storage, Domestic-Water Heaters:
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawing or comparable product by one of the following:
    - a. Bradford White Corporation.
    - b. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
    - c. State Industries.
  2. Standard: UL 1453.
  3. Storage-Tank Construction: Non-ASME-code, vertical arrangement.
    - a. Tappings: Factory fabricated of materials compatible with tank and piping connections. Attach tappings to tank before testing.
      - 1) NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1.
    - b. Pressure Rating: 150 psig (1035 kPa).
    - c. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.
  4. Factory-Installed Storage-Tank Appurtenances:
    - a. Anode Rod: Replaceable magnesium.
    - b. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
    - c. Insulation: Comply with ASHRAE/IESNA 90.1.
    - d. Jacket: Steel with enameled finish.
    - e. Heating Elements: Electric, screw-in or bolt-on immersion type arranged in multiples of three.
    - f. Temperature Control: Adjustable thermostat.
    - g. Safety Controls: High-temperature-limit and low-water cutoff devices or systems.
    - h. Relief Valves: ASME rated and stamped for combination temperature-and-pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.
  5. Special Requirements: NSF 5 construction.

## 2.02 Domestic-WATER HEATER ACCESSORIES

## A. Domestic-Water Compression Tanks:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - a. Honeywell International Inc.
  - b. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
  - c. State Industries.
2. Description: Steel pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
3. Construction:
  - a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
  - b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
  - c. Air-Charging Valve: Factory installed.
4. Capacity and Characteristics:
  - a. Working-Pressure Rating: 150 psig (1035 kPa).
  - b. Capacity Acceptable: 2 gal. (7.6 L) minimum.

B. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 (DN 20) with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.

C. Combination Temperature-and-Pressure Relief Valves: ASME rated and stamped. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.

D. Pressure Relief Valves: ASME rated and stamped. Include pressure setting less than domestic-water heater working-pressure rating.

E. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4.

## 2.03 SOURCE QUALITY CONTROL

A. Hydrostatically test commercial domestic-water heaters to minimum of one and one-half times pressure rating before shipment.

B. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 01 40 00 "Quality Requirements" for retesting and reinspecting requirements and Section 01 73 00 "Execution" for requirements for correcting the Work.

C. Prepare test and inspection reports.

## PART 3 - EXECUTION

## 3.01 DOMESTIC-WATER HEATER INSTALLATION

- A. Install electric, domestic-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.
  - 1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 22 05 23 "General-Duty Valves for Plumbing Piping."
- B. Install combination temperature-and-pressure relief valves in water piping for electric, domestic-water heaters without storage. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- C. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for electric, domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 22 11 19 "Domestic Water Piping Specialties."
- D. Fill electric, domestic-water heaters with water.
- E. Charge domestic-water compression tanks with air.

## 3.02 CONNECTIONS

- A. Comply with requirements for piping specified in Section 22 11 16 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

## 3.03 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

3.04 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.
  - 2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
  - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 01 40 00 "Quality Requirements" for retesting and reinspecting requirements and Section 01 73 00 "Execution" for requirements for correcting the Work.
- C. Prepare test and inspection reports.

END OF SECTION

SECTION 23 05 13 COMMON MOTOR REQUIREMENTS  
FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.02 RELATED DOCUMENTS

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

1.03 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
  - 1. Electrical Division of the Project Manual
  - 2. Motor controllers.
  - 3. Torque, speed, and horsepower requirements of the load.
  - 4. Ratings and characteristics of supply circuit and required control sequence.
  - 5. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.01 GENERAL MOTOR REQUIREMENTS

- A. Comply with NEMA MG 1 unless otherwise indicated.
- B. Comply with IEEE 841 for severe-duty motors when indicated.

2.02 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 104 deg F (40 deg C) and at altitude of 3300 feet (1000 m) above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

### 2.03 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Energy efficient, as defined in NEMA MG 1.
- C. Multispeed Motors: Separate winding for each speed.
- D. Rotor: Random-wound, squirrel cage.
- E. Bearings: greasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- F. Temperature Rise: One class below insulation rating class.
- G. Insulation: Class F or higher if indicated.
- H. Code Letter Designation:
  - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
  - 2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

### 2.04 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
  - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
  - 2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
  - 3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
  - 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
- B. Severe-Duty Motors (when indicated): Comply with IEEE 841, with 1.15 minimum service factor.

### 2.05 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
  - 1. Permanent-split capacitor.
  - 2. Split phase.
  - 3. Capacitor start, inductor run.
  - 4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Used)

END OF SECTION



SECTION 23 05 17

SLEEVES FOR HVAC PIPING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Sleeves.
2. Grout.

1.02 RELATED DOCUMENTS

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

1.03 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.01 SLEEVES

- A. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- B. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- C. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.02 GROUT

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

## PART 3 - EXECUTION

## 3.01 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. Install sleeves in concrete floors, concrete roof slabs, and concrete or brick walls as new slabs and walls are constructed.
  - 1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves unless indicated otherwise.
  - 2. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
  - 3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- C. Install sleeves for pipes passing through interior partitions.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
  - 2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
  - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 07 92 00 "Joint Sealants."
- 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 for firestopping specified in Section 07 84 13 "Penetration Firestopping" and drawing details where applicable.

## 3.02 SLEEVE SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
  - 1. Exterior Concrete and Brick Walls above Grade:
    - a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
    - b. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves.
  - 2. Interior Partitions:
    - a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
    - b. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION

SECTION 23 05 18 ESCUTCHEONS FOR HVAC PIPING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

1.02 RELATED DOCUMENTS

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

1.03 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.01 ESCUTCHEONS

- A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.
- C. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed hinge, and spring-clip fasteners.

2.02 FLOOR PLATES

- A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.
- B. Split-Casting Floor Plates: Cast brass with concealed hinge.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
    - 1. Escutcheons for New Piping:
      - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
      - b. Chrome-Plated Piping: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
      - c. Insulated Piping: Split-plate, stamped-steel type with concealed hinge.
      - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
      - e. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge.
      - f. Bare Piping in Unfinished Service Spaces: Split-plate, stamped-steel type with concealed hinge.
      - g. Bare Piping in Equipment Rooms: Split-plate, stamped-steel type with concealed hinge.
  - C. Install floor plates for piping penetrations of floors.
  - D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
    - 1. New Piping: One-piece, floor-plate type.
- 3.02 FIELD QUALITY CONTROL
- A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION

SECTION 23 05 29 HANGERS AND SUPPORTS FOR HVAC  
PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal-hanger shield inserts.
4. Fastener systems.
5. Pipe stands.
6. Equipment supports.
7. Tool box shelves.

B. Related Sections:

1. Section 05 50 00 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section 23 05 48 "Vibration Controls for HVAC Piping and Equipment" for vibration isolation devices.
3. Section 23 31 13 "Metal Ducts" for duct hangers and supports.

1.02 RELATED DOCUMENTS

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

1.03 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.04 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.05 ACTION SUBMITTALS

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

1.06 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.07 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.01 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:

- 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
- 2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
- 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
- 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
- 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

- B. Copper Pipe Hangers:

- 1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
- 2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.02 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.03 METAL FRAMING SYSTEMS

- A. MFMA Manufacturer Metal Framing Systems:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Allied Tube & Conduit.
  - b. Cooper B-Line, Inc.
  - c. Flex-Strut Inc.
  - d. GS Metals Corp.
  - e. Thomas & Betts Corporation.
  - f. Unistrut Corporation; Tyco International, Ltd.
  - g. Wesanco, Inc.
- 2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.

3. Standard: MFMA-4.
4. Channels: Continuous slotted steel channel with in-turned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
7. Metallic Coating: Mill galvanized.

#### 2.04 THERMAL-HANGER SHIELD INSERTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Carpenter & Paterson, Inc.
  2. Clement Support Services.
  3. ERICO International Corporation.
  4. National Pipe Hanger Corporation.
  5. PHS Industries, Inc.
  6. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
  7. Piping Technology & Products, Inc.
  8. Rilco Manufacturing Co., Inc.
  9. Value Engineered Products, Inc.
- B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.
- C. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.
- D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

#### 2.05 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type, stainless-steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- C. Verify fastener suitability for the receiving concrete structure.

**2.06 EQUIPMENT SUPPORTS**

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

**2.07 TOOL BOX SHELVES**

- A. Welded, shop or field fabricated shelf made from structural steel shapes and expanded metal.

**2.08 MISCELLANEOUS MATERIALS**

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
1. Properties: Nonstaining, noncorrosive, and nongaseous.
  2. Design Mix: 5000-psi, 28-day compressive strength.

**PART 3 - EXECUTION****3.01 HANGER AND SUPPORT INSTALLATION**

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
  2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Fastener System Installation:
1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured.



2. Use operators that are licensed by powder-actuated tool manufacturer.
  3. Install fasteners according to powder-actuated tool manufacturer's operating manual.
  4. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured.
  5. Install fasteners according to manufacturer's written instructions.
- F. Pipe Stand Installation:
1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
  2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 07 72 00 "Roof Accessories" for curbs.
- G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- I. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- L. Insulated Piping:
1. Attach clamps and spacers to piping.
    - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
  2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
  3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:
  - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

### 3.02 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

### 3.03 TOOL BOX SHELVES

- A. Fabricate steel shelves to support tool and tool boxes, equipment and parts for the maintenance of all equipment and HVAC components that are located 10 feet or more above finished floor. This includes any component that requires service, testing or adjusting.
- B. Provide lateral bracing to prevent swaying.

### 3.04 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
  1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  2. Obtain fusion without undercut or overlap.
  3. Remove welding flux immediately.
  4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

### 3.05 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

### 3.06 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers and metal framing systems and attachments for general service applications.
- F. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.
- G. Use thermal-hanger shield inserts for insulated piping and tubing.
- H. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
  - 2. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
  - 3. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
  - 4. 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.
  - 5. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
  - 6. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
  - 7. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
  - 8. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
  - 9. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
  - 10. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
  - 11. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
  - 12. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
  - 13. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.

- I. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
  2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
  3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
  4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
  5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- J. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
  2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction, to attach to top flange of structural shape.
  3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
  4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
  5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
  6. C-Clamps (MSS Type 23): For structural shapes.
  7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
  8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
  9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
  10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
  11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
  12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    - a. Light (MSS Type 31): 750 lb.
    - b. Medium (MSS Type 32): 1500 lb.
    - c. Heavy (MSS Type 33): 3000 lb.
  13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
  14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
  15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- K. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.

2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
  3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- L. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
  2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
  3. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
  4. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
- M. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- N. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- O. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction as applicable.

END OF SECTION

SECTION 23 05 48

VIBRATION CONTROLS FOR HVAC  
PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes the following:
  - 1. Isolation pads.
  - 2. Isolation mounts.
  - 3. Elastomeric hangers.
  - 4. Spring hangers.
  - 5. Vibration isolation roof-curb rails.

1.02 RELATED DOCUMENTS

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

1.03 DEFINITIONS

- A. IBC: International Building Code.
- B. ICC-ES: ICC-Evaluation Service.
- C. OSHPD: Office of Statewide Health Planning and Development for the State of California.

1.04 ACTION SUBMITTALS

- A. Product Data: For the following:
  - 1. Include Vibration Isolation Devices.

1.05 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.01 VIBRATION ISOLATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Kinetics Noise Control.

2. Mason Industries.
  3. Vibro-Acoustics - Fluid Systems Co.
- B. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.
1. Resilient Material: Oil- and water-resistant neoprene or rubber.
- C. Mounts: Double-deflection type, with molded, oil-resistant rubber, or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.
1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
  2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.
- D. Elastomeric Hangers: Single or double-deflection type, fitted with molded, oil-resistant elastomeric isolator elements bonded to steel housings with threaded connections for hanger rods. Color-code or otherwise identify to indicate capacity range.
- E. Spring Hangers with Vertical-Limit Stop: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression and with a vertical-limit stop.
1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
  2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
  3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
  4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

## 2.02 FACTORY FINISHES

- A. Finish: Manufacturer's standard prime-coat finish ready for field painting.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation and seismic- and wind-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 APPLICATIONS

- A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.
- B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

### 3.03 VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Piping Restraints:
  - 1. Comply with requirements in MSS SP-127.
  - 2. Space lateral supports a maximum of 40 feet on center, and longitudinal supports a maximum of 80 feet on center.
  - 3. Brace a change of direction longer than 12 feet.
- B. Install cables so they do not bend across edges of adjacent equipment or building structure.
- C. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- D. Drilled-in Anchors:
  - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
  - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
  - 3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
  - 4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
  - 5. Set anchors to manufacturer's recommended torque, using a torque wrench.
  - 6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.



3.04 ADJUSTING

- A. Adjust isolators after piping system is at operating weight.
- B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
- C. Adjust active height of spring isolators.
- D. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION

SECTION 23 05 53

IDENTIFICATION FOR HVAC  
PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
  - 1. Equipment labels.
  - 2. Warning signs and labels.
  - 3. Pipe labels.
  - 4. Stencils.
  - 5. Warning tags.

1.02 RELATED DOCUMENTS

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

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- D. Valve numbering scheme.
- E. Valve Schedules: For each piping system to include in maintenance manuals.

1.04 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

## PART 2 - PRODUCTS

## 2.01 EQUIPMENT LABELS

## A. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
4. Fasteners: Stainless-steel rivets or self-tapping screws.
5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

## B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Black.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

## C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

## D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

## 2.02 WARNING SIGNS AND LABELS

## A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

## B. Letter Color: White.

- C. Background Color: Black.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel rivets or self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information, plus emergency notification instructions.

#### 2.03 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
  - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
  - 2. Lettering Size: At least 1-1/2 inches high.

#### 2.04 STENCILS

- A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches for ducts; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.
  - 1. Stencil Material: Brass.
  - 2. Stencil Paint: Exterior, gloss, acrylic enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
  - 3. Identification Paint: Exterior, acrylic enamel in colors according to ASME A13.1 unless otherwise indicated.

2.05 WARNING TAGS

- A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
  - 1. Size: Approximately 4 by 7 inches.
  - 2. Fasteners: Brass grommet and wire.
  - 3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
  - 4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.02 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.03 PIPE LABEL INSTALLATION

- A. Piping Color-Coding: Painting of piping is specified in Section 09 90 00 "Painting and coatings".
- B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels with painted, color-coded bands or rectangles, complying with ASME A13.1, on each piping system.
  - 1. Identification Paint: Use for contrasting background.
  - 2. Stencil Paint: Use for pipe marking.

- C. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
1. Near each valve and control device.
  2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
  3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
  4. At access doors, manholes, and similar access points that permit view of concealed piping.
  5. Near major equipment items and other points of origination and termination.
  6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
  7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

3.04 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION

SECTION 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Balancing Air Systems: Constant-volume air systems.

1.02 RELATED DOCUMENTS

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

1.03 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. TAB: Testing, adjusting, and balancing.
- C. TAB Specialist: An entity engaged to perform TAB Work.

1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Within 45 days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Contract Documents Examination Report: Within 45 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.
- C. Strategies and Procedures Plan: Within 90 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.
- D. Certified TAB reports.
- E. Sample report forms.
- F. Instrument calibration reports, to include the following:
  - 1. Instrument type and make.
  - 2. Serial number.
  - 3. Application.
  - 4. Dates of use.
  - 5. Dates of calibration.

## 1.05 QUALITY ASSURANCE

- A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC.
  - 1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC.
  - 2. TAB Technician: Employee of the TAB contractor and who is certified by AABC as a TAB technician.
- B. TAB Conference: Meet with Commissioning Authority when applicable on approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Require the participation of the TAB field supervisor and technicians. Provide seven days' advance notice of scheduled meeting time and location.
  - 1. Agenda Items:
    - a. The Contract Documents examination report.
    - b. The TAB plan.
    - c. Coordination and cooperation of trades and subcontractors.
    - d. Coordination of documentation and communication flow.
- C. 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.
- D. TAB Report Forms: Use standard TAB contractor's forms approved by Engineer.
- E. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."
- F. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
- G. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

## 1.06 PROJECT CONDITIONS

- A. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

## 1.07 COORDINATION

- A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.
- B. Perform TAB after leakage and pressure tests on air distribution systems have been satisfactorily completed.



PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 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 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 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 VRF units and verify that they are accessible and their controls are connected and functioning.
- J. Examine operating safety interlocks and controls on HVAC equipment.
- K. 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.

### 3.02 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. Automatic temperature-control systems are operational.
  - 3. Equipment and duct access doors are securely closed.
  - 4. Balance, smoke, and fire dampers are open.
  - 5. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
  - 6. Windows and doors can be closed so indicated conditions for system operations can be met.

### 3.03 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" 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.
  - 2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 23 33 00 "Air Duct Accessories."
  - 3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 23 07 13 "Duct Insulation."
- 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.

### 3.04 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. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

- D. 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.
- E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- F. Verify that motor starters are equipped with properly sized thermal protection.
- G. Check dampers for proper position to achieve desired airflow path.
- H. Check for airflow blockages.
- I. Check condensate drains for proper connections and functioning.
- J. Check for proper sealing of air-handling-unit components.
- K. Verify that air duct system is sealed as specified in Section 23 31 13 "Metal Ducts."

### 3.05 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 Engineer for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC 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.

### 3.06 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.

### 3.07 PROCEDURES FOR CONDENSING UNITS

- A. Verify proper rotation of fans.
- B. Measure entering- and leaving-air temperatures.
- C. Record compressor data.

### 3.08 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.

### 3.09 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. Engineer'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. Data for terminal units, including manufacturer's name, type, size, and fittings.
  13. Notes to explain why certain final data in the body of reports vary from indicated values.
  14. 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. Fan drive settings including settings and percentage of maximum pitch diameter.
    - e. Settings for supply-air, static-pressure controller.
    - f. 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. Duct, outlet, and inlet sizes.
  3. Pipe and valve sizes and locations.
  4. Terminal units.
  5. Balancing stations.
  6. Position of balancing devices.
- E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:
1. Unit Data:
    - a. Unit identification.
    - b. Location.
    - c. Make and type.
    - d. Model number and unit size.
    - e. Manufacturer's serial number.
    - f. Unit arrangement and class.
    - g. Discharge arrangement.
    - h. Sheave make, size in inches, and bore.
    - i. Center-to-center dimensions of sheave, and amount of adjustments in inches.
    - j. Number, make, and size of belts.
    - k. Number, type, and size of filters.

2. Motor Data:
  - a. Motor make, and frame type and size.
  - b. Horsepower and rpm.
  - c. Volts, phase, and hertz.
  - d. Full-load amperage and service factor.
  - e. Sheave make, size in inches, and bore.
  - f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
3. Test Data (Indicated and Actual Values):
  - a. Total air flow rate in cfm.
  - b. Total system static pressure in inches wg.
  - c. Fan rpm.
  - d. Discharge static pressure in inches wg.
  - e. Filter static-pressure differential in inches wg.
  - f. Preheat-coil static-pressure differential in inches wg.
  - g. Cooling-coil static-pressure differential in inches wg.
  - h. Heating-coil static-pressure differential in inches wg.
  - i. Outdoor airflow in cfm.
  - j. Return airflow in cfm.
  - k. Outdoor-air damper position.
  - l. Return-air damper position.
  - m. Vortex damper position.

F. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:
  - a. System identification.
  - b. Location.
  - c. Make and type.
  - d. Model number and size.
  - e. Manufacturer's serial number.
  - f. Arrangement and class.
  - g. Sheave make, size in inches, and bore.
  - h. Center-to-center dimensions of sheave, and amount of adjustments in inches.
2. Motor Data:
  - a. Motor make, and frame type and size.
  - b. Horsepower and rpm.
  - c. Volts, phase, and hertz.
  - d. Full-load amperage and service factor.
  - e. Sheave make, size in inches, and bore.
  - f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
  - g. Number, make, and size of belts.
3. Test Data (Indicated and Actual Values):
  - a. Total airflow rate in cfm.
  - b. Total system static pressure in inches wg.
  - c. Fan rpm.
  - d. Discharge static pressure in inches wg.
  - e. Suction static pressure in inches wg.

- G. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
1. Report Data:
    - a. System and air-handling-unit number.
    - b. Location and zone.
    - c. Traverse air temperature in deg F.
    - d. Duct static pressure in inches wg.
    - e. Duct size in inches.
    - f. Duct area in sq. ft..
    - g. Indicated air flow rate in cfm.
    - h. Indicated velocity in fpm.
    - i. Actual air flow rate in cfm.
    - j. Actual average velocity in fpm.
    - k. Barometric pressure in psig.
- H. Air-Terminal-Device Reports:
1. Unit Data:
    - a. System and air-handling unit identification.
    - b. Location and zone.
    - c. Apparatus used for test.
    - d. Area served.
    - e. Make.
    - f. Number from system diagram.
    - g. Type and model number.
    - h. Size.
    - i. Effective area in sq. ft..
  2. Test Data (Indicated and Actual Values):
    - a. Air flow rate in cfm.
    - b. Air velocity in fpm.
    - c. Preliminary air flow rate as needed in cfm.
    - d. Preliminary velocity as needed in fpm.
    - e. Final air flow rate in cfm.
    - f. Final velocity in fpm.
    - g. Space temperature in deg F.
- I. Instrument Calibration Reports:
1. Report Data:
    - a. Instrument type and make.
    - b. Serial number.
    - c. Application.
    - d. Dates of use.
    - e. Dates of calibration.



### 3.11 INSPECTIONS

#### A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
2. Check the following for each system:
  - a. Measure airflow of at least 10 percent of air outlets.
  - b. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
  - c. Verify that balancing devices are marked with final balance position.
  - d. Note deviations from the Contract Documents in the final report.

#### B. Final Inspection:

1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Engineer.
2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of Engineer.
3. Engineer shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

#### C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:

1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.

#### D. Prepare test and inspection reports.

3.12 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 near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION

SECTION 23 07 13

DUCT INSULATION

PART 1 - GENERAL

1.01 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 exhaust between isolation damper and penetration of building exterior.
  
- B. Related Sections:
  - 1. Section 23 07 19 "HVAC Piping Insulation."
  - 2. Section 23 31 13 "Metal Ducts" for duct liners.

1.02 RELATED DOCUMENTS

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

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).

1.04 INFORMATIONAL SUBMITTALS

- A. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
  
- B. Field quality-control reports.

1.05 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.

## 1.06 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

## 1.07 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

## PART 2 - PRODUCTS

## 2.01 INSULATION MATERIALS

- A. Comply with requirements in "Duct Insulation Schedule, General" and "Indoor 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. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type II for sheet materials.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Aeroflex USA, Inc.; Aerocel.
    - b. Armacell LLC; AP Armaflex.
    - c. K-Flex USA; Insul-Sheet, K-Flex Gray Duct Liner, and K-FLEX LS.

- G. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. CertainTeed Corp.; SoftTouch Duct Wrap.
    - b. Johns Manville; Microlite, Type 75.
    - c. Knauf Insulation; Friendly Feel Duct Wrap.
    - d. Manson Insulation Inc.; Alley Wrap.
    - e. Owens Corning; SOFTR All-Service Duct Wrap.
- H. 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 with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
1. Products: Subject to compliance with requirements, provide one of 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.

## 2.02 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. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Aeroflex USA, Inc.; AeroSeal.
    - b. Armacell LLC; Armaflex 520 Adhesive.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.K-Flex USA; R-373 Contact 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."
- C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.Eagle Bridges - Marathon Industries; 225.
    - b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.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."
- D. 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, provide one of 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.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."

### 2.03 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, provide one of 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 at 43-mil dry film thickness.
  3. Service Temperature Range: Minus 20 to plus 180 deg F.
  4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
  5. Color: White.
- C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-30.
    - b. Eagle Bridges - Marathon Industries; 501.

- c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-35.
      - d. Mon-Eco Industries, Inc.; 55-10.
    - 2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
    - 3. Service Temperature Range: 0 to 180 deg F.
    - 4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
    - 5. Color: White.
  - D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.
    - 1. Products: Subject to compliance with requirements, provide one of the following:
      - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Encacel.
      - b. Eagle Bridges - Marathon Industries; 570.
      - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 60-95/60-96.
    - 2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
    - 3. Service Temperature Range: Minus 50 to plus 220 deg F.
    - 4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
    - 5. Color: White.
  - E. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
    - 1. Products: Subject to compliance with requirements, provide one of 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 at 0.0625-inch dry film thickness.
    - 3. Service Temperature Range: Minus 20 to plus 180 deg F.
    - 4. Solids Content: 60 percent by volume and 66 percent by weight.
    - 5. Color: White.
- 2.04 LAGGING ADHESIVES
- A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
    - 1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
    - 2. Products: Subject to compliance with requirements, provide one of the following:
      - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-50 AHV2.Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-36.
      - b. Vimasco Corporation; 713 and 714.
    - 3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct insulation.

4. Service Temperature Range: 0 to plus 180 deg F.
5. Color: White.

## 2.05 SEALANTS

### A. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.Eagle Bridges - Marathon Industries; 405.
  - b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
  - c. 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.
5. Color: Aluminum.
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."

## 2.06 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 when tested according to ASTM E 96/E 96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

## 2.07 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, provide one of 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: 4 inches.



3. Thickness: 11.5 mils.
  4. Adhesion: 90 ounces force/inch in width.
  5. Elongation: 2 percent.
  6. Tensile Strength: 40 lbf/inch 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, provide one of 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: 4 inches.
  3. Thickness: 6.5 mils.
  4. Adhesion: 90 ounces force/inch in width.
  5. Elongation: 2 percent.
  6. Tensile Strength: 40 lbf/inch 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, provide one of 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: 4 inches.
  3. Thickness: 3.7 mils.
  4. Adhesion: 100 ounces force/inch in width.
  5. Elongation: 5 percent.
  6. Tensile Strength: 34 lbf/inch in width.

## 2.08 SECUREMENTS

- A. Bands:
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. ITW Insulation Systems; Gerrard Strapping and Seals.
    - b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.
  2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304; 0.015 inch thick, 1/2 inch wide with wing seal.
  3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal.
  4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

## B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
  - a. Products: Subject to compliance with requirements, provide one of the following:
    - 1) AGM Industries, Inc.; CWP-1.
    - 2) GEMCO; CD.
    - 3) Midwest Fasteners, Inc.; CD.
    - 4) Nelson Stud Welding; TPA, TPC, and TPS.
2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
  - a. Products: Subject to compliance with requirements, provide one of the following:
    - 1) AGM Industries, Inc.; CHP-1.
    - 2) GEMCO; Cupped Head Weld Pin.
    - 3) Midwest Fasteners, Inc.; Cupped Head.
    - 4) Nelson Stud Welding; CHP.
3. 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, provide one of 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 thick by 2 inches square.
  - c. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch- 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.
4. Self-Sticking-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, provide one of the following:
    - 1) AGM Industries, Inc.; Tactoo Self-Adhering Insul-Hangers.
    - 2) GEMCO; Peel & Press.
    - 3) Midwest Fasteners, Inc.; Self Stick.
  - b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
  - c. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
  - d. Adhesive-backed base with a peel-off protective cover.

5. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
  - a. Products: Subject to compliance with requirements, provide one of 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- wide, stainless steel or Monel.
- D. Wire: 0.080-inch nickel-copper alloy.
  1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. C & F Wire.

### PART 3 - EXECUTION

#### 3.01 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
  1. Verify that systems to be insulated have been tested and are free of defects.
  2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.02 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

#### 3.03 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- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
  - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches 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 beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

### 3.04 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.
  - 1. Comply with requirements in Section 07 84 00 " Firestopping" for Firestopping and fire-resistive joint sealers.

### 3.05 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

### 3.06 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. 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 and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    - b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches 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.
  - 3. 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 from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch 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 at 18-foot 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.
  4. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
  5. 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.
  6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches on center.
- 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. 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 and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    - b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches 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.
  3. 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 from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch on center. 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 at 18-foot 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.

4. 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.
5. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches on center.

### 3.07 FINISHES

- A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- B. Color: Final color as selected by Engineer. Vary first and second coats to allow visual inspection of the completed Work.
- C. Do not field paint aluminum or stainless-steel jackets.

### 3.08 DUCT INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation:
  1. Indoor, concealed supply and outdoor air.
  2. Indoor, exposed supply and outdoor air.
  3. Indoor, concealed return located in unconditioned space.
  4. Indoor, exposed exhaust between isolation damper and penetration of building exterior.
- 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.

### 3.09 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Concealed, round and flat-oval, supply-air duct insulation shall be the following:
  1. Mineral-Fiber Blanket: 2-1/3 inches thick and 0.75-lb/cu. ft. nominal density.
- B. Concealed, round and flat-oval, return-air duct insulation shall be the following:
  1. Mineral-Fiber Blanket: 2-1/3 inches thick and 0.75-lb/cu. ft. nominal density.

- C. Concealed, round and flat-oval, outdoor-air duct insulation shall be the following:
1. Mineral-Fiber Blanket: 2-1/3 inches thick and 0.75-lb/cu. ft. nominal density.
- D. Concealed, round and flat-oval, exhaust-air duct insulation shall be the following:
1. Not insulated, except as otherwise indicated and as a minimum insulate to within 10 feet of exterior wall louvers or soffit grille using 1 inch thick 0.75-lb/cu ft. nominal density.
- E. Concealed, rectangular, supply-air duct insulation shall be the following:
1. Mineral-Fiber Blanket: 2-1/3 inches thick and 0.75-lb/cu. ft. nominal density.
- F. Concealed, rectangular, return-air duct insulation shall be the following:
1. Mineral-Fiber Blanket: 2-1/3 inches thick and 2-lb/cu. ft. nominal density.
- G. Concealed, rectangular, outdoor-air duct insulation shall be the following:
1. Mineral-Fiber Blanket: 2-1/3 inches thick and 0.75-lb/cu. ft. nominal density.
- H. Concealed, rectangular, exhaust-air duct insulation within 10'-0" of penetration of building exterior shall be the following: Same as for round exhaust duct (1-1/2 inches thick).
- I. Exposed, round and flat-oval, supply-air duct insulation shall be the following:
1. Mineral-Fiber Blanket: 2-1/3 inches thick and 0.75-lb/cu. ft. nominal density.
- J. Exposed, round and flat-oval, return-air duct insulation shall be the following:
1. Mineral-Fiber Blanket: 2-1/3 inches thick and 0.75-lb/cu. ft. nominal density.
- K. Exposed, round and flat-oval, outdoor-air duct insulation shall be the following:
1. Mineral-Fiber Blanket: 2-1/3 inches thick and 0.75-lb/cu. ft. nominal density.
- L. Exposed, round and flat-oval, exhaust-air duct insulation shall be the following:
1. Not insulated, except as otherwise indicated and as a minimum insulate to within 10 feet of exterior wall louvers using 1 inch thick 0.75-lb/cu ft. nominal density.
- M. Exposed, rectangular, supply-air duct insulation shall be one of the following:
1. Mineral-Fiber Blanket: 2-1/3 inches thick and 0.75-lb/cu. ft. nominal density except for ductwork within 6'-0" of floor.
  2. Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft. nominal density for ductwork less than 6'-0" above floor.



- N. Exposed, rectangular, return-air duct insulation shall be one of the following:
1. Mineral-Fiber Blanket: 2-1/3 inches thick and 0.75-lb/cu. ft. nominal density except for ductwork within 6'-0" of floor.
  2. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density for ductwork less than 6'-0" from floor.
- O. Exposed, rectangular, outdoor-air duct insulation shall be one of the following:
1. Mineral-Fiber Blanket: 2-1/3 inches thick and 0.75-lb/cu. ft. nominal density except for ductwork within 6'-0" of floor.
  2. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density for ductwork less than 6'-0" from floor.
- P. Exposed, rectangular, exhaust-air duct insulation shall be the following:
1. Not insulated, except as otherwise indicated and as a minimum insulate to within 10 feet of exterior wall louvers using 1 inch thick 0.75-lb/cu ft. nominal density.

END OF SECTION

SECTION 23 07 19

HVAC PIPING INSULATION

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes insulating the following HVAC piping systems:
  - 1. Condensate drain piping, indoors and outdoors.
  - 2. Refrigerant suction and hot-gas piping, indoors and outdoors.
- B. Related Sections:
  - 1. Section 23 07 13 "Duct Insulation."

1.02 RELATED DOCUMENTS

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

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

1.04 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 and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
  - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
  - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.06 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment."

- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

#### 1.07 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

### PART 2 - PRODUCTS

#### 2.01 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground 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. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Flexible Elastomeric Insulation (Maximum 220 deg F): Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Aeroflex USA, Inc.; Aerocel.
    - b. Armacell LLC; AP Armaflex.
    - c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.
- G. Mineral-Fiber, Preformed Pipe Insulation:
  - 1. Products: Subject to compliance with requirements, provide one of 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 Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
3. Type II, when required, 1200 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type II, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

## 2.02 INSULATING CEMENTS

- A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.
  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.; Super-Stik.
    - b. PK Insulation, Quikcote
    - c. Calcote 127
- B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.
  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.; Thermokote V.
    - b. PK Insulation, Quikcote
    - c. Calcote 127
- C. 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.
    - b. PK Insulation, Quikcote
    - c. Calcote 127

## 2.03 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. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.
  1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Aeroflex USA, Inc.; Aero seal.
    - b. Armacell LLC; Armaflex 520 Adhesive.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
    - d. K-Flex USA; R-373 Contact 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).

- C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
1. Products: Subject to compliance with requirements, provide one of 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).
- D. ASJ Adhesive, and FSK and PVDC 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, provide one of 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).

#### 2.04 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 at 43-mil dry film thickness.
  3. Service Temperature Range: Minus 20 to plus 180 deg F.
  4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
  5. Color: White.
- C. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below-ambient services.
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Encacel.

- b. Eagle Bridges - Marathon Industries; 570.
  - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 60-95/60-96.
  - 2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
  - 3. Service Temperature Range: Minus 50 to plus 220 deg F.
  - 4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
  - 5. Color: White.
- D. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
- 1. Products: Subject to compliance with requirements, provide one of 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 at 0.0625-inch dry film thickness.
  - 3. Service Temperature Range: Minus 20 to plus 180 deg F.
  - 4. Solids Content: 60 percent by volume and 66 percent by weight.
  - 5. Color: White.

## 2.05 LAGGING ADHESIVES

- A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
- 1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-50 AHV2.
    - b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-36.
    - c. Vimasco Corporation; 713 and 714.
  - 3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
  - 4. Service Temperature Range: 0 to plus 180 deg F.
  - 5. Color: White.

## 2.06 SEALANTS

- A. FSK and Metal Jacket Flashing Sealants:
- 1. Products: Subject to compliance with requirements, provide one of 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.
  - 5. Color: Aluminum.
  - 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. For Schools: 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:
- 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. Foster 95-44
    - c. Marathon 405 Sure-Joint Sealer
  - 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.
  - 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. For Schools: 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."

## 2.07 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.

## 2.08 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

## C. Metal Jacket:

1. Products: Subject to compliance with requirements, provide one of 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. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
  - a. Factory cut and rolled to size.
  - b. Finish and thickness are indicated in field-applied jacket schedules.
  - c. Moisture Barrier for Indoor Applications: 2.5-mil- thick polysurlyn.
  - d. Moisture Barrier for Outdoor Applications: 2.5-mil- thick polysurlyn.
  - e. Factory-Fabricated Fitting Covers:
    - 1) Same material, finish, and thickness as jacket.
    - 2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
    - 3) Tee covers.
    - 4) Flange and union covers.
    - 5) End caps.
    - 6) Beveled collars.
    - 7) Valve covers.
    - 8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

## 2.09 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, provide one of 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.
  3. Thickness: 11.5 mils.
  4. Adhesion: 90 ounces force/inch in width.
  5. Elongation: 2 percent.
  6. Tensile Strength: 40 lbf/inch 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, provide one of 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.
  3. Thickness: 6.5 mils.
  4. Adhesion: 90 ounces force/inch in width.



5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch 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, provide one of 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.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

## 2.10 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
  - a. ITW Insulation Systems; Gerrard Strapping and Seals.
  - b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.
  - c. Ideal Metal.
2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 1/2 inch wide with wing seal.
3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

C. Wire: 0.062-inch soft-annealed, stainless steel.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. C & F Wire.
  - b. American Wire.
  - c. RPR Products.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.

2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 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.

### 3.03 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-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches on center.
  3. Overlap jacket longitudinal seams at least 1-1/2 inches. 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 4 inches on center.
    - 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 beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
1. Vibration-control devices.
  2. Testing agency labels and stamps.
  3. Nameplates and data plates.
  4. Manholes.
  5. Handholes.
  6. Cleanouts.
- 3.04 PENETRATIONS
- A. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
  4. Seal jacket to wall flashing with flashing 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.
1. Comply with requirements in Section 07 84 00 "Firestopping" for firestopping and fire-resistive joint sealers.
- D. Insulation Installation at Floor Penetrations:
1. Pipe: Install insulation continuously through floor penetrations.
  2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 07 84 00 "Firestopping."

### 3.05 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 specified or 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 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.

### 3.06 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
  - 1. Install pipe insulation to outer diameter of pipe flange.
  - 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
  - 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
  - 4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
  - 1. Install mitered sections of pipe insulation.
  - 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:
  - 1. Install preformed valve covers manufactured of same material as pipe insulation when available.
  - 2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
  - 3. Install insulation to flanges as specified for flange insulation application.
  - 4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

### 3.07 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:
  - 1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
  - 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
  - 3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
  - 4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

- B. Insulation Installation on Pipe Flanges:
1. Install preformed pipe insulation to outer diameter of pipe flange.
  2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
  3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
  4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.
- C. Insulation Installation on Pipe Fittings and Elbows:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
  2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.
- D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
  2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
  3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
  4. Install insulation to flanges as specified for flange insulation application.

### 3.08 FIELD-APPLIED JACKET INSTALLATION

- A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
  2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
  3. Completely encapsulate insulation with coating, leaving no exposed insulation.
- B. 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 laps at longitudinal seams and 3-inch-wide joint strips at end joints.
  5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- C. Where metal jackets are indicated, install with 2-inch 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 on center and at end joints.

### 3.09 FINISHES

- A. When indicated or specified elsewhere: Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 09 90 00 "Painting and Coating".
  - 1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
    - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets. Contact manufacturer for type paint for PVC.

### 3.10 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.

### 3.11 INDOOR PIPING INSULATION SCHEDULE

- A. Condensate and Equipment Drain Water below 60 Deg F:
  - 1. All Pipe Sizes: Insulation shall be the following:
    - a. Flexible Elastomeric: 1 inch thick.
- B. Refrigerant Suction and Hot-Gas Piping:
  - 1. All Pipe Sizes: Insulation shall be one of the following:
    - a. Flexible Elastomeric (220 deg F maximum): 1 inch thick (suction lines only).
    - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.



3.12 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Refrigerant Suction and Hot-Gas Piping:

1. All Pipe Sizes: Insulation shall be one of the following:
  - a. Flexible Elastomeric (220 deg F maximum): 2 inches thick (suction lines only).
  - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.
  - c. Phenolic: 2 inches thick (suction lines only).
  - d. Polyisocyanurate: 2 inches thick.
  - e. Polyolefin: 2 inches thick (suction lines only).
  - f. Polystyrene: 2 inches thick outdoor use only).

3.13 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Exposed:
  1. Aluminum, Corrugated with Z-Shaped Locking Seam: 0.024 inch thick.

END OF SECTION

SECTION 23 11 23

FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Pipes, tubes, and fittings.
2. Piping specialties.
3. Piping and tubing joining materials.
4. Valves.
5. Pressure regulators.

1.02 RELATED DOCUMENTS

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

1.03 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

1.04 PERFORMANCE REQUIREMENTS

A. Minimum Operating-Pressure Ratings:

1. Piping and Valves: 100 psig minimum unless otherwise indicated.
2. Service Regulators: 100 psig minimum unless otherwise indicated.

- B. Natural-Gas System Pressure within Buildings: As indicated on the Drawings.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of the following:

1. Piping specialties.
2. Corrugated, stainless-steel tubing with associated components.
3. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
4. Pressure regulators. Indicate pressure ratings and capacities.
5. Dielectric fittings.

## 1.06 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Field quality-control reports.

## 1.07 QUALITY ASSURANCE

- A. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

## 1.08 DELIVERY, STORAGE, AND HANDLING

- A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.
- B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.
- D. Protect stored PE pipes and valves from direct sunlight.

## PART 2 - PRODUCTS

## 2.01 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. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
    - a. Material Group: 1.1.
    - b. End Connections: Threaded or butt welding to match pipe.
    - c. Lapped Face: Not permitted underground.
    - d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
    - e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.
  - 5. Protective Coating for Underground Piping: Use PE piping.

6. Mechanical Couplings:
  - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1) Dresser Piping Specialties; Division of Dresser, Inc.
    - 2) Smith-Blair, Inc.
    - 3) JCM, Inc.
  - b. Stainless-steel flanges and tube with epoxy finish.
  - c. Buna-nitrile seals.
  - d. Stainless-steel bolts, washers, and nuts.
  - e. Coupling shall be capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
- B. Corrugated, Stainless-Steel Tubing: Comply with ANSI/IAS LC 1, 1 inch and smaller, rated at maximum 0.5 psig, optional where applicable.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. OmegaFlex, Inc.
    - b. Parker Hannifin Corporation; Parflex Division.
    - c. Titeflex.
    - d. Tru-Flex Metal Hose Corp.
  2. Tubing: ASTM A 240/A 240M, corrugated, Series 300 stainless steel.
  3. Coating: PE with flame retardant.
    - a. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
      - 1) Flame-Spread Index: 25 or less.
      - 2) Smoke-Developed Index: 50 or less.
  4. Fittings: Copper-alloy mechanical fittings with ends made to fit and listed for use with corrugated stainless-steel tubing and capable of metal-to-metal seal without gaskets. Include brazing socket or threaded ends complying with ASME B1.20.1.
  5. Striker Plates: Steel, designed to protect tubing from penetrations.
  6. Manifolds: Malleable iron or steel with factory-applied protective coating. Threaded connections shall comply with ASME B1.20.1 for pipe inlet and corrugated tubing outlets.
  7. Operating-Pressure Rating: 0.5 psig.
- C. Aluminum Tubing: Comply with ASTM B 210 and ASTM B 241/B 241M.
  1. Aluminum Alloy: Alloy 5456 is prohibited.
  2. Protective Coating: Factory-applied coating capable of resisting corrosion on tubing in contact with masonry, plaster, insulation, water, detergents, and sewerage.
  3. Flare Fittings: Comply with ASME B16.26 and SAE J513.
    - a. Copper-alloy fittings.
    - b. Metal-to-metal compression seal without gasket.
    - c. Dryseal threads shall comply with ASME B1.20.3.

- D. Tin-Lined Copper Tube: ASTM B 280, seamless, annealed, with interior tin-plated lining.
1. Flare Fittings: Comply with ASME B16.26 and SAE J513.
    - a. Copper fittings with long nuts.
    - b. Metal-to-metal compression seal without gasket.
    - c. Dryseal threads complying with ASME B1.20.3.
- E. PE Pipe: ASTM D 2513, SDR 11.
1. PE Fittings: ASTM D 2683, socket-fusion type or ASTM D 3261, butt-fusion type with dimensions matching PE pipe. Tracer Wire: Provide 12 gage, single wire (stranded wire not acceptable).
  2. PE Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D 2513, SDR 11; and steel pipe complying with ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
  3. Anodeless Service-Line Risers: Factory fabricated and leak tested.
    - a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet.
    - b. Casing: Steel pipe complying with ASTM A 53/A 53M, Schedule 40, black steel, Type E or S, Grade B, with corrosion-protective coating covering.
    - c. Aboveground Portion: PE transition fitting.
    - d. Outlet shall be threaded or flanged or suitable for welded connection.
    - e. Tracer wire connection.
    - f. Ultraviolet shield.
    - g. Stake supports with factory finish to match steel pipe casing or carrier pipe.
  4. Transition Service-Line Risers: Factory fabricated and leak tested.
    - a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet connected to steel pipe complying with ASTM A 53/A 53M, Schedule 40, Type E or S, Grade B, with corrosion-protective coating for aboveground outlet.
    - b. Outlet shall be threaded or flanged or suitable for welded connection.
    - c. Bridging sleeve over mechanical coupling.
    - d. Factory-connected anode.
    - e. Tracer wire connection.
    - f. Ultraviolet shield.
    - g. Stake supports with factory finish to match steel pipe casing or carrier pipe.
  5. Plastic Mechanical Couplings, NPS 1-1/2 and Smaller: Capable of joining PE pipe to PE pipe. Subject to utility requirements.
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) Lyall, R. W. & Company, Inc.
      - 2) Mueller Co.; Gas Products Div.
      - 3) Perfection Corporation; a subsidiary of American Meter Company.
    - b. PE body with molded-in, stainless-steel support ring.
    - c. Buna-nitrile seals.
    - d. Acetal collets.
    - e. Electro-zinc-plated steel stiffener.

6. Plastic Mechanical Couplings, NPS 2 and Larger: Capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe. Subject to utility requirements.
  - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1) Lyall, R. W. & Company, Inc.
    - 2) Mueller Co.; Gas Products Div.
    - 3) Perfection Corporation; a subsidiary of American Meter Company.
  - b. Fiber-reinforced plastic body.
  - c. PE body tube.
  - d. Buna-nitrile seals.
  - e. Acetal collets.
  - f. Stainless-steel bolts, nuts, and washers.
7. Steel Mechanical Couplings: Capable of joining plain-end PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe. Subject to utility requirements.
  - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1) Dresser Piping Specialties; Division of Dresser, Inc.
    - 2) Smith-Blair, Inc.
    - 3) Victaulic, Inc.
  - b. Stainless-steel flanges and tube with epoxy finish.
  - c. Buna-nitrile seals.
  - d. Stainless-steel bolts, washers, and nuts.
  - e. Factory-installed anode for steel-body couplings installed underground.

## 2.02 PIPING 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.
5. Operating-Pressure Rating: 0.5 psig.
6. End Fittings: Zinc-coated steel.
7. Threaded Ends: Comply with ASME B1.20.1.
8. Maximum Length: 72 inches

### B. Y-Pattern Strainers (optional):

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 60-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

### C. Basket Strainers (optional):

1. Body: ASTM A 126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.

2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
  3. Strainer Screen: 60-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
  4. CWP Rating: 125 psig.
- D. 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.

## 2.03 JOINING MATERIALS

- A. Joint Compound and Tape: Suitable for natural gas.
- B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

## 2.04 MANUAL GAS SHUTOFF VALVES

- A. See "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.
- B. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.
  1. CWP Rating: 125 psig.
  2. Threaded Ends: Comply with ASME B1.20.1.
  3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
  4. Tamperproof Feature: Locking feature for valves indicated in "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
  5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
  6. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.
- C. General Requirements for Metallic Valves, NPS 2-1/2 and Larger: Comply with ASME B16.38.
  1. CWP Rating: 125 psig.
  2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
  3. Tamperproof Feature: Locking feature for valves indicated in "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
  4. Service Mark: Initials "WOG" shall be permanently marked on valve body.

- D. One-Piece, Bronze Ball Valve with Bronze Trim: MSS SP-110.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. BrassCraft Manufacturing Company; a Masco company.
    - b. Conbraco Industries, Inc.; Apollo Div.
    - c. Lyall, R. W. & Company, Inc.
    - d. McDonald, A. Y. Mfg. Co.
    - e. Perfection Corporation; a subsidiary of American Meter Company.
  2. Body: Bronze, complying with ASTM B 584.
  3. Ball: Chrome-plated brass.
  4. Stem: Bronze; blowout proof.
  5. Seats: Reinforced TFE; blowout proof.
  6. Packing: Separate packnut with adjustable-stem packing threaded ends.
  7. Ends: Threaded, flared, or socket as indicated in "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
  8. CWP Rating: 600 psig.
  9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
  10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- E. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. BrassCraft Manufacturing Company; a Masco company.
    - b. Conbraco Industries, Inc.; Apollo Div.
    - c. Lyall, R. W. & Company, Inc.
    - d. McDonald, A. Y. Mfg. Co.
    - e. Perfection Corporation; a subsidiary of American Meter Company.
  2. Body: Bronze, complying with ASTM B 584.
  3. Ball: Chrome-plated bronze.
  4. Stem: Bronze; blowout proof.
  5. Seats: Reinforced TFE; blowout proof.
  6. Packing: Threaded-body packnut design with adjustable-stem packing.
  7. Ends: Threaded, flared, or socket as indicated in "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
  8. CWP Rating: 600 psig.
  9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
  10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- F. Two-Piece, Regular-Port Bronze Ball Valves with Bronze Trim: MSS SP-110.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. BrassCraft Manufacturing Company; a Masco company.
    - b. Conbraco Industries, Inc.; Apollo Div.
    - c. Lyall, R. W. & Company, Inc.
    - d. McDonald, A. Y. Mfg. Co.
    - e. Perfection Corporation; a subsidiary of American Meter Company.
  2. Body: Bronze, complying with ASTM B 584.
  3. Ball: Chrome-plated bronze.



4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE.
6. Packing: Threaded-body packnut design with adjustable-stem packing.
7. Ends: Threaded, flared, or socket as indicated in "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
8. CWP Rating: 600 psig.
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

G. Bronze Plug Valves: MSS SP-78.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Lee Brass Company.
  - b. McDonald, A. Y. Mfg. Co.
  - c. Nibco
2. Body: Bronze, complying with ASTM B 584.
3. Plug: Bronze.
4. Ends: Threaded, socket, or flanged as indicated in "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
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.

H. Cast-Iron, Nonlubricated Plug Valves: MSS SP-78.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. McDonald, A. Y. Mfg. Co.
  - b. Mueller Co.; Gas Products Div.
  - c. Xomox Corporation; a Crane company.
2. Body: Cast iron, complying with ASTM A 126, Class B.
3. Plug: Bronze or nickel-plated cast iron.
4. Seat: Coated with thermoplastic.
5. Stem Seal: Compatible with natural gas.
6. Ends: Threaded or flanged as indicated in "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
7. Operator: Square head or lug type with tamperproof feature where indicated.
8. Pressure Class: 125 psig.
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

2.05 PRESSURE REGULATORS

A. General Requirements:

1. Single stage and suitable for natural gas.
2. Steel jacket and corrosion-resistant components.

3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 and smaller; flanged for regulators NPS 2-1/2 and larger.

B. Line Pressure Regulators: Comply with ANSI Z21.80.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Actaris.
  - b. American Meter Company.
  - c. Eclipse Combustion, Inc.
  - d. Fisher Control Valves and Regulators; Division of Emerson Process Management.
  - e. Invensys.
  - f. Maxitrol Company.
  - g. Richards Industries; Jordan Valve Div.
2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
6. Orifice: Aluminum; interchangeable.
7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
10. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
11. Maximum Inlet Pressure: 5 psig.

2.06 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, provide products by one of the following:
    - a. Capitol Manufacturing Company.
    - b. Central Plastics Company.
    - c. Hart Industries International, Inc.
    - d. Jomar International Ltd.
    - e. Matco-Norca, Inc.
    - f. McDonald, A. Y. Mfg. Co.
    - g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    - h. Wilkins; a Zurn company.

2. Description:
  - a. Standard: ASSE 1079.
  - b. Pressure Rating: 125 psig minimum at 180 deg F.
  - c. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Capitol Manufacturing Company.
  - b. Central Plastics Company.
  - c. Matco-Norca, Inc.
  - d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
  - e. Wilkins; a Zurn company.
2. Description:
  - a. Standard: ASSE 1079.
  - b. Factory-fabricated, bolted, companion-flange assembly.
  - c. Pressure Rating: 150 psig.
  - d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Advance Products & Systems, Inc.
  - b. Calpico, Inc.
  - c. Central Plastics Company.
  - d. Pipeline Seal and Insulator, Inc.
2. Description:
  - a. Nonconducting materials for field assembly of companion flanges.
  - b. Pressure Rating: 150 psig.
  - c. Gasket: Neoprene or phenolic.
  - d. Bolt Sleeves: Phenolic or polyethylene.
  - e. Washers: Phenolic with steel backing washers.

2.07 LABELING AND IDENTIFYING

- A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 PREPARATION

- A. Close equipment shutoff valves before turning off natural gas to premises or piping section.
- B. Inspect natural-gas piping according to NFPA 54 and the International Fuel Gas Code to determine that natural-gas utilization devices are turned off in piping section affected.
- C. Comply with NFPA 54 and the International Fuel Gas Code requirements for prevention of accidental ignition.

### 3.03 OUTDOOR PIPING INSTALLATION

- A. Comply with NFPA 54 and the International Fuel Gas Code for installation and purging of natural-gas piping.
- B. Install underground, natural-gas piping buried at least 36 inches below finished grade. Comply with requirements in Section 31 23 11 "Excavation, Fill and Grading for Building" for excavating, trenching, and backfilling.
  - 1. If natural-gas piping is installed less than 36 inches below finished grade, install it in containment conduit.
- C. Install underground, PE, natural-gas piping according to ASTM D 2774.
- D. Exposed Steel Piping with Protective Coating:
  - 1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
  - 2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
  - 3. Replace pipe having damaged PE coating with new pipe.
- E. Install fittings for changes in direction and branch connections.
- F. Install pressure gage downstream from each service regulator.

### 3.04 INDOOR PIPING INSTALLATION

- A. Comply with NFPA 54 and the International Fuel Gas Code for installation and purging of natural-gas piping.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. 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.
- C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.

- D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- E. 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.
- F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- G. Locate valves for easy access. Do not install above ceiling or in un-accessible locations.
- H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.
- I. Install piping free of sags and bends.
- J. Install fittings for changes in direction and branch connections.
- K. Verify final equipment locations for roughing-in.
- L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.
- M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
  - 1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.
- N. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.
- O. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings and in floor channels unless indicated to be exposed to view.
- P. Concealed Location Installations: Except as specified below, install concealed natural-gas piping and piping installed under the building in containment conduit constructed of steel pipe with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.
  - 1. Above Accessible Ceilings: Natural-gas valves and regulators may not be installed in these accessible spaces.

2. In Floors: Do not install natural-gas piping with welded or brazed joints and protective coating in cast-in-place concrete floors without approval from authorities having jurisdiction. Cover piping to be cast in concrete slabs with minimum of 1-1/2 inches of concrete. Piping may not be in physical contact with other metallic structures such as reinforcing rods or electrically neutral conductors. Do not embed piping in concrete slabs containing quick-set additives or cinder aggregate.
  3. In Floor Channels: Install natural-gas piping in floor channels. Channels must have cover and be open to space above cover for ventilation.
  4. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.
    - a. Exception: Tubing passing through partitions or walls does not require striker barriers.
  5. Prohibited Locations:
    - a. Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
    - b. Do not install natural-gas piping in solid walls or partitions.
- Q. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
- R. Connect branch piping from top or side of horizontal piping.
- S. 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.
- T. Do not use natural-gas piping as grounding electrode.
- U. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.
- V. Install pressure gage downstream from each line regulator.
- W. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 23 05 17 "Sleeves for HVAC Piping."
- X. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 23 05 18 "Escutcheons for HVAC Piping."
- 3.05 VALVE INSTALLATION
- A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.
  - B. Install underground valves with valve boxes.
  - C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.
  - D. Install anode for metallic valves in underground PE piping.

### 3.06 PIPING JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints:
  - 1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
  - 2. Cut threads full and clean using sharp dies.
  - 3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
  - 4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
  - 5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- D. Welded Joints:
  - 1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
  - 2. Bevel plain ends of steel pipe.
  - 3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.
- F. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.
- G. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.
- H. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
  - 1. Plain-End Pipe and Fittings: Use butt fusion.
  - 2. Plain-End Pipe and Socket Fittings: Use socket fusion.

### 3.07 HANGER AND SUPPORT INSTALLATION

- A. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 23 05 48 "Vibration and for HVAC Piping and Equipment."
- B. Comply with requirements for pipe hangers and supports specified in Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment."

- C. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
  2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
  3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
  4. NPS 2-1/2 to NPS 3-1/2: Maximum span, 10 feet; minimum rod size, 1/2 inch.
  5. NPS 4 and Larger: Maximum span, 10 feet; minimum rod size, 5/8 inch.
- D. Install hangers for horizontal drawn-temper copper tubing with the following maximum spacing and minimum rod sizes:
1. NPS 3/8: Maximum span, 48 inches; minimum rod size, 3/8 inch.
  2. NPS 1/2 and NPS 5/8: Maximum span, 72 inches; minimum rod size, 3/8 inch.
  3. NPS 3/4 and NPS 7/8: Maximum span, 84 inches; minimum rod size, 3/8 inch.
  4. NPS 1: Maximum span, 96 inches; minimum rod size, 3/8 inch.
- E. Install hangers for horizontal, corrugated stainless-steel tubing with the following maximum spacing and minimum rod sizes:
1. NPS 3/8: Maximum span, 48 inches; minimum rod size, 3/8 inch.
  2. NPS 1/2: Maximum span, 72 inches; minimum rod size, 3/8 inch.
  3. NPS 3/4 and larger: Maximum span, 96 inches; minimum rod size, 3/8 inch.

### 3.08 CONNECTIONS

- A. Connect to utility's gas main according to utility's procedures and requirements.
- B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.
- C. Install piping adjacent to appliances to allow service and maintenance of appliances.
- D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.
- E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

### 3.09 LABELING AND IDENTIFYING

- A. Comply with requirements in Section 23 05 53 "Identification for HVAC Piping and Equipment" for piping and valve identification.

### 3.10 PAINTING

- A. Comply with requirements in Section 09 90 00 "Painting and Coating" for painting interior and exterior natural-gas piping if specified.



- B. Paint exposed, exterior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.
    - 1. Alkyd System: MPI EXT 5.1D.
      - a. Prime Coat: Alkyd anticorrosive metal primer.
      - b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
      - c. Topcoat: Exterior alkyd enamel (semigloss).
      - d. Color: Gray.
  - C. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.
- 3.11 FIELD QUALITY CONTROL
- A. Perform tests and inspections.
  - B. Tests and Inspections:
    - 1. Test, inspect, and purge natural gas according to NFPA 54 and the International Fuel Gas Code and authorities having jurisdiction.
  - C. Natural-gas piping will be considered defective if it does not pass tests and inspections.
  - D. Prepare test and inspection reports.
- 3.12 OUTDOOR PIPING SCHEDULE
- A. Underground natural-gas piping shall be the following:
    - 1. PE pipe and fittings joined by heat fusion, or mechanical couplings; service-line risers with tracer wire terminated in an accessible location.
  - B. Aboveground natural-gas piping 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.
  - C. Branch Piping in Cast-in-Place Concrete to Single Appliance: Annealed-temper copper tube with wrought-copper fittings and flared joints. Install piping embedded in concrete with no joints in concrete.
  - D. Containment Conduit (when indicated): Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

**3.13 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG**

- A. Aboveground, branch piping NPS 1 and smaller shall be one of the following:
1. Corrugated stainless-steel tubing with mechanical fittings having socket or threaded ends to match adjacent piping.
  2. Annealed-temper, tin-lined copper tube with flared joints and fittings.
  3. Aluminum tube with flared fittings and joints.
  4. Steel pipe with malleable-iron fittings and threaded joints.
- B. Aboveground, distribution piping shall be one of the following:
1. Steel pipe with malleable-iron fittings and threaded joints or as required by authorities having jurisdiction.
  2. Steel pipe with wrought-steel fittings and welded joints.

**3.14 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES MORE THAN 0.5 PSIG AND 5 PSIG**

- A. Aboveground, branch piping NPS 1 and smaller shall be one of the following:
1. Annealed-temper, tin-lined copper tube with flared joints and fittings.
  2. Aluminum tube with flared fittings and joints.
  3. Steel pipe with malleable-iron fittings and threaded joints.
- B. Aboveground, distribution piping shall be one of the following:
1. Steel pipe with malleable-iron fittings and threaded joints or as required by authority having jurisdiction.
  2. Steel pipe with steel welding fittings and welded joints.

**3.15 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE**

- A. Valves for pipe sizes NPS 2 and smaller at service meter shall be one of the following (include security feature when located outdoors):
1. One-piece, bronze ball valve with bronze trim.
  2. Bronze plug valve.
- B. Valves for pipe sizes NPS 2-1/2 and larger at service meter shall be one of the following (include security feature when located outdoors):
1. Two-piece, regular-port, bronze ball valves with bronze trim.
  2. Bronze plug valve.
  3. Cast-iron, nonlubricated plug valve.
- C. Distribution piping valves for pipe sizes NPS 2 and smaller shall be one of the following:
1. One-piece, bronze ball valve with bronze trim.
  2. Two-piece, full-port, bronze ball valves with bronze trim.
  3. Bronze plug valve.

- D. Distribution piping valves for pipe sizes NPS 2-1/2 and larger shall be one of the following:
1. Two-piece, full-port, bronze ball valves with bronze trim.
  2. Bronze plug valve.
  3. Cast-iron, lubricated plug valve.
- E. Valves in branch piping for single appliance shall be one of the following:
1. One-piece, bronze ball valve with bronze trim.
  2. Bronze plug valve.

END OF SECTION

## SECTION 23 23 00 REFRIGERANT PIPING

## PART 1 - GENERAL

## 1.01 SUMMARY

- A. This Section includes refrigerant piping used for air-conditioning applications.

## 1.02 RELATED DOCUMENTS

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

## 1.03 PERFORMANCE REQUIREMENTS

- A. Line Test Pressure for Refrigerant R-134a:

1. Suction Lines for Air-Conditioning Applications: 115 psig.
2. Suction Lines for Heat-Pump Applications: 225 psig.
3. Hot-Gas and Liquid Lines: 225 psig.

- B. Line Test Pressure for Refrigerant R-407C:

1. Suction Lines for Air-Conditioning Applications: 230 psig.
2. Suction Lines for Heat-Pump Applications: 380 psig.
3. Hot-Gas and Liquid Lines: 380 psig.

- C. Line Test Pressure for Refrigerant R-410A:

1. Suction Lines for Air-Conditioning Applications: 300 psig.
2. Suction Lines for Heat-Pump Applications: 535 psig.
3. Hot-Gas and Liquid Lines: 535 psig.

## 1.04 ACTION SUBMITTALS

- A. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details, all as applicable. Show interface and spatial relationships between piping and equipment.

1. Shop Drawing Scale: 1/4 inch equals 1 foot.
2. Refrigerant piping indicated on Drawings is schematic only. Size piping and design actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.
3. For systems 5 tons cooling and less, a schematic drawing showing pipe sizes is adequate.

1.05 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Field quality-control test reports.

1.06 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
- B. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."
- C. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.07 PRODUCT STORAGE AND HANDLING

- A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

PART 2 - PRODUCTS

2.01 Pre-purged and charged ACR tubing is acceptable if adequate pipe sizes are available and are applied to 5 tons and smaller systems.

2.02 COPPER TUBE AND FITTINGS

- A. Copper Tube: ASTM B 88, Type K or ASTM B 280, Type ACR.
- B. Wrought-Copper Fittings: ASME B16.22.
- C. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.
- D. Brazing Filler Metals: AWS A5.8.
- E. Flexible Connectors:
  - 1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
  - 2. End Connections: Socket ends.
  - 3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch-long assembly.
  - 4. Pressure Rating: Factory test at minimum 500 psig.
  - 5. Maximum Operating Temperature: 250 deg F.

2.03 VALVES AND SPECIALTIES

- A. The usual valves and specialties furnished with packaged equipment is specified with the equipment under other Sections.

## 2.04 REFRIGERANTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Atofina Chemicals, Inc.
  2. DuPont Company; Fluorochemicals Div.
  3. Honeywell, Inc.; Genetron Refrigerants.
  4. INEOS Fluor Americas LLC.
- B. ASHRAE 34, R-134a: Tetrafluoroethane.
- C. ASHRAE 34, R-407C: Difluoromethane/Pentafluoroethane/1,1,1,2-Tetrafluoroethane.
- D. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

## PART 3 - EXECUTION

### 3.01 PIPING APPLICATIONS FOR REFRIGERANT R-134a

- A. Suction Lines NPS 1-1/2 and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed joints.
- B. Suction Lines NPS 2 to NPS 4 for Conventional Air-Conditioning Applications: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with brazed joints.
- C. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications:
1. NPS 1-1/2 and Smaller: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed joints.
  2. NPS 4 and Smaller: Copper, Type ACR or K, drawn-temper tubing and wrought-copper fittings with brazed joints.
- D. Safety-Relief-Valve Discharge Piping: Copper, Type K or L, drawn-temper tubing and wrought-copper fittings with soldered joints.

### 3.02 PIPING APPLICATIONS FOR REFRIGERANT R-407C

- A. Suction Lines NPS 1-1/2 and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed joints.
- B. Suction Lines NPS 2 to NPS 4 for Conventional Air-Conditioning Applications: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with brazed joints.
- C. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications:
1. NPS 1 and Smaller: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed joints.

2. NPS 1-1/4 to NPS 3: Copper, Type K, annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.
  3. NPS 4: Copper, Type ACR or K, drawn-temper tubing and wrought-copper fittings with soldered joints.
- D. Safety-Relief-Valve Discharge Piping: Copper, Type K or L, drawn-temper tubing and wrought-copper fittings with soldered joints.

### 3.03 PIPING APPLICATIONS FOR REFRIGERANT R-410A

- A. Suction Lines NPS 1-1/2 and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed joints.
- B. Suction Lines NPS 2 to NPS 3-1/2 for Conventional Air-Conditioning Applications: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with brazed joints.
- C. Suction Lines NPS 4 for Conventional Air-Conditioning Applications: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with soldered joints.
- D. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications:
  1. NPS 5/8 and Smaller: Copper, Type ACR, annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.
  2. NPS 3/4 to NPS 1 and Smaller: Copper, Type K, annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.
  3. NPS 1-1/4 and Smaller: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with 95-5 tin-antimony soldered joints.
  4. NPS 1-1/2 to NPS 2: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with Alloy HB soldered joints.
- E. Safety-Relief-Valve Discharge Piping: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with Alloy HB soldered joints.

### 3.04 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.
- B. Install refrigerant piping according to ASHRAE 15.
- C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- D. 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.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

- F. Install piping adjacent to machines to allow service and maintenance.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Select system components with pressure rating equal to or greater than system operating pressure.
- J. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- K. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Section 08 31 13 "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.
- L. Install refrigerant piping in protective conduit where installed belowground.
- M. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.
- N. Slope refrigerant piping as follows:
  - 1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
  - 2. Install horizontal suction lines with a uniform slope downward to compressor.
  - 3. Install traps and double risers to entrain oil in vertical runs.
  - 4. Liquid lines may be installed level.
- O. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.
- P. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.
- Q. Identify refrigerant piping and valves according to Section 23 05 53 "Identification for HVAC Piping and Equipment."
- R. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 23 05 17 "Sleeves and Sleeve Seals for HVAC Piping."
- S. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 23 05 17 "Sleeves and Sleeve Seals for HVAC Piping."
- T. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 23 05 18 "Escutcheons for HVAC Piping."



**3.05 PIPE 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 pipe and fittings before assembly.
- C. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."
- D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
  - 1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
  - 2. Use Type BA<sub>g</sub>, cadmium-free silver alloy for joining copper with bronze.

**3.06 HANGERS AND SUPPORTS**

- A. Hanger, support, and anchor products are specified in Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment."
- B. Install the following pipe attachments:
  - 1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
  - 2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
  - 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
  - 4. Spring hangers to support vertical runs.
  - 5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
- C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:
  - 1. NPS 1/2: Maximum span, 60 inches; minimum rod size, 1/4 inch.
  - 2. NPS 5/8: Maximum span, 60 inches; minimum rod size, 1/4 inch.
  - 3. NPS 1: Maximum span, 72 inches; minimum rod size, 1/4 inch.
  - 4. NPS 1-1/4: Maximum span, 96 inches; minimum rod size, 3/8 inch.
  - 5. NPS 1-1/2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
  - 6. NPS 2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
- D. Support multifloor vertical runs at least at each floor.

**3.07 FIELD QUALITY CONTROL**

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
  - 1. Comply with ASME B31.5, Chapter VI.

2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.
  - a. Fill system with nitrogen to the required test pressure.
  - b. System shall maintain test pressure at the manifold gage throughout duration of test as applicable.
  - c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
  - d. Remake leaking joints using new materials and retest until satisfactory results are achieved.

### 3.08 SYSTEM CHARGING

- A. Charge system using the following procedures:
  1. Install core in filter dryers after leak test but before evacuation if applicable.
  2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
  3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
  4. Charge system.

### 3.09 ADJUSTING

- A. Adjust thermostatic expansion valve to obtain proper evaporator superheat if applicable.
- B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure if applicable.
- C. Adjust set-point temperature of air-conditioning controllers to the system design temperature if applicable.
- D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions as applicable.
  1. Verify that compressor oil level is correct.
  2. Open compressor suction and discharge valves.
  3. Open refrigerant valves except bypass valves that are used for other purposes.
  4. Check open compressor-motor alignment and verify lubrication for motors and bearings.
- E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established as applicable.

END OF SECTION

SECTION 23 31 13

METAL DUCTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Single-wall round and flat-oval ducts and fittings.
3. Sheet metal materials.
4. Duct liner.
5. Sealants and gaskets.
6. Hangers and supports.

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.

1.02 RELATED DOCUMENTS

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

1.03 PERFORMANCE REQUIREMENTS

- A. 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" and ASCE/SEI 7.
- B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.
3. Sheet metal materials.

1.05 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Field quality-control reports.

## 1.06 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 when applicable.
  3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

## PART 2 - PRODUCTS

## 2.01 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 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."

## 2.02 SINGLE-WALL ROUND AND FLAT-OVAL 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, provide products by one of the following:
    - a. Lindab Inc.
    - b. McGill AirFlow LLC.
    - c. SEMCO Incorporated.
    - d. Sheet Metal Connectors, Inc.
    - e. Spiral Manufacturing Co., Inc.

- B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).
- C. 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."
  - 1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.
- D. 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."
  - 1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
  - 2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.
- E. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "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."

### 2.03 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
  - 1. Galvanized Coating Designation: G60.
  - 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. Factory- or Shop-Applied Antimicrobial Coating (after fabrication):
  - 1. Apply to the surface of sheet metal that will form the interior surface of the duct. An untreated clear coating shall be applied to the exterior surface.
  - 2. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
  - 3. Coating containing the antimicrobial compound shall have a hardness of 2H, minimum, when tested according to ASTM D 3363.
  - 4. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

5. Shop-Applied Coating Color: White unless indicated otherwise.
6. Antimicrobial coating on sheet metal is not required for duct containing liner treated with antimicrobial coating.

## 2.04 DUCT LINER

### A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. CertainTeed Corporation; Insulation Group.
  - b. Johns Manville.
  - c. Knauf Insulation.
  - d. Owens Corning.
2. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
3. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.
  - a. 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).

### B. Insulation Pins and Washers:

1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick stainless steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

### C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."

1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
3. Butt transverse joints without gaps, and coat joint with adhesive.
4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.

7. For duct velocities less than 2500 fpm. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:
  - a. Fan discharges.
  - b. Intervals of lined duct preceding unlined duct.
  - c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.
9. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

## 2.05 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: 4 inches.
  3. Sealant: Modified styrene acrylic.
  4. Water resistant.
  5. Mold and mildew resistant.
  6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
  7. Service: Indoor and outdoor.
  8. Service Temperature: Minus 40 to plus 200 deg F.
  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. For Schools: 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, 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. For Schools: 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 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg 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.
- 2.06 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, "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

## 3.01 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install round and flat-oval ducts in maximum practical lengths.
- D. Install ducts with fewest possible joints.
- E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of 1 inch, 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.
- 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.

**3.02 INSTALLATION OF EXPOSED DUCTWORK IN FINISHED SPACES**

- 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.
- 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.

**3.03 DUCT SEALING**

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

**3.04 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 thick.
  - 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches 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, "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 of each elbow and within 48 inches 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.

- 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.

### 3.05 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.

### 3.06 START UP

- A. Air Balance: Comply with requirements in Section 23 05 93 "Testing, Adjusting, and Balancing for HVAC."

### 3.07 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel except as otherwise indicated.
- B. The following Duct Construction Class ratings apply except as indicted otherwise on the Drawings.
- C. Supply Ducts:
  - 1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
    - a. Pressure Class: Positive 1-inch wg.
    - b. Minimum SMACNA Seal Class: B.
  - 2. Ducts Connected to Energy Recovery Units:
    - a. Pressure Class: Positive 2-inch wg.
    - b. Minimum SMACNA Seal Class: A.
  - 3. Ducts Connected to Equipment Not Listed Above:
    - a. Pressure Class: Positive 2-inch wg.
    - b. Minimum SMACNA Seal Class: A.
- D. Return Ducts:
  - 1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
    - a. Pressure Class: Positive or negative 1-inch wg.
    - b. Minimum SMACNA Seal Class: B.
  - 2. Ducts Connected to Equipment Not Listed Above:
    - a. Pressure Class: Positive or negative 2-inch wg.
    - b. Minimum SMACNA Seal Class: B.
    - c. SMACNA Leakage Class for Rectangular: 6.
    - d. SMACNA Leakage Class for Round and Flat Oval: 3.

## E. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
  - a. Pressure Class: Negative 2-inch wg.
  - 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: 6.
2. Ducts Connected to Equipment Not Listed Above:
  - a. Pressure Class: Positive or negative 2-inch wg.
  - 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: 6.

## F. 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 1-inch wg.
  - b. Minimum SMACNA Seal Class: B.
  - c. SMACNA Leakage Class for Rectangular: 24.
  - d. SMACNA Leakage Class for Round and Flat Oval: 12.
2. Ducts Connected to Energy Recovery Units:
  - a. Pressure Class: Positive or negative 2-inch wg.
  - b. Minimum SMACNA Seal Class: A.
  - c. SMACNA Leakage Class for Rectangular: 12.
  - d. SMACNA Leakage Class for Round and Flat Oval: 6.
3. Ducts Connected to Equipment Not Listed Above:
  - a. Pressure Class: Positive or negative 2-inch wg.
  - b. Minimum SMACNA Seal Class: A.
  - c. SMACNA Leakage Class for Rectangular: 6.
  - d. SMACNA Leakage Class for Round and Flat Oval: 3.

## G. Liner:

1. Provide duct liner when or where indicated on the drawings.
2. Supply Air Ducts: Fibrous glass, Type I, 2 inch thick or as indicated.
3. Return Air Ducts: Fibrous glass, Type I, 1-1/2 inch thick or as indicated.
4. Exhaust Air Ducts: None.

## H. 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 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:
    - 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 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. 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 or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
    - 2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
    - 3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
  - b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
  - c. Round Elbows, 14 Inches and Larger in Diameter: Welded.
- I. 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 and Flat Oval: 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 or Lower: 90-degree tap.
    - b. Velocity 1000 to 1500 fpm: Conical tap.
    - c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION

SECTION 23 33 00

AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Manual volume dampers.
2. Fire dampers.
3. Flange connectors.
4. Turning vanes.
5. Duct-mounted access doors.
6. Flexible connectors.
7. Flexible ducts.
8. Duct accessory hardware.

B. Related Requirements:

1. Section 28 31 11 "Digital, Addressable Fire-Alarm System" for duct-mounted fire and smoke detectors when included.

1.02 RELATED DOCUMENTS

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

PART 2 - PRODUCTS

2.01 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.

2.02 MATERIALS

- A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
1. Galvanized Coating Designation: G60.
  2. Exposed-Surface Finish: Mill phosphatized.

## 2.03 MANUAL VOLUME DAMPERS

- A. Standard, Steel, Manual Volume Dampers (for Balancing only):
1. Manufacturers: Subject to compliance with requirements, provide products by one of 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. Ruskin Company.
  2. Standard leakage rating, with linkage outside airstream when indicated.
  3. Suitable for horizontal or vertical applications.
  4. Frames:
    - a. Frame: Hat-shaped, 0.094-inch- thick, galvanized sheet steel.
    - b. Mitered and welded corners.
    - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
  5. Blades:
    - a. Multiple or single blade.
    - b. Parallel- or opposed-blade design.
    - c. Stiffen damper blades for stability.
    - d. Galvanized-steel, 0.064 inch thick.
  6. Blade Axles: Galvanized steel.
  7. Bearings:
    - a. Molded synthetic.
    - b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
  8. Tie Bars and Brackets: Galvanized steel.

## 2.04 FIRE DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Air Balance Inc.; a division of Mestek, Inc.
  2. Arrow United Industries; a division of Mestek, Inc.
  3. Greenheck Fan Corporation.
  4. Nailor Industries Inc.
  5. Ruskin Company.
  6. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Type: Dynamic; rated and labeled according to UL 555 by an NRTL.
- C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.
- D. Fire Rating: 1-1/2 or 3 hours as required.
- E. Frame: Curtain type with blades outside airstream except when located behind grille where blades may be inside airstream; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.

- F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.
  - 1. Minimum Thickness: 0.138 inch thick, as indicated, and of length to suit application.
  - 2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.
- G. Mounting Orientation: Vertical or horizontal as indicated.
- H. Blades: Roll-formed, interlocking, minimum 0.024-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.
- I. Horizontal Dampers: Include blade lock and stainless-steel closure spring.
- J. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.

#### 2.05 FLANGE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
  - 1. Ductmate Industries, Inc.
  - 2. Nexus PDQ; Division of Shilco Holdings Inc.
  - 3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.
- C. Material: Galvanized steel.
- D. Gage and Shape: Match connecting ductwork.

#### 2.06 TURNING VANES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Ductmate Industries, Inc.
  - 2. Duro Dyne Inc.
  - 3. Elgen Manufacturing.
  - 4. METALAIRE, Inc.
  - 5. SEMCO Incorporated.
  - 6. 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 into vane runners suitable for duct mounting.



C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vaness and Vane Runners," and 4-4, "Vane Support in Elbows."

D. Vane Construction: Double wall.

## 2.07 DUCT-MOUNTED ACCESS DOORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Warming and Ventilating; a division of Mestek, Inc.
2. Ductmate Industries, Inc.
3. Elgen Manufacturing.
4. Greenheck Fan Corporation.
5. McGill AirFlow LLC.
6. Nailor Industries Inc.
7. Ventfabrics, Inc.
8. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Duct-Mounted Access Doors (not for grease ducts): Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."

1. Door:
  - a. Double wall, rectangular.
  - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
  - c. Vision panel.
  - d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
  - e. Fabricate doors airtight and suitable for duct pressure class.
2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Number of Hinges and Locks:
  - a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
  - b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
  - c. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches with outside and inside handles.
  - d. Access Doors Larger Than 24 by 48 Inches: Four hinges and two compression latches with outside and inside handles.

## 2.08 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Elgen Manufacturing.
4. Ventfabrics, Inc.
5. 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 5-3/4 inches wide attached to two strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel.
- E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
  - 1. Minimum Weight: 26 oz./sq. yd..
  - 2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
  - 3. Service Temperature: Minus 40 to plus 200 deg F.
- F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
  - 1. Minimum Weight: 24 oz./sq. yd..
  - 2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
  - 3. Service Temperature: Minus 50 to plus 250 deg F.

## 2.09 FLEXIBLE DUCTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Flexmaster U.S.A., Inc.
  - 2. McGill AirFlow LLC.
  - 3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Noninsulated, Flexible Duct: UL 181, Class 1, multiple layers of aluminum laminate supported by helically wound, spring-steel wire, for non-conditioned air systems.
  - 1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
  - 2. Maximum Air Velocity: 4000 fpm.
  - 3. Temperature Range: Minus 20 to plus 210 deg F.
- C. Insulated, Flexible Duct: UL 181, Class 1, multiple layers of aluminum laminate supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film, for conditioned air systems.
  - 1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
  - 2. Maximum Air Velocity: 4000 fpm.
  - 3. Temperature Range: Minus 20 to plus 210 deg F.
  - 4. Insulation R-value: Comply with ASHRAE/IESNA 90.1.
- D. Flexible Duct Connectors:
  - 1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches, to suit duct size.

## 2.10 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.
- B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal 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 where applicable.
- C. Install control dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
- D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
- E. Set dampers to fully open position before testing, adjusting, and balancing.
- F. Install test holes at fan inlets and outlets and elsewhere as indicated.
- G. Install fire and smoke dampers according to UL listing.
- H. Install duct security bars. Connect duct security bars to ducts with flexible connections. Provide 12-by-12-inch hinged access panel with cam lock in duct in each side of sleeve.
- I. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
  - 1. On both sides of duct coils.
  - 2. Upstream and downstream from duct filters.
  - 3. At outdoor-air intakes and mixed-air plenums.
  - 4. At drain pans and seals.
  - 5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
  - 6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.

7. At each change in direction and at maximum 50-foot spacing.
  8. Upstream from turning vanes.
  9. Control devices requiring inspection.
  10. Elsewhere as indicated.
- J. Install access doors with swing against duct static pressure.
- K. Access Door Sizes:
1. One-Hand or Inspection Access: 8 by 5 inches.
  2. Two-Hand Access: 12 by 6 inches.
- L. Label access doors according to Section 23 05 53 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.
- M. Install flexible connectors to connect ducts to equipment.
- N. Connect terminal units to supply ducts with maximum 12-inch lengths of flexible duct. Do not use flexible ducts to change directions.
- O. Connect flexible ducts to metal ducts with draw bands.
- P. Install duct test holes where required for testing and balancing purposes.
- 3.02 FIELD QUALITY CONTROL
- A. Tests and Inspections:
1. Operate dampers to verify full range of movement.
  2. Inspect locations of access doors and verify that purpose of access door can be performed.
  3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
  4. Inspect turning vanes for proper and secure installation.
  5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION

SECTION 23 34 23

HVAC POWER VENTILATORS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
  - 1. Ceiling-mounted ventilators.
  - 2. In-Line centrifugal fans.
  - 3. Propeller fans.

1.02 RELATED DOCUMENTS

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

1.03 PERFORMANCE REQUIREMENTS

- A. Project Altitude: Base fan-performance ratings on sea level.
- B. Operating Limits: Classify according to AMCA 99.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Also include the following:
  - 1. Certified fan performance curves with system operating conditions indicated.
  - 2. Certified fan sound-power ratings or sone ratings.
  - 3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
  - 4. Material thickness and finishes.
  - 5. Dampers, including housings, linkages, and operators.
  - 6. Fan speed controllers.

1.05 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.06 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.07 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. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.
- C. UL Standards: Power ventilators shall comply with UL 705.

PART 2 - PRODUCTS

2.01 CEILING-MOUNTED VENTILATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Carnes Company.
  - 2. Greenheck Fan Corporation.
  - 3. Loren Cook Company.
  - 4. PennBarry.
  - 5. Twin City.
- 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: Painted aluminum, louvered 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. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
  - 2. Manual Starter Switch: Single-pole rocker switch assembly with cover and pilot light.
  - 3. Time-Delay Switch: Assembly with single-pole rocker switch, timer, and cover plate.
  - 4. Motion Sensor: Motion detector with adjustable shutoff timer.
  - 5. Isolation: Rubber-in-shear vibration isolators.
  - 6. Manufacturer's standard roof jack or wall cap, and transition fittings.
- G. Capacities and Characteristics: As shown on Drawings.

2.02 IN-LINE CENTRIFUGAL FANS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Carnes Company.
  - 2. Greenheck Fan Corporation.
  - 3. Loren Cook Company.

4. PennBarry.
  5. Twin City.
- B. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.
- C. Direct-Drive Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing; with wheel, inlet cone, and motor on swing-out service door.
- D. Belt-Driven Units: Motor mounted on adjustable base, with adjustable sheaves, enclosure around belts within fan housing, and lubricating tubes from fan bearings extended to outside of fan housing.
- E. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.
- F. Accessories: Where indicated.
1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
  2. Volume-Control Damper: Manually operated with quadrant lock, located in fan outlet.
  3. Companion Flanges: For inlet and outlet duct connections.
  4. Fan Guards: 1/2- by 1-inch mesh of galvanized steel in removable frame. Provide guard for inlet or outlet for units not connected to ductwork.
  5. Motor and Drive Cover (Belt Guard): Epoxy-coated steel.
- G. Capacities and Characteristics: As shown on Drawings.

### 2.03 PROPELLER FANS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Aerovent; a division of Twin City Fan Companies, Ltd.
  2. American Coolair Corporation.
  3. Ammerman; Millennium Equipment.
  4. Greenheck.
  5. Carnes Company.
  6. Chicago Blower Corporation.
  7. Loren Cook Company.
  8. PennBarry.
- B. Housing: Galvanized-steel sheet with flanged edges and integral orifice ring with baked-enamel finish coat applied after assembly.
- C. Steel Fan Wheels: Formed-steel blades riveted to heavy-gage steel spider bolted to cast-iron hub. (Where indicated).
- D. Fan Drive: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing. (Where indicated).

- E. Fan Drive: (When Belt Drive is indicated).
1. Resiliently mounted to housing.
  2. Statically and dynamically balanced.
  3. Selected for continuous operation at maximum rated fan speed and motor horsepower, with final alignment and belt adjustment made after installation.
  4. Extend grease fitting to accessible location outside of unit.
  5. Service Factor Based on Fan Motor Size: 1.4.
  6. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
  7. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
    - a. Ball-Bearing Rating Life: ABMA 9,  $L_{10}$  of 100,000 hours.
  8. Pulleys: Cast iron with split, tapered bushing; dynamically balanced at factory.
  9. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
  10. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
  11. Belt Guards: Fabricate of steel for motors mounted on outside of fan cabinet.
- F. Accessories:
1. Gravity Shutters: Aluminum blades in aluminum frame; interlocked blades with nylon bearings.
  2. Motor-Side Back Guard: Galvanized steel, complying with OSHA specifications, removable for maintenance.
  3. Wall Sleeve: Galvanized steel to match fan and accessory size.
  4. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
- G. Capacities and Characteristics: As shown on Drawings.

## 2.04 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 23 05 13 "Common Motor Requirements for HVAC Equipment."
1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
- B. Enclosure Type: Totally enclosed, fan cooled.

## 2.05 SOURCE QUALITY CONTROL

- A. Certify sound-power level ratings according to AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.



- B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

### PART 3 - EXECUTION

#### 3.01 INSTALLATION

- A. Ceiling Units: Suspend units from structure; use steel wire or metal straps.
- B. Install units with clearances for service and maintenance.
- C. Label units according to requirements specified in Section 23 05 53 "Identification for HVAC Piping and Equipment."

#### 3.02 CONNECTIONS

- A. Drawings indicate general arrangement of ducts and duct accessories.
- B. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."
- C. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

#### 3.03 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
  - 1. Verify that shipping, blocking, and bracing are removed.
  - 2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
  - 3. Verify that cleaning and adjusting are complete.
  - 4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
  - 5. Adjust belt tension.
  - 6. Adjust damper linkages for proper damper operation.
  - 7. Verify lubrication for bearings and other moving parts.
  - 8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
  - 9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
  - 10. Shut unit down and reconnect automatic temperature-control operators.
  - 11. Remove and replace malfunctioning units and retest as specified above.

- C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Prepare test and inspection reports.

3.04 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Adjust belt tension.
- C. Comply with requirements in Section 23 05 93 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.
- D. Replace fan and motor pulleys as required to achieve design airflow.
- E. Lubricate bearings.

END OF SECTION

SECTION 23 37 13 DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Round ceiling diffusers.
2. Rectangular and square ceiling diffusers.
3. Perforated diffusers.
4. Louver face diffusers.
5. Modular core supply grilles.
6. Louvers.

B. Related Sections:

1. Section 23 33 00 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.02 RELATED DOCUMENTS

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

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

- B. Samples for Verification: For diffusers, registers, and grilles, in manufacturer's standard sizes to verify color selected, if requested by Engineer.

PART 2 - PRODUCTS

2.01 DIFFUSERS, REGISTERS AND GRILLES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Anemostat Products; a Mestek company.
2. Carnes.
3. METALAIRE, Inc.
4. Price Industries.

5. Titus.
  6. Tuttle & Bailey.
  7. Krueger.
  8. Nailor.
- B. Products shall be sizes, types and finishes as indicated below unless shown otherwise on the drawings. All painted finishes shall be "Powder Coat."
- C. Round Ceiling Diffuser:
1. Material: Steel.
  2. Finish: Baked enamel, white.
  3. Face Style: Three cones.
  4. Mounting: Duct connection or ceiling surface mount.
  5. Pattern: Fully adjustable.
  6. Dampers: Radial opposed blade.
  7. Accessories: (Where indicated).
    - a. Equalizing grid.
    - b. Plaster ring.
    - c. Safety chain.
    - d. Wire guard.
    - e. Sectorizing baffles.
    - f. Operating rod extension.
- D. Rectangular and Square Ceiling Diffusers:
1. Devices shall be specifically designed for variable-air-volume flows where applicable.
  2. Material: Aluminum.
  3. Finish: Baked enamel, white.
  4. Face Style: Three cones.
  5. Mounting: Mounting panel.
  6. Pattern: Fixed.
  7. Dampers: Radial opposed blade.
  8. Accessories: (Where indicated).
    - a. Equalizing grid.
    - b. Plaster ring.
    - c. Safety chain.
    - d. Wire guard.
    - e. Sectorizing baffles.
    - f. Operating rod extension.
- E. Perforated Diffuser:
1. Devices shall be specifically designed for variable-air-volume flows, where applicable.
  2. Material: Steel backpan and pattern controllers, with aluminum face.
  3. Finish: Baked enamel, white.
  4. Face Style: Flush.
  5. Mounting: Mounting panel.
  6. Pattern Controller: Fixed with curved blades at inlet.

7. Dampers: Opposed blade.
8. Accessories: (Where indicated).
  - a. Equalizing grid.
  - b. Plaster ring.
  - c. Safety chain.
  - d. Wire guard.
  - e. Sectorizing baffles.
  - f. Operating rod extension.

F. Louver Face Diffuser:

1. Devices shall be specifically designed for variable-air-volume flows, where applicable.
2. Material: Aluminum.
3. Finish: Baked enamel, white.
4. Mounting: Mounting panel.
5. Pattern: Four-way core style.
6. Dampers: Radial opposed blade.
7. Accessories: Where indicated.
  - a. Square to round neck adaptor.
  - b. Adjustable pattern vanes.
  - c. Throw reducing vanes.
  - d. Equalizing grid.
  - e. Plaster ring.
  - f. Safety chain.
  - g. Wire guard.
  - h. Sectorizing baffles.
  - i. Operating rod extension.

G. Fixed Face Grille:

1. Material: Aluminum.
2. Finish: Baked enamel, white.
3. Face Arrangement: 1/2-by-1/2-by-1/2-inch grid core.
4. Core Construction: Integral.
5. Frame: 1 inch wide.
6. Mounting: Concealed.

2.02 HVAC LOUVERS AND PENTHOUSES

A. Manufacturers:

1. American Warming and Ventilating Co.
2. Ruskin
3. Nailor
4. AMCA Certified
5. Or approved Manufacturer

## B. Extruded Aluminum Louvers Drainable Blades

1. Frame: 4 inches deep channel, .081 inch thick 6063-T5 extruded aluminum alloy.
2. Blades: .081 inch thick 6063-T5 extruded aluminum alloy.
3. Finish: Mill or as indicated.
4. Screen: 1/2 inch removable expanded aluminum bird screen, located on interior.
5. Maximum panel size: 96 inches by 96 inches.
6. Minimum panel size: 12 inches by 12 inches.
7. Panels over 60" wide shall be 5-1/2 inches deep to accommodate a vertical interior blade support angle.
8. Water penetration – 0.01 oz (3.0 g) at 1025 fpm free area velocity.
9. Pressure drop – 0.2 SPWG (49.8 Pa) at 1025 fpm and 8210 SCFM.
10. Free area – 8.01 sq. ft. (0.744 sq.m) and 50.1 percent for 48 inches by 48 inches test size.
11. Furnish with extruded sill. Coordinate with other construction.

## 2.03 SOURCE QUALITY CONTROL

- A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."
- B. Louvers shall beam AMCA seals and be AMCA certified according to publication 511 and the AMCA certified ratings program.

## PART 3 - EXECUTION

## 3.01 EXAMINATION

- A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.02 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb.
- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.
- D. Insulate tops of devices above ceilings to prevent sweating.

3.03 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION

SECTION 23 51 00

BREECHINGS, CHIMNEYS, AND STACKS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following:

1. Listed single and double-wall vents and chimneys.

1.02 RELATED DOCUMENTS

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

1.03 ACTION SUBMITTALS

A. Product Data: For the following:

1. Type B and BW vents.

1.04 QUALITY ASSURANCE

A. Source Limitations: Obtain listed system components through one source from a single manufacturer.

B. Certified Sizing Calculations: Manufacturer shall certify venting system sizing calculations.

PART 2 - PRODUCTS

2.01 LISTED TYPE B AND BW VENTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Metal Products; MASCO Corporation.
2. Cleaver-Brooks; Div. of Aqua-Chem Inc.
3. FAMCO.
4. Hart & Cooley, Inc.
5. Heat-Fab, Inc.
6. Industrial Chimney Company.
7. LSP Products Group, Inc.
8. Metal-Fab, Inc.
9. Schebler Co. (The).
10. Selkirk Inc.; Selkirk Metalbestos and Air Mate.
11. Simpson Dura-Vent Co., Inc.; Subsidiary of Simpson Manufacturing Co.
12. Tru-Flex Metal Hose Corp.
13. Van-Packer Company, Inc.



- B. Description: Double-wall metal vents tested according to UL 441 and rated for 480 deg F continuously for Type B, or 550 deg F continuously for Type BW; with neutral or negative flue pressure complying with NFPA 211.
- C. Construction: Inner shell and outer jacket separated by at least a 1/4-inch airspace.
- D. Inner Shell: ASTM A 666, Type 430 stainless steel.
- E. Outer Jacket: Aluminized steel.
- F. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.
  - 1. Termination: Stack cap designed to exclude minimum 90 percent of rainfall;

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of work.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 APPLICATION

- A. Listed Type B and BW Vents: Vents for certified gas appliances.

3.03 INSTALLATION OF LISTED VENTS AND CHIMNEYS

- A. Locate to comply with minimum clearances from combustibles and minimum termination heights according to product listing or NFPA 211, whichever is most stringent.
- B. Seal between sections of positive-pressure vents and grease exhaust ducts according to manufacturer's written installation instructions, using sealants recommended by manufacturer.
- C. Support vents at intervals recommended by manufacturer to support weight of vents and all accessories, without exceeding appliance loading.

- D. For appliances more than 83 percent efficient, slope breechings down in direction of appliance, with condensate drain connection at lowest point piped to nearest drain.
- E. Lap joints in direction of flow.

END OF SECTION

SECTION 23 54 00 FURNACES, CONDENSING UNITS, ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes the following:
  - 1. Gas-fired, condensing, furnaces and accessories complete with controls.
  - 2. Air filters.
  - 3. Refrigeration components.

1.02 RELATED DOCUMENTS

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

1.03 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.

1.04 INFORMATIONAL SUBMITTALS

- A. Warranty: Special warranty specified in this Section.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each furnace to include in emergency, operation, and maintenance manuals for each of the following:
  - 1. Furnace and accessories complete with controls.
  - 2. Air filter.
  - 3. Refrigeration components.

1.06 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- 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.

#### 1.07 COORDINATION

A. Coordinate size and location of concrete bases where applicable. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

#### 1.08 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace the following components of that fail in materials or workmanship within specified warranty period:

1. Warranty Period, Commencing on Date of Final 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: 5 years.
  - e. Evaporator and Condenser Coils: Five years.

### PART 2 - PRODUCTS

#### 2.01 GAS-FIRED FURNACES, CONDENSING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Bryant Heating & Cooling Systems; Div. of United Technologies Corp.
2. Carrier Corporation; Div. of United Technologies Corp.
3. Lennox Industries Inc.
4. York International Corp.; a division of Unitary Products Group.

B. 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.

C. Cabinet: 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.

- D. 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 when indicated.
- E. Type of Gas: Natural.
- F. Heat Exchanger:
1. Primary: Aluminized steel.
  2. Secondary: Aluminum Fins, Stainless Steel Tubes.
- G. 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.
- H. 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.
- I. 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.
- J. Furnace Controls: Solid-state board integrates ignition, heat, cooling, and fan speeds; adjustable fan-on and fan-off timing; terminals for connection to accessories.
- K. Accessories:
1. Combination-Air Intake and Vent: CPVC plastic fitting to combine combustion air inlet and vent through outside wall.
  2. CPVC Plastic Vent Materials.
    - a. CPVC Plastic Pipe: Schedule 40, complying with ASTM F 441/F 441M.

- b. 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).

## 2.02 THERMOSTATS

- A. Controls shall comply with requirements in ASHRAE/IESNA 90.1, "Controls."
- B. Solid-State Thermostat: Wall-mounting, programmable, microprocessor-based unit with automatic switching from heating to cooling, seven-day programmability with minimum of four temperature presets per day and battery backup protection against power failure for program settings.
- C. Thermostat shall be backlit, touch screen type Honeywell or as approved.

## 2.03 AIR FILTERS

- A. Disposable Filters: 1-inch- (25-mm-) thick fiberglass media with ASHRAE 52.2 MERV rating of 6 or higher.

## 2.04 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 Piping: Comply with requirements in Section 23 23 00 "Refrigerant Piping."
- D. 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. 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. 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 30 deg F.
7. Mounting Base: Polyethylene.

### PART 3 - EXECUTION

#### 3.01 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine factory-installed insulation before furnace installation. Reject units that are wet, moisture damaged, or mold damaged.
- C. Examine roughing-in for gas and refrigerant piping systems to verify actual locations of piping connections before equipment installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.02 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.
- C. Controls: Install thermostats at mounting height of 40 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 4-inch- (100-mm-) thick, reinforced concrete base; 4 inches (100 mm) larger on each side than unit. Concrete, reinforcement, and formwork are specified in Section 03 30 00 "Cast-in-Place Concrete." or Section 03 30 53 "Miscellaneous Cast-in-Place Concrete." Coordinate anchor installation with concrete base.

### 3.03 CONNECTIONS

- A. Gas piping installation requirements are specified in Section 23 11 23 "Facility Natural-Gas Piping." 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. 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. Comply with requirements in Section 23 23 00 "Refrigerant Piping" for installation and joint construction of refrigerant piping.

### 3.04 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.
- 3.05 STARTUP SERVICE
- A. Complete installation and startup checks according to manufacturer's written instructions and perform the following:
- 1. Inspect for physical damage to unit casings.
  - 2. Verify that access doors move freely and are weathertight.
  - 3. Clean units and inspect for construction debris.
  - 4. Verify that all bolts and screws are tight.
  - 5. Adjust vibration isolation and flexible connections.
  - 6. Verify that controls are connected and operational.
- B. Start unit according to manufacturer's written instructions and complete manufacturer's operational checklist.
- C. Measure and record airflows.
- D. Verify proper operation of capacity control device.
- 3.06 ADJUSTING
- A. Adjust initial temperature set points.
- B. 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.
- 3.07 CLEANING
- A. After completing installation, clean furnaces internally according to manufacturer's written instructions.
- B. Install new filters in each furnace within 14 days after Substantial Completion.

END OF SECTION

SECTION 23 55 23

LOW-INTENSITY, GAS-FIRED, RADIANT HEATERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 CODES AND STANDARDS

- A. American National Standard / CSA Standard Gas-Fired Low Intensity Infrared Heaters: Construct and certify gas fired radiant heaters in accordance with latest edition ANSI Z83.20 / CSA 2.34 "Gas-Fired Low-Intensity Infrared Heaters" including all current supplements.
- B. Installation Compliance: Install gas fired radiant heaters in accordance with Z223.1 National Fuel Gas Code (latest edition).
- C. CSA Compliance: Provide CSA Seal affixed to each burner name plate and provide CSA Certification of heater design as vented or unvented infrared heater for indoor installation.
- D. National Standard Gas Piping Compliance: Install and connect gas piping to gas fired radiant heaters in accordance with Z223.1 National Fuel Gas Code (latest edition).
- E. National Electrical Code Compliance: Install and connect electrical wiring to gas fired radiant heaters in accordance with NFPA 70 "National Electrical Code" (latest edition).

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.04 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.
- B. Sample Warranty: For manufacturer's special warranties.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For gas-fired, radiant heaters to include in emergency, operation, and maintenance manuals.

1.06 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace components of radiant heaters that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: All warranty periods listed below are from date of Final Completion.
    - a. Burner Assembly: Five years.
    - b. Combustion and Emitter Tubes: Five years.
    - c. Heater Controls: One year(s).

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. UL listed and labeled, with UL label clearly visible on units indicating compliance with ANSI Z83.20/CSA 2.34.
- 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.

2.02 FORCED-DRAFT HEATERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
  - 1. Combustion Research Corporation.
  - 2. Detroit Radiant Products Company.
  - 3. Roberts-Gordon, LLC.
- B. Description: Factory-assembled, indoor, overhead-mounted, electrically controlled, low-intensity, infrared radiant heating units using gas combustion. Heater to have all necessary factory-installed wiring and piping required prior to field installation and startup.
- C. Fuel Type: Design burner for natural gas as indicated.
- D. Burner Assembly and Controls:
  - 1. Natural Gas model, enclosed and sealed box design with silicone gasketed doors and internally mounted blower, nickel plated steel burner cup, outside air adapter, hot surface ignition, four-try ignition, door interlock safety switch, all components easily accessed, durable spot welded construction, mica flame observation window, balanced air rotor, gas and electric controls are separated from the combustion air stream, and CSA approved. Burner box paint shall be epoxy-polyester powder coat for corrosion resistance. Stainless steel flexible gas line and high-pressure gas cock assembly included
  - 2. Heater shall be equipped with permanently lubricated motor with thermal overload protection enclosed inside burner compartment.

3. Factory Wired: All burners shall be factory wired for 120 Vac operation, Hot Surface Ignition and Honeywell® SmartValve control.
4. Fail-Safe Controls: To assure a high degree of fail-safe operation, the design shall include an air proving safety pressure switch to verify blower operation before gas valve opens.
5. Ignition Controls: All units shall be equipped with a fully automatic Hot Surface Ignition Module (HSI). The ignition module shall have a prepurge and timed trial for ignition with multiple ignition trial before lockout occurs. In addition, the ignition module shall be capable of a minimum of 4 trials for ignition to provide maximum reliability. Burner shall have automatic reset from lockout.
6. Reflectors: Provide aluminum, or other highly radiant reflective material reflectors, installed to provide continuous coverage over all straight lengths of heat exchanger. In order to maximize radiant output and minimize convection losses, reflectors are to extend below the bottom of the heat exchanger pipe.
7. Cover Elbow Fittings: Provide reflector joint pieces over heat exchanger elbows so reflector covers heat exchanger continuously.
8. End Cap Fittings: All reflectors at terminate of the heat exchanger pipe and any elbows shall have end caps to prevent convective heat from escaping.
9. Side Reflectors: System to have perimeter side extension reflector in certain areas of layout as shown on plan where specified. Side reflectors permanently attach to side to top reflector and are secured to the pipe by three side reflector supports and two "Z" clips for each 8 ft. section of side reflector. To prevent convection losses, tilting of reflectors will not be acceptable.
10. Outside Air: Provide fresh outside air to supply each burner for the support of combustion air.
11. Thermostats: Provide where indicated line voltage type connected to radiant heater. Mount thermostat 5 ft. -6 ft. above finish floor or otherwise as noted on the drawings. All thermostats shall be numbered instead of marked in degrees and shall not have thermometers.
12. Radiant Piping - Heat Exchanger:
  - a. Radiant Tube: Shall be new 4 in. O. D. Heat Treated Aluminized steel tube X 16 gauge wall with an emissivity factor of 0.80 or greater.
  - b. Burner Tube: shall be ALUMITHERM® steel (aluminized steel/titanium alloy) tube for the first 10 ft. of each radiant heater.
  - c. Fittings for radiant tube shall be as described in the installation manual.
  - d. Hanging Materials: All system's tube must be supported in accordance with acceptable practices, local codes, seismic requirements, and applicable standards and as shown on plans. Heat exchanger tube shall pitch down at least 1/2 inch in 20 ft. on radiant tube, away from burner box.

### PART 3 - EXECUTION

#### 3.01 EXAMINATION

- A. Examine structures, substrates, areas and conditions for compliance with requirements for installation tolerances, required clearances, and other conditions affecting performance of the Work.
- B. Examine roughing-in for fuel-gas piping to verify actual locations of piping connections before equipment installation.

- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 INSTALLATION

- A. Equipment Installation: Install gas-fired, radiant heaters and associated gas features and systems according to NFPA 54.
- B. Suspended Units: Mount to substrate using manufacturer's rigid mounting kits or custom fabricated brackets.
  - 1. Restrain the unit to resist seismic acceleration. Comply with requirements for seismic-restraint devices specified in Section 230548 "Vibration and Seismic Controls for HVAC Piping and Equipment."
  - 2. Comply with requirements for hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- C. Maintain manufacturers' recommended clearances for combustibles.

### 3.03 CONNECTIONS

- A. Gas Piping: Comply with Section 23 11 23 "Facility Natural-Gas Piping" or Section 23 11 26 "Facility Liquefied-Petroleum Gas Piping" as indicated. Connect gas piping to gas train inlet; provide union with enough clearance for burner removal and service.
  - 1. Gas Connections: Connect gas piping to radiant heaters according to NFPA 54.
- B. Where installing piping adjacent to gas-fired, radiant heaters, allow space for service and maintenance.
- C. Vent Connections: Comply with Section 233113 "Metal Ducts" and with Section 235100 "Breechings, Chimneys, and Stacks."
- D. Electrical Connections: Comply with applicable requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
  - 1. Install electrical devices furnished with heaters but not specified to be factory mounted.

### 3.04 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
  - 1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
  - 2. Verify bearing lubrication.
  - 3. Verify proper motor rotation.
- B. Gas-fired, radiant heaters will be considered defective if they do not pass tests and inspections.

- C. Prepare test and inspection reports when requested.

3.05 ADJUSTING

- A. Adjust initial-temperature set points.
- B. Adjust burner and other unit components for optimum heating performance and efficiency.

3.06 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain gas-fired, radiant heaters.

END OF SECTION

## SECTION 26 05 00

## COMMON WORK RESULTS FOR ELECTRICAL

## PART 1 - GENERAL

## 1.01 SECTION INCLUDES

- A. Basic materials and methods, along with Division 01, General Requirements, that are applicable to Division 26 sections.
- B. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 01 specification Sections apply to all Division 26 sections.

## 1.02 QUALITY ASSURANCE

- A. Comply with applicable local, state, and federal codes.
- B. Warrant electrical Work against faulty material or Workmanship in accordance with Division 01. If the Project is occupied or the systems placed in operation in several phases at the request of the Owner's Representative, then the warranty of each system or piece of equipment used, shall begin on the date each system or piece of equipment was placed in satisfactory operation and accepted as such, in writing, by the Owner's Representative. The use of building equipment for temporary service and testing does not constitute the beginning of the warranty.
- C. Equipment and material provided under this Division shall be periodically inspected and serviced by competent mechanics. This function becomes the responsibility of the Owner's Representative when the system is accepted by the Owner's Representative. The one year material and Workmanship warranty is not intended to supplant normal inspection or service and shall not be construed to mean the Contractor shall provide free service for normal maintenance items such as periodic lubrication and adjustment due to normal use, nor to correct without charge, breakage, maladjustment, and other trouble caused by improper maintenance.
- D. Turn over electrical equipment provided under this Division to the Owner's Representative in lubricated condition. Include instructions on further lubrication in the operating manual.
- E. Upon completion of contract and progressively as work proceeds, clean-up and remove dirt, debris and scrap materials. Maintain premises neat and clean. Protect and preserve access to energized equipment at all times. Clean items with factory finishes. Touch-up minor damage to surfaces; refinish entire piece of equipment when sustained major damage. Use only factory supplied paints of matching color and formula. Schedule an off-hour shutdown of all electrical equipment during the 2-week period preceding substantial completion. During this shut down, clean all buses and insulators inside all switchgear, switchboards, bus ducts, collector buses and panelboards located inside or adjacent to the project limits.

### 1.03 REGULATORY REQUIREMENTS

- A. Perform Work specified in Division 26 in accordance with standards listed below of the latest applicable edition adopted by the authority having jurisdiction. Where these Specifications are more stringent, they shall take precedence. In case of conflict, obtain a decision from the Architect.
1. NFPA 70: National Electrical Code
  2. NFPA 72: National Fire Alarm Code
  3. NFPA 90A: Standard for the Installation of Air Conditioning and Ventilating Systems
  4. NFPA 90B: Standard for the Installation of Warm Air Heating and Air Conditioning Systems
  5. NFPA 101: Life Safety Code
  6. NFPA 110: Standard for Emergency and Standby Power Systems
  7. ASTM E814-08B: Standard Test Method for Fire Tests Penetration Firestop Systems.
  8. U.L. Fire Resistance Index.
  9. International Building Code
  10. City of Dekalb, MS Electrical Code
  11. State of Mississippi Electrical Code
  12. All applicable Occupational Safety and Health Administration (OSHA) Publications, Rules and Regulations.
  13. Americans with Disabilities Act (ADA)

### 1.04 RELATED WORK SPECIFIED UNDER OTHER DIVISIONS

- A. Foundations and pads required for equipment furnished under this Division
- B. Field painting, except such painting as is required to maintain shop coat painting and factory finish painting
- C. Flashing of conduits into roofing and outside walls
- D. Heating, ventilating, and air conditioning equipment
- E. Plumbing equipment
- F. Fireproofing
- G. Automatic Doors
- H. Cutting and patching for electrical Work, except for errors and omissions under this Division.

### 1.05 SUBMITTALS

- A. Comply with provisions of Division 01.
- B. Submit product data, equipment details, capacities, and shop drawings as specified in sections of this Division.



- C. Submit fire alarm point-to-point drawings with product data submission.
- D. Submit dimensioned equipment room layouts.
  - 1. Show location of all electrical equipment in rooms including but not limited to:
    - a. Electrical rooms and closets
  - 2. Draw room layouts to 1/4" scale, with equipment locations shown therein. Clearances shall be in accordance with NEC and local codes. Indicate on drawing the mechanical equipment and mechanical and sprinkler pipe routing.
  - 3. Electrical equipment submittals will be rejected without dimensioned equipment room or equipment location layouts..

1.06 OPERATING AND MAINTENANCE MANUALS

- A. Provide manuals in accordance with Division 01.
- B. In addition to required submittals, include copies of all test reports required in Part 3, "Execution" of section 26 05 00.
- C. Provide completed warranty certificates for systems and equipment.
- D. Provide tabulation of overload heaters, including each motor identified, nameplate data and o/l heater part number.

1.07 DELIVERY AND STORAGE

- A. Insofar as possible, deliver items in manufacturer's original unopened packaging. Where this is not practical, cover items with protective materials to keep them from being damaged. Use care in loading, transporting, unloading, and storage to keep items from being damaged.
- B. Store items in a clean dry place and protect from damage. Evidence of damage from water or other contaminants will be cause for rejection.

1.08 RECORD DRAWINGS

- A. Comply with provisions of Division 01.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

- A. Equipment and materials furnished shall be listed by UL or other nationally accredited testing laboratory where available. When listing is not available for a piece of equipment, it shall be submitted in accordance with Drawings and Specifications and shall be approved by the authorities having jurisdiction.

- B. Specifications and Drawings indicate name, type and/or catalog number of materials and equipment to establish standards of quality. Submittals shall be based on the standards specified. The standards should not be construed as limiting competition.
- C. If materials and equipment other than specified herein are intended to be submitted, a letter providing a list of all the suggested alternates by section number, brand and series or model shall be submitted to the Architect for review and approval. Submit in accordance with Division 01 and a minimum of 14 days prior to submission of bids.

## 2.02 PIPE FREEZE PROTECTION

- A. Comply with provisions of Divisions 21, 22 and 23.
- B. Furnish and install heating cable to prevent freezing of water in piping exposed to outdoor temperatures.
- C. Acceptable manufacturers: Chromalox, Raychem.
- D. Select cable according to pipe size and pipe insulation employed.
  - 1. Condenser water piping
    - a. 1-5 inch dia. - 7 watts per lineal foot
    - b. 6-10 inch dia. - 11 watts per lineal foot
    - c. 12-18 inch dia. - 17 watts per lineal foot
  - 2. Domestic water and drain piping
    - a. 1/2-1 inch dia. - 3 watts per lineal foot
    - b. 1-1/4 - 2 inch dia. - 5 watts per lineal foot
- E. Heat cable shall be 120 volt for plug-in to receptacle and shall be controlled by integral thermostat preset to energize tape at 38 degrees F.
- F. Install heat cable direct to pipe, under insulation, spiralled along piping. Do not cross tape with itself. Do not cut factory lengths. Install first six inches of tape exposed, outside insulating wrap.
- G. Provide weatherproof receptacles, GFI type, at locations required by tape installation.

## 2.03 WALL AND CEILING ACCESS PANELS

- A. Style and type as required for material in which installed.
  - 1. Size: 16" X 16" minimum, as indicated, or as required to allow inspection, service and removal of items served
  - 2. 14 gauge minimum sheet metal for doors, 16 gauge frames of cadmium-plated or galvanized construction. Doors shall have expanded plaster rings where located in plaster walls or flanged finish where located in drywall or block construction
  - 3. Panels shall have spring hinges with screwdriver locks in non-public areas. Key lock, keyed alike, for panels in public areas
  - 4. Prime painted or rust inhibitive paint finish

5. UL labeled when in fire-rated construction, 1 1/2 hour rating
6. Provide in walls, floors, and ceilings to permit access to all equipment and junction boxes.
7. Furnish and locate access panels under this Division. Coordinate with trades who are responsible for building system in which panels are to be installed.
8. Acceptable manufactures: Milcor, Nystrom, Karp, J.L. Industries, or Williams Brothers. Use panels equal to Milcor Style M for masonry and drywall construction; equal to Milcor Style K for plastered masonry walls and ceilings. Stainless steel panels shall be used in ceramic tile or glazed structural tile

### PART 3 - EXECUTION

#### 3.01 COORDINATION

- A. Install equipment in accordance with manufacturer's recommendations. Where conflicts occur between Contract Documents and these recommendations, request a ruling before proceeding with such Work.
- B. Visit site and observe conditions under which work must be performed. No subsequent allowance will be made because of error or failure to obtain necessary information to completely estimate and perform work required by these documents.
- C. Examine Specifications and Drawings to be familiar with items which require electrical connections and coordination. Electrical Drawings are diagrammatic and shall not be scaled for exact sizes.
- D. Prior to commencement of installation, prepare coordination drawings for work under this division, as specified in Division 01 and as called for herein. Coordinate work under other divisions, including but not limited to mechanical, plumbing, fire protection, telecommunication and miscellaneous steel to develop these coordination drawings that will serve as the agreed upon plan for a coordinated installation of work for all trades. Include electrical equipment, panelboards, starters, disconnect switches, conduit racks and conduits 3" and larger on drawings confirming coordination with other trades. Incorporate the information onto the coordination drawings required under Division 01 and 23 to develop master coordination drawings. Account for lighting fixture depths in the coordination. Inform Design Professional of conflicts that cannot be resolved.
- E. Do NOT submit coordination drawings to Architect for review. Keep a copy on site for reference purposes. Notify Architect of conflicts that cannot be resolved.

#### 3.02 FEES AND PERMITS

- A. Obtain and pay for all necessary permits and inspection fees required for electrical installation.

### 3.03 TEMPORARY LIGHTS AND POWER

- A. Comply with provisions of Division 01.
- B. Provide a temporary electrical lighting and power distribution system of adequate size to properly serve the following requirements, including adequate feeder sizes to prevent excessive voltage drop. Temporary Work shall be installed in a neat and safe manner in accordance with the National Electrical Code, Article 305, NFPA 241, and as required by OSHA or applicable local safety codes.
- C. Provide one pigtail socket with 150 watt lamp, CFL medium base, for every 1,000 square feet of floor area, evenly distributed throughout the building and with minimum of one pigtail socket per room.
- D. Provide suitable guards for temporary lights to prevent accidental contact with lamps.
- E. Provide a minimum of one GFCI-protected duplex power outlet for every 1,500 square feet of floor area, evenly distributed throughout the building. Power outlets shall be GFCI-protected duplex 20 amp, 120 volt.
- F. Provide feeders, disconnects, connections, etc., required for construction equipment, eg: cranes, pumps, etc.
- G. Prior to installation, determine if any lighting or power outlets over the minimum quantity noted above are required and if so, provide them.
- H. Provide service and panelboards required for above lighting and power outlets.
- I. Requirement for payment of utility bills during construction are specified in Division 01.
- J. Provide single phase and three phase service as required by Project.
- K. Remove temporary wiring upon completion of use.

### 3.04 DEMOLITION

- A. Visit the site to observe existing conditions before submitting a bid.
- B. Work in existing buildings shall be scheduled well in advance with the Owner's Representative. Work shall be performed at such times and under such conditions as suit the convenience of the Owner's Representative. Plan the Work to minimize disruption of normal operations. Notify Owner's Representative before any circuit is de-energized in occupied areas.
- C. Reconnect circuits to other panelboards when required to complete the renovation shown.
- D. Remove abandoned wire and conduit back to source. Splice and terminate in junction boxes as appropriate. Where entire circuit is to be removed, remove conduit and wire back to existing panelboard. Where such work would not be possible without disturbing areas not being renovated, consult with the Architect prior to performing the work.

- E. Where a circuit is interrupted by removal of a device or fixture from that circuit, install wire and conduit as required to restore service to the remaining devices and fixtures on that circuit. Ensure proper grounding is maintained.
- F. Lighting fixtures, wiring devices, panelboards, equipment, conduits and conductors removed shall be transported to the Owner's designated location and offered to the OWNER. If he chooses to retain these items or a part of these items, turn those chosen over to him. Items rejected by the OWNER shall be removed completely from the project site and disposed of legally by the CONTRACTOR.

### 3.05 CUTTING AND PATCHING

- A. Comply with provisions of Division 01
- B. Repair or replace routine damage caused by cutting in performance of Work under this Division.
- C. Correct unnecessary damage caused due to installation of electrical Work, brought about through carelessness or lack of coordination.
- D. Holes cut through floor slabs shall be core drilled with drill designed for this purpose. All openings, sleeves, and holes in slabs between floors shall be properly sealed, fire proofed and water proofed.
- E. Holes cut through walls shall be drilled or cut with tools designed for the purpose. All openings, sleeves and holes in walls that extend to underside of floor above shall be properly sealed and fire proofed.
- F. Repairs shall be performed with materials which match existing materials and be installed in accordance with appropriate sections of these Specifications.
- G. Contractor shall not be permitted to cut or modify any structural members without the written permission of the Architect .

### 3.06 TRENCHING, EXCAVATION, BACKFILLING, AND REPAIRS

- A. Comply with provisions of Division 31.
- B. Provide trenching, excavation, and backfilling necessary for performance of Work under this Division.
- C. Provide sheathing, shoring, dewatering, and cleaning necessary to keep trenches and their grades in proper condition for Work to be performed.
- D. Trenching and excavation shall be unclassified. No extra will be paid in event that rock is encountered.

### 3.07 FOUNDATIONS AND PADS

- A. Provide concrete foundations and pads for equipment per the requirements Division 03. Locate and size foundations, pads, and anchor bolts as required for equipment in this Division.

- B. Provide concrete foundations and pads as required for electrical utility company's equipment such as transformers, CT cabinets, metering cabinets, switches, fused disconnects, and circuit breakers. All work shall be in compliance with the utility company's specifications.

### 3.08 CONTROL SYSTEMS AND INTERLOCK WIRING

- A. Control systems, components and control and interlock wiring for mechanical equipment will be furnished under Divisions 21, 22 and 23. Control devices including, but not limited to VFD's, thermostats, fan speed and level control switches, relays and electro-pneumatic switches shall be furnished under Divisions 22 and 23.
- B. Provide motor control centers per section 26 24 19.
- C. Provide magnetic starters per section 26 29 13.
- D. Provide manual motor starters per Section 26 29 13.
- E. Provide power wiring to starters and contactors under Division 26. Power wiring to magnetic starters shall consist of wiring to the line side terminals of the magnetic starter or contactor and wiring away from the load side terminals to the equipment, except where such wiring is installed pre-wired by the equipment vendor.
  - 1. Power wiring to 120V, 1-phase, 60 Hz and 277V, 1-phase, 60 Hz volt fans, unit heaters, fan-coil units, VAV boxes, pumps and other equipment shall include all portions of the branch circuit, except for wiring inside an automatic temperature control panel (ATC) or Direct Digital Control Panel (DDC), Building Automation System panels, equipment control panels, or magnetic starters. Such internal wiring shall be furnished under Divisions 21, 22 and 23.
- F. Under Division 28:
  - 1. Furnish duct mounted smoke detectors.
  - 2. Provide wiring among detectors, fire alarm system, magnetic starters and relays, ATC panels and DDC panels
- G. See Building Automation System sections of Division 23.

### 3.09 UTILITY COMPANY COORDINATION

- A. Coordinate with the serving utility company as to all types of work required to be done by the contractor for utility equipment.
- B. Confirm exact location of point of common coupling, duct banks, pads, etc.
- C. Obtain copies of all pertinent utility company specifications relating to duct banks, concrete pads, raceways, and cable that are contractor installed for the utility company use. Maintain copies at project site.
- D. Install at components in compliance with utility company specifications and project specifications.

3.10 TESTING ELECTRICAL SYSTEMS

- A. On completion of work, installation shall be completely operational and entirely free from grounds, short circuits, and open circuits. Perform operational tests as required to demonstrate substantial completion of the Work. Balance circuits so that feeders to panels are not more than 10% out of balance between phases with all available load energized and operating. Furnish all labor, materials and instruments for above tests. All ampere readings shall be made with a true RMS reading meter.
- B. Perform megger tests of all service entrance circuits, feeder and branch circuits size #4 AWG and larger. Provide a report of all such megger test results.
- C. Prior to final observation and acceptance test, install all electrical systems and equipment complete and in satisfactory operating condition.

END OF SECTION





## 2.02 CONNECTORS AND SPLICES

- A. Basis-of-Design Product: Subject to compliance with requirements, provide or comparable product by one of the following:
1. Ideal Industries, Inc.
  2. IlSCO; a branch of Bardes Corporation.
  3. 3M; Electrical Markets Division.
  4. Tyco Electronics.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

## 2.03 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

### 3.01 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.

### 3.02 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type THHN-2-THWN-2, single conductors in raceway.
- B. Exposed Feeders: Type THHN-2-THWN-2, single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN-2-THWN-2, single conductors in raceway Metal-clad cable, Type MC.
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-2-THWN-2, single conductors in raceway.
- E. Exposed Branch Circuits, Including in Crawlspace: Type THHN-2-THWN-2, single conductors in raceway.
- F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-2-THWN-2, single conductors in raceway Metal-clad cable, Type MC.

- G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-2-THWN-2, single conductors in raceway.

### 3.03 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 260533 "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 260529 "Hangers and Supports for Electrical Systems."
- G. Complete cable tray systems installation according to Section 260536 "Cable Trays for Electrical Systems" prior to installing conductors and cables.

### 3.04 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.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

### 3.05 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 260553 "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.

3.06 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.07 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

END OF SECTION

SECTION 26 05 26                      GROUNDING AND BONDING  
FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01      SUMMARY

- A.      Section includes grounding and bonding systems and equipment.

1.02      RELATED DOCUMENTS

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

1.03      ACTION SUBMITTALS

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

1.04      QUALITY ASSURANCE

- A.      Testing Agency Qualifications: Member company of NETA or an NRTL.
  - 1.      Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.
- 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 UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.01      MANUFACTURERS

- A.      Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:
  - 1.      Burndy; Part of Hubbell Electrical Systems.
  - 2.      ERICO International Corporation.
  - 3.      ILSCO.

2.02      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.

2.03 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

2.04 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.

2.05 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet 5/8 by 96 inches.

PART 3 - EXECUTION

3.01 APPLICATIONS

- A. Conductor Terminations and Connections:
  - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
  - 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
  - 3. Connections to Structural Steel: Welded connectors.

3.02 GROUNDING AT THE SERVICE

- A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.03 GROUNDING SEPARATELY DERIVED SYSTEMS

- A. Generator: Install grounding electrode(s) at the generator location. The electrode shall be connected to the equipment grounding conductor and to the frame of the generator.

3.04 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

## 3.05 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. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.
1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
  2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
  2. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.
- E. Grounding and Bonding for Piping:
1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by 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. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- F. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.

END OF SECTION

SECTION 26 05 29 HANGERS AND SUPPORTS  
FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes hangers and supports for electrical equipment and systems.
- B. Related Sections include the following:
  - 1. Section 260548.16 "Seismic Controls for Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.

1.02 RELATED DOCUMENTS

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

1.03 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. IMC: Intermediate metal conduit.
- C. RMC: Rigid metal conduit.

1.04 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.

1.05 ACTION SUBMITTALS

- A. Product Data: For the following:
  - 1. Steel slotted support systems.

## 1.06 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Comply with NFPA 70.

## 1.07 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified together with concrete Specifications.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

## PART 2 - PRODUCTS

## 2.01 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
  - 1. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
  - 2. 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 hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
  - 1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
  - 2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
  - 3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 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, and high strength. Comply with ASTM A 325.
  - 6. Hanger Rods: Threaded steel.



## 2.02 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

## PART 3 - EXECUTION

### 3.01 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 required by NFPA 70. Minimum rod size shall be 1/4 inch 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.
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

### 3.02 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 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.
- 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 New Concrete: Bolt to concrete inserts.
  - 2. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
  - 3. To Existing Concrete: Expansion anchor fasteners.

4. 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 thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
  5. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
  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.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

### 3.03 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

### 3.04 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.
- B. Touchup: Comply with requirements in Painting Specification Section for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 26 05 33

RACEWAYS AND BOXES  
FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, and fittings.
3. Boxes, enclosures, and cabinets.
4. Handholes and boxes for exterior underground cabling.

B. Related Requirements:

1. Section 26 05 43 "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.
2. Section 28 05 28 "Pathways for Electronic Safety and Security" for conduits, surface pathways, innerduct, boxes, and faceplate adapters serving electronic safety and security.

1.02 RELATED DOCUMENTS

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

1.03 DEFINITIONS

- A. ARC: Aluminum rigid conduit.
- B. GRC: Galvanized rigid steel conduit.
- C. IMC: Intermediate metal conduit.

1.04 ACTION SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

## PART 2 - PRODUCTS

## 2.01 METAL CONDUITS, TUBING, AND FITTINGS

- 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. Allied Tube & Conduit.
  2. Republic Conduit.
  3. Thomas & Betts Corporation.
  4. Wheatland Tube Company.
- B. 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.
- C. GRC: Comply with ANSI C80.1 and UL 6.
- D. EMT: Comply with ANSI C80.3 and UL 797.
- E. FMC: Comply with UL 1; zinc-coated steel.
- F. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- G. 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.
    - 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, with overlapping sleeves protecting threaded joints.
- H. 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.

## 2.02 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

- 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. Lamson & Sessions.
  2. Thomas & Betts Corporation.
  3. Cantex, Inc

- B. Listing and Labeling: Nonmetallic 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.
- C. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- D. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

## 2.03 BOXES, ENCLOSURES, AND CABINETS

- 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 Technologies Company; Cooper Crouse-Hinds.
  - 2. FSR Inc.
  - 3. RACO; Hubbell.
  - 4. Spring City Electrical Manufacturing Company.
  - 5. Thomas & Betts Corporation.
- B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- E. Metal Floor Boxes:
  - 1. Material: Cast metal.
  - 2. Type: Fully adjustable.
  - 3. Shape: Rectangular.
  - 4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- F. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.
- G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- H. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.
- I. Gangable boxes are allowed.

- J. Hinged-Cover Metal Enclosures: Comply with UL 50 and NEMA 250, Type 1 with continuous-hinge cover with flush latch unless otherwise indicated. Steel, finished inside and out with manufacturer's standard enamel.

## 2.04 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

### A. General Requirements for Handholes and Boxes:

1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

### B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.

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. Oldcastle Precast, Inc.
  - b. Quazite: Hubbell Power System, Inc.
  - c. Armorcast Products, Inc.
2. Standard: Comply with SCTE 77.
3. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
6. Cover Legend: Molded lettering, "ELECTRIC."
7. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
8. Handholes 12 Inches Wide by 24 Inches Long and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

## PART 3 - EXECUTION

### 3.01 RACEWAY APPLICATION

#### A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC.
2. Underground Conduit: RNC, Type EPC-40-PVC, concrete encased.
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 and Subject to Severe Physical Damage: GRC. Raceway locations include the following:
    - a. Mechanical rooms.
    - b. Gymnasiums.
  3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
  4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
  5. Damp or Wet Locations: GRC.
  6. Boxes and Enclosures: NEMA 250, Type 1.
- C. Minimum Raceway Size: 1/2-inch 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 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.
- 3.02 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 away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
  - C. Complete raceway installation before starting conductor installation.
  - D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
  - E. Arrange stub-ups so curved portions of bends are not visible above finished slab.
  - F. 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 of changes in direction.

- G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- H. Support conduit within 12 inches of enclosures to which attached.
- I. 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. Secure raceways to reinforcement at maximum 10-foot intervals.
  2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
  3. Arrange raceways to keep a minimum of 1 inch of concrete cover in all directions.
  4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
- J. 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.
- K. 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.
- L. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- M. 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 trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- N. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- O. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- P. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- Q. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.



- R. 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. Install raceway sealing fittings according to NFPA 70.
- S. 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.
- T. Comply with manufacturer's written instructions for solvent welding RNC and fittings.
- U. Expansion-Joint Fittings:
1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet .
  2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
    - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
    - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
    - c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
    - d. Attics: 135 deg F temperature change.
  3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
  4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
  5. 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.
- V. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semirecessed 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.

- W. 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] [top] [bottom] of box unless otherwise indicated.
- X. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
- Y. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- Z. Locate boxes so that cover or plate will not span different building finishes.
- AA. 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.
- BB. Set metal floor boxes level and flush with finished floor surface.

### 3.03 INSTALLATION OF UNDERGROUND CONDUIT

#### A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section "31 23 11 "Excavation, Fill and Grading for Buildings" for pipe less than 6 inches in nominal diameter.
2. Install backfill as specified in Section 31 23 11 "Excavation, Fill and Grading for Buildings".
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 31 23 11 "Excavation, Fill and Grading for Buildings".
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
  - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete for a minimum of 12 inches on each side of the coupling.
  - b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
6. Warning Planks: Bury warning planks approximately 12 inches above direct-buried conduits but a minimum of 6 inches below grade. Align planks along centerline of conduit.
7. Underground Warning Tape: Comply with requirements in Section 26 05 53 "Identification for Electrical Systems."

**3.04 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES**

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.
- D. Install handholes with bottom below frost line, below grade.
- E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables but short enough to preserve adequate working clearances in enclosure.
- F. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

**3.05 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS**

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

**3.06 FIRESTOPPING**

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 07 84 00 "Firestopping".

**3.07 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

SECTION 26 05 43 UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Direct-buried conduit, ducts, and duct accessories.
2. Concrete-encased conduit, ducts, and duct accessories.

1.02 RELATED DOCUMENTS

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

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include duct-bank materials, including separators and miscellaneous components.
2. Include ducts and conduits and their accessories, including elbows, end bells, bends, fittings, and solvent cement.
3. Include warning tape.
4. Include warning planks.

1.04 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

1.05 FIELD CONDITIONS

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions, and then only after arranging to provide temporary electrical service according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without Owner's written permission.

- B. Ground Water: Assume ground-water level is at grade level unless a lower water table is noted on Drawings.

- C. Ground Water: Assume ground-water level is 36 inches below ground surface unless a higher water table is noted on Drawings.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS FOR DUCTS AND RACEWAYS

- A. Comply with ANSI C2.

2.02 CONDUIT

- A. Rigid Steel Conduit: Galvanized. Comply with ANSI C80.1.
- B. RNC: NEMA TC 2, Type EPC-40-PVC, UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.

2.03 NONMETALLIC DUCTS AND DUCT ACCESSORIES

- A. Manufacturer: 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. Lamson & Sessions.
  - 2. Thomas & Betts Corporation.
  - 3. JM Eagle, Inc.
- B. Underground Plastic Utilities Duct: NEMA TC 2, UL 651, ASTM F 512, Type EPC-40, with matching fittings complying with NEMA TC 3 by same manufacturer as the duct.
- C. Duct Accessories:
  - 1. Duct Separators: Factory-fabricated rigid PVC interlocking spacers, sized for type and size of ducts with which used, and selected to provide minimum duct spacing indicated while supporting ducts during concreting or backfilling.
  - 2. Warning Tape: Underground-line warning tape specified in Section 260553 "Identification for Electrical Systems."
  - 3. Concrete Warning Planks: Nominal 12 by 24 by 3 inches in size, manufactured from 6000-psi concrete.
    - a. Color: Red dye added to concrete during batching.
    - b. Mark each plank with "ELECTRIC" in 2-inch- high, 3/8-inch- deep letters.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Coordinate layout and installation of ducts, manholes, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field. Notify Architect if there is a conflict between areas of excavation and existing structures or archaeological sites to remain.

- B. Coordinate elevations of ducts and duct-bank entrances into manholes, handholes, and boxes with final locations and profiles of ducts and duct banks, as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations as required to suit field conditions and to ensure that duct runs drain to manholes and handholes, and as approved by Project Engineer / MDOT Architect.

### 3.02 UNDERGROUND DUCT APPLICATION

- A. Ducts for Electrical Feeders 600 V and Less: RNC, NEMA Type EPC-40-PVC, in concrete-encased duct bank unless otherwise indicated.

### 3.03 EARTHWORK

- A. Excavation and Backfill: Comply with Section 31 23 11 "Excavation, Fill and Grading for Buildings" but do not use heavy-duty, hydraulic-operated, compaction equipment.
- B. Restore surface features at areas disturbed by excavation, and re-establish original grades unless otherwise indicated. Replace removed sod immediately after backfilling is completed.
- C. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching.
- D. Cut and patch existing pavement in the path of underground ducts and utility structures according to the "Cutting and Patching" Article in Section 01 73 00 "Execution."

### 3.04 DUCT INSTALLATION

- A. Install ducts according to NEMA TCB 2.
- B. Slope: Pitch ducts a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope ducts from a high point in runs between two manholes, to drain in both directions.
- C. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 inches, both horizontally and vertically, at other locations unless otherwise indicated.
- D. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.
- E. Installation Adjacent to High-Temperature Steam Lines: Where duct banks are installed parallel to underground steam lines, perform calculations showing the duct bank will not be subject to environmental temperatures above 40 deg C. Where environmental temperatures are calculated to rise above 40 deg C, and anywhere the duct bank crosses above an underground steam line, install insulation blankets listed for direct burial to isolate the duct bank from the steam line.

- F. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig hydrostatic pressure.
- G. Pulling Cord: Install 100-lbf- test nylon cord in empty ducts.
- H. Concrete-Encased Ducts: Support ducts on duct separators.
1. Excavate trench bottom to provide firm and uniform support for duct bank. Prepare trench bottoms as specified in Section 31 23 11 "Excavation, Fill and Grading for Buildings" for pipes less than 6 inches in nominal diameter.
  2. Width: Excavate trench 12 inches wider than duct bank on each side.
  3. Width: Excavate trench 3 inches wider than duct bank on each side.
  4. Depth: Install top of duct bank at least 24 inches below finished grade in areas not subject to deliberate traffic, and at least 30 inches below finished grade in deliberate traffic paths for vehicles unless otherwise indicated.
  5. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.
  6. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts, with not less than four spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent floating during concreting. Stagger separators approximately 6 inches between tiers. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
  7. Minimum Space between Ducts: 3 inches between ducts and exterior envelope wall, 2 inches between ducts for like services, and 4 inches between power and signal ducts.
  8. Elbows: Use manufactured rigid steel conduit elbows for stub-ups at poles and equipment, at building entrances through floor, and at changes of direction in duct run.
    - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
    - b. Stub-Ups to Equipment: For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of base. Install insulated grounding bushings on terminations at equipment.
  9. Reinforcement: Reinforce concrete-encased duct banks where they cross disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
  10. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
  11. Concrete Cover: Install a minimum of 3 inches of concrete cover at top and bottom, and a minimum of 2 inches on each side of duct bank.

12. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.
  - a. Start at one end and finish at the other, allowing for expansion and contraction of ducts as their temperature changes during and after the pour. Use expansion fittings installed according to manufacturer's written recommendations, or use other specific measures to prevent expansion-contraction damage.
  - b. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch reinforcing-rod dowels extending a minimum of 18 inches into concrete on both sides of joint near corners of envelope.
13. Pouring Concrete: Comply with requirements in "Concrete Placement" Article in Section 033000 "Cast-in-Place Concrete." Place concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-bank application.
  - I. Warning Tape: Bury warning tape approximately 12 inches above all concrete-encased ducts and duct banks. Align tape parallel to and within 3 inches of centerline of duct bank. Provide an additional warning tape for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional tapes 12 inches apart, horizontally.

### 3.05 GROUNDING

- A. Ground underground ducts and utility structures according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."

END OF SECTION



SECTION 26 05 44

SLEEVES AND SLEEVE SEALS FOR ELECTRICAL  
RACEWAYS AND CABLING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

B. Related Requirements:

1. Section 07 84 00 "Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.02 RELATED DOCUMENTS

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

1.03 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.01 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

- B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

- C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

- D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.
- E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.
- F. Sleeves for Rectangular Openings:
  - 1. Material: Galvanized sheet steel.
  - 2. Minimum Metal Thickness:
    - a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
    - b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

## 2.02 SLEEVE-SEAL FITTINGS

- A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.
  - 1. Manufacturer: 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. Presealed Systems.
    - b. Metraseal.
    - c. O-Z Gedney

## 2.03 GROUT

- A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

## 2.04 SILICONE SEALANTS

- A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
  - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated
- B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

## PART 3 - EXECUTION

## 3.01 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Comply with NECA 1.
- B. Comply with NEMA VE 2 for cable tray and cable penetrations.
- C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
  - 1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
    - a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 07 92 00 "Joint Sealants."
    - b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
  - 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
  - 3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
  - 4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
  - 5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.
- D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
  - 1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
  - 2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.
- E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.02 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.
- B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.03 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification for conductors.
3. Underground-line warning tape.
4. Warning labels and signs.
5. Equipment identification labels.
6. Miscellaneous identification products.

1.02 RELATED DOCUMENTS

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

1.03 QUALITY ASSURANCE

- A. Comply with ANSI A13.1 and IEEE C2.
- 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.

1.04 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

**PART 2 - PRODUCTS****2.01 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.

**2.02 ARMORED AND METAL-CLAD CABLE IDENTIFICATION MATERIALS**

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Colors for Raceways Carrying Circuits at 600 V and Less:
  - 1. Black letters on an orange field.
  - 2. Legend: Indicate voltage.
- C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- D. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches wide; compounded for outdoor use.

**2.03 CONDUCTOR IDENTIFICATION MATERIALS**

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.
- 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.

**2.04 UNDERGROUND-LINE WARNING TAPE**

- A. Tape:
  - 1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
  - 2. Printing on tape shall be permanent and shall not be damaged by burial operations.

3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:

1. Comply with ANSI Z535.1 through ANSI Z535.5.
2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE.
3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.

C. Tag:

1. Pigmented polyolefin, bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
2. Thickness: 4 mils .
3. Weight: 18.5 lb/1000 sq. ft. .
4. 3-Inch Tensile According to ASTM D 882: 30 lbf , and 2500 psi .

## 2.05 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Baked-Enamel Warning Signs:

1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal size, 7 by 10 inches.

D. Metal-Backed, Butyrate Warning Signs:

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal size, 10 by 14 inches.

E. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

**2.06 EQUIPMENT IDENTIFICATION LABELS**

- A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

**2.07 MISCELLANEOUS IDENTIFICATION PRODUCTS**

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

**PART 3 - EXECUTION****3.01 INSTALLATION**

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- F. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.
- G. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

**3.02 IDENTIFICATION SCHEDULE**

- A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Identify with self-adhesive vinyl tape applied in bands. Install labels at 10-foot maximum intervals.
- B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:
  - 1. Emergency Power.
  - 2. Power.
  - 3. UPS.



- C. 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 service, 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 208/110-V Circuits:
      - 1) Phase A: Black.
      - 2) Phase B: Red.
      - 3) Phase C: Blue.
    - c. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches 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.
- D. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.
- E. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
1. Limit use of underground-line warning tape to direct-buried cables.
  2. Install underground-line warning tape for both direct-buried cables and cables in raceway.
- F. 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: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, 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.
    - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
    - d. 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.

2. Equipment to Be Labeled:
  - a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be engraved, laminated acrylic or melamine label.
  - b. Enclosures and electrical cabinets.
  - c. Emergency system boxes and enclosures.
  - d. Enclosed switches.
  - e. Enclosed circuit breakers.
  - f. Enclosed controllers.
  - g. Power transfer equipment.
  - h. Contactors.
  - i. Power-generating units.

END OF SECTION

SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Weather-resistant receptacles.
3. Snap switches and wall-box dimmers.
4. Floor service outlets, poke-through assemblies, service poles, and multioutlet assemblies.

1.02 RELATED DOCUMENTS

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

1.03 DEFINITIONS

- A. GFCI: Ground-fault circuit interrupter.
- B. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- C. UTP: Unshielded twisted pair.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Receptacles for Owner-Furnished Equipment: Match plug configurations.

1.05 ACTION SUBMITTALS

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

1.06 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

**PART 2 - PRODUCTS****2.01 MANUFACTURERS**

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
1. Cooper Wiring Devices; Division of Cooper Industries, Inc. (Cooper).
  2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
  3. Leviton Mfg. Company Inc. (Leviton).
  4. Pass & Seymour/Legrand (Pass & Seymour).
- B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

**2.02 GENERAL WIRING-DEVICE REQUIREMENTS**

- A. Wiring Devices, Components, 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.
- C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
  2. Devices shall comply with the requirements in this Section.

**2.03 STRAIGHT-BLADE RECEPTACLES**

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.
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. Cooper; 5351 (single), CR5362 (duplex).
    - b. Hubbell; HBL5351 (single), HBL5352 (duplex).
    - c. Leviton; 5891 (single), 5352 (duplex).
    - d. Pass & Seymour; 5361 (single), 5362 (duplex).

**2.04 GFCI RECEPTACLES**

- A. General Description:
1. Straight blade, feed-through type.
  2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
  3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

## B. Duplex GFCI Convenience Receptacles, 125 V, 20 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. Cooper; VGF20.
  - b. Hubbell; GFR5352L.
  - c. Pass & Seymour; 2095.
  - d. Leviton; 7590.

## 2.05 TOGGLE SWITCHES

## A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

## B. Switches, 120/277 V, 20 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. Single Pole:
    - 1) Cooper; AH1221.
    - 2) Hubbell; HBL1221.
    - 3) Leviton; 1221-2.
    - 4) Pass & Seymour; CSB20AC1.
  - b. Three Way:
    - 1) Cooper; AH1223.
    - 2) Hubbell; HBL1223.
    - 3) Leviton; 1223-2.
    - 4) Pass & Seymour; CSB20AC3.
  - c. Four Way:
    - 1) Cooper; AH1224.
    - 2) Hubbell; HBL1224.
    - 3) Leviton; 1224-2.
    - 4) Pass & Seymour; CSB20AC4.

## 2.06 WALL PLATES

## A. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: Smooth, high-impact thermoplastic.
3. Material for Unfinished Spaces: Galvanized steel.
4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

## B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

## 2.07 FLOOR SERVICE FITTINGS

## A. Type: Modular, flush-type, dual-service units suitable for wiring method used.

## B. Compartments: Barrier separates power from voice and data communication cabling.

## C. Service Plate: Rectangular, solid brass with satin finish.

- D. Power Receptacle: NEMA WD 6 Configuration 5-20R, gray finish, unless otherwise indicated.
- E. Voice and Data Communication Outlet: Blank cover with bushed cable opening.

## 2.08 FINISHES

- A. Device Color:
  - 1. Wiring Devices Connected to Normal Power System: Ivory unless otherwise indicated or required by NFPA 70 or device listing.
  - 2. Wiring Devices Connected to Emergency Power System: Red.
- B. Wall Plate Color: For plastic covers, match device color.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- B. Coordination with Other Trades:
  - 1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
  - 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
  - 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
  - 4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
  - 1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
  - 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
  - 3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
  - 4. Existing Conductors:
    - a. Cut back and pigtail, or replace all damaged conductors.
    - b. Straighten conductors that remain and remove corrosion and foreign matter.
    - c. Pigtailling existing conductors is permitted, provided the outlet box is large enough.

- D. Device Installation:
1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
  2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
  3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
  4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
  5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
  6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
  7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
  8. Tighten unused terminal screws on the device.
  9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.
- E. Receptacle Orientation: Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.
- F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
- G. Dimmers:
1. Install dimmers within terms of their listing.
  2. Verify that dimmers used for fan speed control are listed for that application.
  3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.
- H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.
- I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.
- 3.02 GFCI RECEPTACLES
- A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.
- 3.03 IDENTIFICATION
- A. Comply with Section 260553 "Identification for Electrical Systems."

END OF SECTION

SECTION 26 28 16

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. Molded-case circuit breakers (MCCBs).
4. Enclosures.

1.02 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.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
4. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.

1.04 QUALITY ASSURANCE

- A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- 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.



1.05 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
  - 1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
  - 2. Altitude: Not exceeding 6600 feet.
  
- B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
  - 1. Notify Owner no fewer than seven days in advance of proposed interruption of electric service.
  - 2. Indicate method of providing temporary electric service.
  - 3. Do not proceed with interruption of electric service without Owner's written permission.
  - 4. Comply with NFPA 70E.

1.06 COORDINATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.01 FUSIBLE SWITCHES

- A. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:
  - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  - 3. Siemens Energy & Automation, Inc.
  - 4. Square D; a brand of Schneider Electric.
  
- B. Type HD, Heavy Duty, Six Pole, Single Throw, 240-V ac, 200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate [indicated] fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
  
- C. Accessories: Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.

## 2.02 NONFUSIBLE SWITCHES

- A. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:
1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  3. Siemens Energy & Automation, Inc.
  4. Square D; a brand of Schneider Electric.
- B. 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.
- C. Accessories: Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.

## 2.03 MOLDED-CASE CIRCUIT BREAKERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:
1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  3. Siemens Energy & Automation, Inc.
  4. Square D; a brand of Schneider Electric.
- B. 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. Features and Accessories: Standard frame sizes, trip ratings, and number of poles.

## 2.04 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.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 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.

3.03 IDENTIFICATION

- A. Comply with requirements in Section 260553 "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.

3.04 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

END OF SECTION

SECTION 26 32 13 ENGINE GENERATORS

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes packaged engine-generator sets for emergency power supply with the following features:
  - 1. Natural Gas engine.
  - 2. Unit-mounted cooling system.
  - 3. Remote-mounting control and monitoring.
  - 4. Outdoor enclosure.
- B. Related Sections include the following:
  - 1. Section 26 36 00 "Transfer Switches" for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine-generator sets.

1.02 RELATED DOCUMENTS

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

1.03 DEFINITIONS

- A. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.
- B. LP: Liquid petroleum.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of packaged engine generator indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. In addition, include the following:
  - 1. Thermal damage curve for generator.
  - 2. Time-current characteristic curves for generator protective device.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 1. Dimensioned outline plan and elevation drawings of engine-generator set and other components specified.

2. Design Calculations: Signed and sealed by a qualified professional engineer. Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
3. Vibration Isolation Base Details: Signed and sealed by a qualified professional engineer. Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include base weights.
4. Wiring Diagrams: Power, signal, and control wiring.

#### 1.05 INFORMATIONAL SUBMITTALS

- A. Field quality-control test reports.
- B. Warranty: Special warranty specified in this Section.

#### 1.06 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For packaged engine generators to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:
  1. List of tools and replacement items recommended to be stored at Project for ready access. Include part and drawing numbers, current unit prices, and source of supply.

#### 1.07 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
  1. Maintenance Proximity: Not more than four hours' normal travel time from Installer's place of business to Project site.
  2. Engineering Responsibility: Preparation of data for vibration isolators and seismic restraints of engine skid mounts, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
- B. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 200 miles of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.
- C. Source Limitations: Obtain packaged generator sets and auxiliary components through one source from a single manufacturer.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- E. Comply with ASME B15.1.
- F. Comply with NFPA 37.
- G. Comply with NFPA 70.

- H. Comply with NFPA 110 requirements for Level 1 emergency power supply system.
- I. Comply with UL 2200.
- J. Engine Exhaust Emissions: Comply with applicable state and local government requirements.
- K. Noise Emission: Comply with applicable state and local government requirements for maximum noise level at adjacent property boundaries due to sound emitted by generator set including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.

#### 1.08 PROJECT CONDITIONS

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
  - 1. Notify Owner no fewer than two days in advance of proposed interruption of electrical service.
  - 2. Do not proceed with interruption of electrical service without Owner's written permission.
- B. Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:
  - 1. Ambient Temperature: 5 to 40 deg C.
  - 2. Relative Humidity: 0 to 95 percent.
  - 3. Altitude: Sea level to 1000 feet.

#### 1.09 COORDINATION

- A. Coordinate size and location of concrete bases for package engine generators. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

#### 1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: Five years from date of Final Completion.

## PART 2 - PRODUCTS

## 2.01 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide a comparable product by one of the following:
1. Caterpillar; Engine Div.
  2. Generac Power Systems, Inc.
  3. Kohler Co.; Generator Division.
  4. Onan / Cummins Power Generation; Industrial Business Group.

## 2.02 ENGINE-GENERATOR SET

- A. Factory-assembled and -tested, engine-generator set.
- B. Mounting Frame: Maintain alignment of mounted components without depending on concrete foundation; and have lifting attachments.
1. Rigging Diagram: Inscribed on metal plate permanently attached to mounting frame to indicate location and lifting capacity of each lifting attachment and generator-set center of gravity.
- C. Capacities and Characteristics:
1. Power Output Ratings: Nominal ratings as indicated.
  2. Output Connections: Three-phase, four wire.
  3. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component.
- D. Generator-Set Performance:
1. Steady-State Voltage Operational Bandwidth: 3 percent of rated output voltage from no load to full load.
  2. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within three seconds.
  3. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
  4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
  5. Transient Frequency Performance: Less than 5 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within five seconds.
  6. Output Waveform: At no load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for single harmonics. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.

7. Sustained Short-Circuit Current: For a 3-phase, bolted short circuit at system output terminals, system shall supply a minimum of 250 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to generator system components.
8. Start Time: Comply with NFPA 110, Type 10, system requirements.

## 2.03 ENGINE

- A. Fuel: Natural gas.
- B. Rated Engine Speed: 1800 rpm.
- C. Maximum Piston Speed for Four-Cycle Engines: 2250 fpm .
- D. Lubrication System: The following items are mounted on engine or skid:
  1. Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.
  2. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.
  3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.
- E. Engine Fuel System:
  1. Dual Natural Gas with LP-Gas Backup (Vapor-Withdrawal) System:
    - a. Carburetor.
    - b. Secondary Gas Regulators: One for each fuel type.
    - c. Fuel-Shutoff Solenoid Valves: One for each fuel source.
    - d. Flexible Fuel Connectors: One for each fuel source.
- F. Coolant Jacket Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment for heater capacity.
- G. Governor: Mechanical.
- H. Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine-generator-set mounting frame and integral engine-driven coolant pump.
  1. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
  2. Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
  3. Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed-loop coolant system pressure for engine used. Equip with gage glass and petcock.
  4. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.



5. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, ultraviolet-, and abrasion-resistant fabric.
  - a. Rating: 50-psig maximum working pressure with coolant at 180 deg F., and noncollapsible under vacuum.
  - b. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.
  
- I. Muffler/Silencer: Critical type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.
  1. Minimum sound attenuation of 25 dB at 500 Hz.
  2. Sound level measured at a distance of 10 feet from exhaust discharge after installation is complete shall be 85 dBA or less.
  
- J. Air-Intake Filter: Standard-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.
  
- K. Starting System: 12-V electric, with negative ground.
  1. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in Part 1 "Project Conditions" Article.
  2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
  3. Cranking Cycle: As required by NFPA 110 for system level specified.
  4. Battery: Adequate capacity within ambient temperature range specified in Part 1 "Project Conditions" Article to provide specified cranking cycle at least twice without recharging.
  5. Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
  6. Battery Compartment: Factory fabricated of metal with acid-resistant finish and thermal insulation. Thermostatically controlled heater shall be arranged to maintain battery above 10 deg C regardless of external ambient temperature within range specified in Part 1 "Project Conditions" Article. Include accessories required to support and fasten batteries in place.
  7. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35-A minimum continuous rating.
  8. Battery Charger: Current-limiting, automatic-equalizing and float-charging type. Unit shall comply with UL 1236 and include the following features:
    - a. Operation: Equalizing-charging rate of 10 A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
    - b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40 deg C to plus 60 deg C to prevent overcharging at high temperatures and undercharging at low temperatures.
    - c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.

- d. Ammeter and Voltmeter: Flush mounted in door. Meters shall indicate charging rates.
- e. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.

## 2.04 CONTROL AND MONITORING

- A. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of generator set. When mode-selector switch is switched to the on position, generator set starts. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of a remote emergency-stop switch also shuts down generator set.
- B. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common wall-mounted control and monitoring panel.
- C. Indicating and Protective Devices and Controls: As required by NFPA 110 for Level 1 system, and the following:
  - 1. AC voltmeter.
  - 2. AC ammeter.
  - 3. AC frequency meter.
  - 4. DC voltmeter (alternator battery charging).
  - 5. Engine-coolant temperature gage.
  - 6. Engine lubricating-oil pressure gage.
  - 7. Running-time meter.
  - 8. Ammeter-voltmeter, phase-selector switch(es).
  - 9. Generator-voltage adjusting rheostat.
- D. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator, unless otherwise indicated.
- E. Remote Alarm Annunciator: Comply with NFPA 99. An LED labeled with proper alarm conditions shall identify each alarm event and a common audible signal shall sound for each alarm condition. Silencing switch in face of panel shall silence signal without altering visual indication. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset. Cabinet and faceplate are surface- or flush-mounting type to suit mounting conditions indicated.
- F. Remote Emergency-Stop Switch: Flush; wall mounted, unless otherwise indicated; and labeled. Push button shall be protected from accidental operation.

## 2.05 GENERATOR OVERCURRENT AND FAULT PROTECTION

- A. Generator Circuit Breaker: Molded-case, thermal-magnetic type; 100 percent rated; complying with NEMA AB 1 and UL 489.
  - 1. Tripping Characteristic: Designed specifically for generator protection.
  - 2. Trip Rating: Matched to generator rating.

3. Shunt Trip: Connected to trip breaker when generator set is shut down by other protective devices.
  4. Mounting: Adjacent to or integrated with control and monitoring panel.
- B. Ground-Fault Indication: Comply with NFPA 70, "Emergency System" signals for ground-fault. Integrate ground-fault alarm indication with other generator-set alarm indications.
- 2.06 GENERATOR, EXCITER, AND VOLTAGE REGULATOR
- A. Comply with NEMA MG 1.
  - B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.
  - C. Electrical Insulation: Class H or Class F.
  - D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.
  - E. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.
  - F. Enclosure: Drip-proof.
  - G. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified.
    1. Adjusting rheostat on control and monitoring panel shall provide plus or minus 5 percent adjustment of output-voltage operating band.

2.07 OUTDOOR GENERATOR-SET ENCLOSURE

- A. Description: Vandal-resistant, weatherproof steel housing, wind resistant up to 100 mph. Multiple panels shall be lockable and provide adequate access to components requiring maintenance. Panels shall be removable by one person without tools. Instruments and control shall be mounted within enclosure.
- B. Description: Prefabricated or pre-engineered walk-in enclosure with the following features:
  1. Construction: Galvanized-steel, metal-clad, integral structural-steel-framed building erected on concrete foundation.
  2. Structural Design and Anchorage: Comply with ASCE 7 for wind loads.
  3. Space Heater: Thermostatically controlled and sized to prevent condensation.
  4. Louvers: Equipped with bird screen and filter arranged to permit air circulation when engine is not running while excluding exterior dust, birds, and rodents.
  5. Hinged Doors: With padlocking provisions.
  6. Ventilation: Louvers equipped with bird screen and filter arranged to permit air circulation while excluding exterior dust, birds, and rodents.

7. Thermal Insulation: Manufacturer's standard materials and thickness selected in coordination with space heater to maintain winter interior temperature within operating limits required by engine-generator-set components.
  8. Muffler Location: Within enclosure.
- C. Engine Cooling Airflow through Enclosure: Maintain temperature rise of system components within required limits when unit operates at 110 percent of rated load for 2 hours with ambient temperature at top of range specified in system service conditions.
1. Louvers: Fixed-engine, cooling-air inlet and discharge. Storm-proof and drainable louvers prevent entry of rain and snow.
  2. Automatic Dampers: At engine cooling-air inlet and discharge. Dampers shall be closed to reduce enclosure heat loss in cold weather when unit is not operating.
- D. Interior Lights with Switch: Factory-wired, vaporproof-type fixtures within housing; arranged to illuminate controls and accessible interior. Arrange for external electrical connection.
1. AC lighting system and connection point for operation when remote source is available.
  2. DC lighting system for operation when remote source and generator are both unavailable.
- E. Convenience Outlets: Factory wired. Arrange for external electrical connection.

## 2.08 VIBRATION ISOLATION DEVICES

- A. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint.
1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to wind loads or if weight is removed; factory-drilled baseplate bonded to 1/4-inch- thick, elastomeric isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
  2. Outside Spring Diameter: Not less than 80 percent of compressed height of the spring at rated load.
  3. Minimum Additional Travel: 50 percent of required deflection at rated load.
  4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
  5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

## 2.09 FINISHES

- A. Indoor and Outdoor Enclosures and Components: Manufacturer's standard finish over corrosion-resistant pretreatment and compatible primer.

**PART 3 - EXECUTION****3.01 EXAMINATION**

- A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine-generator performance.
- B. Examine roughing-in of piping systems and electrical connections. Verify actual locations of connections before packaged engine-generator installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

**3.02 INSTALLATION**

- A. Comply with packaged engine-generator manufacturers' written installation and alignment instructions and with NFPA 110.
- B. Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.
- C. Install packaged engine generator with restrained spring isolators having a minimum deflection of 1 inch on 4-inch- high concrete base. Secure sets to anchor bolts installed in concrete bases.
- D. Install Schedule 40, black steel piping with welded joints and connect to engine muffler. Install thimble at wall. Piping shall be same diameter as muffler outlet.
  - 1. Install condensate drain piping to muffler drain outlet full size of drain connection with a shutoff valve, stainless-steel flexible connector, and Schedule 40, black steel pipe with welded joints.
- E. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

**3.03 CONNECTIONS**

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping and specialties.
- B. Connect fuel, cooling-system, and exhaust-system piping adjacent to packaged engine generator to allow service and maintenance.
- C. Connect cooling-system water piping to engine-generator set and heat exchanger with flexible connectors.
- D. Connect engine exhaust pipe to engine with flexible connector.
- E. Connect fuel piping to engines with a gate valve and union and flexible connector.
  - 1. Natural-gas piping, valves, and specialties for gas distribution are specified in Section 23 11 23 "Facility Natural-Gas Piping."

- F. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."
- G. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

### 3.04 IDENTIFICATION

- A. Identify system components according to Section 23 05 53 "Identification for HVAC Piping and Equipment" and Section 26 05 53 "Identification for Electrical Systems."

### 3.05 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
- B. Tests and Inspections:
  1. Perform tests recommended by manufacturer and each electrical test and visual and mechanical inspection for "AC Generators and for Emergency Systems" specified in NETA Acceptance Testing Specification. Certify compliance with test parameters.
  2. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here including, but not limited to, single-step full-load pickup test.
  3. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.
    - a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
    - b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
    - c. Verify acceptance of charge for each element of the battery after discharge.
    - d. Verify that measurements are within manufacturer's specifications.
  4. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
  5. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine-generator system before and during system operation. Check for air, exhaust, and fluid leaks.
  6. Exhaust-System Back-Pressure Test: Use a manometer with a scale exceeding 40-inch wg . Connect to exhaust line close to engine exhaust manifold. Verify that back pressure at full-rated load is within manufacturer's written allowable limits for the engine.
  7. Exhaust Emissions Test: Comply with applicable government test criteria.
  8. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases, and verify that performance is as specified.

9. Harmonic-Content Tests: Measure harmonic content of output voltage under 25 percent and at 100 percent of rated linear load. Verify that harmonic content is within specified limits.
  10. Noise Level Tests: Measure A-weighted level of noise emanating from generator-set installation, including engine exhaust and cooling-air intake and discharge, at four locations on the property line, and compare measured levels with required values.
- C. Coordinate tests with tests for transfer switches and run them concurrently.
  - D. Test instruments shall have been calibrated within the last 12 months, traceable to standards of NIST, and adequate for making positive observation of test results. Make calibration records available for examination on request.
  - E. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - F. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  - G. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
  - H. Remove and replace malfunctioning units and retest as specified above.
  - I. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.
  - J. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.
  - K. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each power wiring termination and each bus connection. Remove all access panels so terminations and connections are accessible to portable scanner.
    1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan 11 months after date of Substantial Completion.
    2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
    3. Record of Infrared Scanning: Prepare a certified report that identifies terminations and connections checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.06 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators. Refer to Section 01 79 00 "Demonstration and Training."

END OF SECTION



## SECTION 26 36 00

## TRANSFER SWITCHES

## PART 1 - GENERAL

## 1.01 SUMMARY

A. Section includes transfer switches rated 600 V and less, including the following:

1. Automatic transfer switches.
2. Remote annunciation systems.

## 1.02 RELATED DOCUMENTS

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

## 1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, weights, operating characteristics, furnished specialties, and accessories.

## 1.04 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

## 1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:

1. Features and operating sequences, both automatic and manual.
2. List of all factory settings of relays; provide relay-setting and calibration instructions, including software, where applicable.

## 1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Maintain a service center capable of providing training, parts, and emergency maintenance repairs within a response period of less than eight hours from time of notification.

B. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

- C. Source Limitations: Obtain automatic transfer switches and remote annunciators through one source from a single manufacturer.
- 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.
- E. Comply with NEMA ICS 1.
- F. Comply with NFPA 70.
- G. Comply with NFPA 99.
- H. Comply with NFPA 110.
- I. Comply with UL 1008 unless requirements of these Specifications are stricter.

#### 1.07 FIELD CONDITIONS

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service:
  - 1. Do not proceed with interruption of electrical service without Owner's written permission.

#### 1.08 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Section 033000 "Cast-in-Place Concrete."

### PART 2 - PRODUCTS

#### 2.01 MANUFACTURED UNITS

- A. Contactor Transfer Switches:
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:
    - a. Caterpillar; Engine Div.
    - b. Generac Power Systems, Inc.
    - c. GE Zenith Controls.
    - d. Kohler Power Systems; Generator Division.
    - e. Onan/Cummins Power Generation; Industrial Business Group.

**2.02 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS**

- A. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.
- B. Tested Fault-Current Closing and Withstand Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.
  - 1. Where transfer switch includes internal fault-current protection, rating of switch and trip unit combination shall exceed indicated fault-current value at installation location.
- C. Solid-State Controls: Repetitive accuracy of all settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.
- D. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.
- E. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism, mechanically and electrically interlocked in both directions.
- F. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
  - 1. Limitation: Switches using molded-case switches or circuit breakers or insulated-case circuit-breaker components are not acceptable.
  - 2. Switch Action: Double throw; mechanically held in both directions.
  - 3. Contacts: Silver composition or silver alloy for load-current switching. Conventional automatic transfer-switch units, rated 225 A and higher, shall have separate arcing contacts.
- G. Battery Charger: For generator starting batteries.
  - 1. Float type.
  - 2. Ammeter to display charging current.
  - 3. Fused ac inputs and dc outputs.
- H. Annunciation, Control, and Programming Interface Components: Devices at transfer switches for communicating with remote programming devices, annunciators, or annunciator and control panels shall have communication capability matched with remote device.
- I. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, either by color-code or by numbered or lettered wire and cable tape markers at terminations. Color-coding and wire and cable tape markers are specified in Section 260553 "Identification for Electrical Systems."
  - 1. Designated Terminals: Pressure type, suitable for types and sizes of field wiring indicated.

2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
  3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.
- J. Enclosures: General-purpose NEMA 250, Type 3R, complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

## 2.03 AUTOMATIC TRANSFER SWITCHES

- A. Comply with Level 1 equipment according to NFPA 110.
- B. Switching Arrangement: Double-throw type, incapable of pauses or intermediate position stops during normal functioning, unless otherwise indicated.
- C. Manual Switch Operation: Under load, with door closed and with either or both sources energized. Transfer time is same as for electrical operation. Control circuit automatically disconnects from electrical operator during manual operation.
- D. Automatic Transfer-Switch Features:
  1. Undervoltage Sensing for Each Phase of Normal Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage is adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.
  2. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals. Adjustable from zero to six seconds, and factory set for one second.
  3. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.
  4. Time Delay for Retransfer to Normal Source: Adjustable from 0 to 30 minutes, and factory set for 10 minutes to automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
  5. Test Switch: Simulate normal-source failure.
  6. Switch-Position Pilot Lights: Indicate source to which load is connected.
  7. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.
    - a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
    - b. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."
  8. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.
  9. Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.
  10. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32-V dc minimum.
  11. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.

12. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods are adjustable from 10 to 30 minutes. Factory settings are for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:
- a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
  - b. Push-button programming control with digital display of settings.
  - c. Integral battery operation of time switch when normal control power is not available.

#### 2.04 REMOTE ANNUNCIATOR SYSTEM

- A. Functional Description: Remote annunciator panel shall annunciate conditions for indicated transfer switches. Annunciation shall include the following:
1. Sources available, as defined by actual pickup and dropout settings of transfer-switch controls.
  2. Switch position.
- B. Annunciator Panel: LED-lamp type with audible signal and silencing switch.
1. Indicating Lights: Grouped for each transfer switch monitored.
  2. Label each group, indicating transfer switch it monitors, location of switch, and identity of load it serves.
  3. Mounting: Flush, modular, steel cabinet, unless otherwise indicated.
  4. Lamp Test: Push-to-test or lamp-test switch on front panel.

#### 2.05 SOURCE QUALITY CONTROL

- A. Factory test and inspect components, assembled switches, and associated equipment. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

### PART 3 - EXECUTION

#### 3.01 INSTALLATION

- A. Floor-Mounting Switch: Anchor to floor by bolting.
1. Concrete Bases: 4 inches high, reinforced, with chamfered edges. Extend base no more than 4 inches in all directions beyond the maximum dimensions of switch, unless otherwise indicated or unless required for seismic support. Construct concrete bases according to Section 260529 "Hangers and Supports for Electrical Systems."
- B. Annunciator and Control Panel Mounting: Flush in wall, unless otherwise indicated.

- C. Identify components according to Section 26 05 53 "Identification for Electrical Systems."
- D. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

### 3.02 CONNECTIONS

- A. Wiring to Remote Components: Match type and number of cables and conductors to control and communication requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.
- B. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."
- C. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

### 3.03 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Testing Agency's Tests and Inspections:
  1. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.
  2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
  3. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.
    - a. Check for electrical continuity of circuits and for short circuits.
    - b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
    - c. Verify that manual transfer warnings are properly placed.
    - d. Perform manual transfer operation.
  4. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.
    - a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
    - b. Simulate loss of phase-to-ground voltage for each phase of normal source.
    - c. Verify time-delay settings.
    - d. Verify pickup and dropout voltages by data readout or inspection of control settings.
    - e. Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for 1 pole deviating by more than 50 percent from other poles.
    - f. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.

- 5. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.
  - a. Verify grounding connections and locations and ratings of sensors.
- C. Coordinate tests with tests of generator and run them concurrently.
- D. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.
- E. Remove and replace malfunctioning units and retest as specified above.
- F. Prepare test and inspection reports.
- G. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switch. Remove all access panels so joints and connections are accessible to portable scanner.
  - 1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switch 11 months after date of Substantial Completion.
  - 2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
  - 3. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.04 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment as specified below. Refer to Section 01 79 00 "Demonstration and Training."
- B. Coordinate this training with that for generator equipment.

END OF SECTION

SECTION 26 51 00

INTERIOR LIGHTING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Interior lighting fixtures, lamps, and ballasts.
2. Exit signs.
3. Lighting fixture supports.

B. Related Sections:

1. Section 26 27 26 "Wiring Devices" for manual wall-box dimmers for incandescent lamps.

1.02 RELATED DOCUMENTS

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

1.03 DEFINITIONS

- A. BF: Ballast factor.
- B. CCT: Correlated color temperature.
- C. CRI: Color-rendering index.
- D. HID: High-intensity discharge.
- E. Lumen: Measured output of lamp and luminaire, or both.
- F. Luminaire: Complete lighting fixture, including ballast housing if provided.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
1. Physical description of lighting fixture including dimensions.
  2. Ballast, including BF.
  3. Energy-efficiency data.
  4. Life, output (lumens, CCT, and CRI), and energy-efficiency data for lamps.



5. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.
  - a. Testing Agency Certified Data: For indicated fixtures, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining fixtures shall be certified by manufacturer.
  - b. Manufacturer Certified Data: Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

#### 1.05 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.
- C. FM Global Compliance: Lighting fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

#### 1.06 COORDINATION

- A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

### PART 2 - PRODUCTS

#### 2.01 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products indicated on Drawings.

#### 2.02 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 minimum unless otherwise indicated.
  - b. UV stabilized.
2. Glass: Annealed crystal glass unless otherwise indicated.

## F. 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. "USE ONLY" and include specific lamp type.
  - b. Lamp diameter code (T-4, T-5, T-8, T-12, etc.), tube configuration (twin, quad, triple, etc.), base type, and nominal wattage for fluorescent and 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, etc.) for fluorescent and compact fluorescent luminaires.
  - e. ANSI ballast type (M98, M57, etc.) for HID luminaires.
  - f. CCT and CRI for all luminaires.

## 2.03 BALLASTS FOR LINEAR FLUORESCENT LAMPS

## A. General Requirements for Electronic Ballasts:

1. Comply with UL 935 and with ANSI C82.11.
2. Designed for type and quantity of lamps served.
3. Ballasts shall be designed for full light output unless another BF, dimmer, or bi-level control is indicated.
4. Sound Rating: Class A.
5. Total Harmonic Distortion Rating: Less than 10 percent.
6. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
7. Operating Frequency: 42 kHz or higher.
8. Lamp Current Crest Factor: 1.7 or less.
9. BF: 0.88 or higher.
10. Power Factor: 0.95 or higher.
11. Parallel Lamp Circuits: Multiple lamp ballasts shall comply with ANSI C82.11 and shall be connected to maintain full light output on surviving lamps if one or more lamps fail.

## B. Electronic Programmed-Start Ballasts for T8 Lamps: Comply with ANSI C82.11 and the following:

1. Lamp end-of-life detection and shutdown circuit for T5 diameter lamps.
2. Automatic lamp starting after lamp replacement.

## 2.04 BALLASTS FOR HID LAMPS

- A. High-Pressure Sodium Ballasts: Electromagnetic type, with solid-state igniter/starter. Igniter/starter shall have an average life in pulsing mode of 10,000 hours at an igniter/starter-case temperature of 90 deg C.

1. Minimum Starting Temperature: Minus 40 deg F.

## 2.05 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. Internally Lighted Signs:

1. Lamps for AC Operation: Fluorescent, two for each fixture, 20,000 hours of rated lamp life.
2. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.
3. 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.

## 2.06 FLUORESCENT LAMPS

- A. T8 rapid-start lamps, rated 32 W maximum, nominal length of 48 inches, 2800 initial lumens (minimum), CRI 75 (minimum), color temperature 3500 K, and average rated life 20,000 hours unless otherwise indicated.

## 2.07 HID LAMPS

- A. High-Pressure Sodium Lamps: ANSI C78.42, CRI 21 (minimum), color temperature 1900 K, and average rated life of 24,000 hours, minimum.

1. Dual-Arc Tube Lamps: Arranged so only one of two arc tubes is lighted at one time and, when power is restored after an outage, the cooler arc tube, with lower internal pressure, lights instantly, providing an immediate 8 to 15 percent of normal light output.

- B. Pulse-Start, Metal-Halide Lamps: Minimum CRI 65, and color temperature 4000 K.

## 2.08 LIGHTING FIXTURE SUPPORT COMPONENTS

- A. Comply with Section 260529 "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.
- C. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Lighting fixtures:
  - 1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
  - 2. Install lamps in each luminaire.
- B. Temporary Lighting: If it is necessary, and approved by Architect, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.
- C. Remote Mounting of Ballasts: Distance between the ballast and fixture shall not exceed that recommended by ballast manufacturer. Verify, with ballast manufacturers, maximum distance between ballast and luminaire.
- D. Lay-in Ceiling Lighting Fixtures Supports: Use grid as a support element.
  - 1. Install ceiling support system rods or wires, independent of the ceiling suspension devices, for each fixture. Locate not more than 6 inches from lighting fixture corners.
  - 2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
  - 3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
- E. Suspended Lighting Fixture Support:
  - 1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
  - 2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
  - 3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
  - 4. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.
- F. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

3.02 IDENTIFICATION

- A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

END OF SECTION

SECTION 28 05 13 CONDUCTORS AND CABLES FOR ELECTRONIC  
SAFETY AND SECURITY

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
  - 1. Fire alarm wire and cable.
  - 2. Identification products.

1.02 RELATED DOCUMENTS

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

1.03 DEFINITIONS

- A. BICSI: Building Industry Consulting Service International.
- B. EMI: Electromagnetic interference.
- C. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.

1.04 ACTION SUBMITTALS

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

1.05 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An NRTL.
  - 1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Test cables upon receipt at Project site.

1.07 FIELD CONDITIONS

- A. Do not install conductors and cables that are wet, moisture damaged, or mold damaged.
  - 1. Indications that wire and cables are wet or moisture damaged include, but are not limited to, discoloration and sagging of factory packing materials.

- B. Environmental Limitations: Do not deliver or install UTP, optical fiber, and coaxial cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

## PART 2 - PRODUCTS

### 2.01 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame-Spread Index: 25 or less.
  - 2. Smoke-Developed Index: 50 or less.
- 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.

### 2.02 FIRE ALARM WIRE AND CABLE

- A. Manufacturer: 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. West Penn Wire.
  - 2. Belden.
  - 3. Alphawire.
- B. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.
- C. Signaling Line Circuits: Twisted, shielded pair, size as recommended by system manufacturer.
  - 1. Circuit Integrity Cable: Twisted shielded pair, NFPA 70, Article 760, Classification CI, for power-limited fire alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a 2-hour rating.

### 2.03 IDENTIFICATION PRODUCTS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:
  - 1. Brady Worldwide, Inc.
  - 2. Panduit Corp.
- B. Comply with UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

- C. Comply with requirements in Section 26 05 53 "Identification for Electrical Systems."

### PART 3 - EXECUTION

#### 3.01 INSTALLATION OF HANGERS AND SUPPORTS

- A. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for installation of supports for cables.

#### 3.02 WIRING METHOD

- A. Install wiring in metal pathways and wireways.
1. Minimum conduit size shall be 3/4 inch. Control and data transmission wiring shall not share conduit with other building wiring systems.
  2. Comply with requirements in Section 28 05 28 "Pathways for Electronic Safety and Security."

#### 3.03 INSTALLATION OF CONDUCTORS AND CABLES

- A. Comply with NECA 1.
- B. Conductors: Size according to system manufacturer's written instructions unless otherwise indicated.
- C. General Requirements for Cabling:
1. Comply with TIA/EIA-568-B.1.
  2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
  3. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
  4. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
  5. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
  6. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
  7. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
  8. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.



## D. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA-569-B recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
  - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
  - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
  - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.
3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
  - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
  - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
  - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.
4. Separation between cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
  - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
  - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
  - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.
5. Separation between Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches .
6. Separation between Cables and Fluorescent Fixtures: A minimum of 5 inches.

## 3.04 FIRE ALARM WIRING INSTALLATION

- A. Comply with NECA 1 and NFPA 72.
- B. Wiring Method: Install wiring in metal raceway according to Section 26 05 33 "Raceways and Boxes for Electrical Systems."
  1. Install plenum cable in environmental air spaces, including plenum ceilings.
  2. Fire alarm circuits and equipment control wiring associated with the fire alarm system shall be installed in a dedicated raceway system. This system shall not be used for any other wire or cable.
- C. Wiring Method:
  1. Cables and raceways used for fire alarm circuits, and equipment control wiring associated with the fire alarm system, may not contain any other wire or cable.
  2. Signaling Line Circuits: Power-limited fire alarm cables may be installed in the same cable or raceway as signaling line circuits.

- D. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
- E. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.
- F. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and another for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.
- G. Risers: Install at least two vertical cable risers to serve the fire alarm system. Separate risers in close proximity to each other with a minimum one-hour-rated wall, so the loss of one riser does not prevent the receipt or transmission of signals from other floors or zones.
- H. Wiring to Remote Alarm Transmitting Device: 1-inch conduit between the fire alarm control panel and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

### 3.05 POWER AND CONTROL-CIRCUIT CONDUCTORS

- A. 120-V Power Wiring: Install according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables" unless otherwise indicated.
- B. Minimum Conductor Sizes:
  1. Class 1 remote-control and signal circuits, No. 14 AWG.
  2. Class 2 low-energy, remote-control and signal circuits, No. 16 AWG.
  3. Class 3 low-energy, remote-control, alarm and signal circuits, No. 12 AWG.

### 3.06 CONNECTIONS

- A. Comply with requirements in Section 28 31 11 "Digital, Addressable Fire-Alarm System for connecting, terminating, and identifying wires and cables.

### 3.07 FIRESTOPPING

- A. Comply with requirements in Section 07 84 00 "Firestopping."
- B. Comply with TIA-569-B, "Firestopping" Annex A.
- C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.08 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

END OF SECTION

SECTION 28 05 28 PATHWAYS FOR ELECTRONIC  
SAFETY AND SECURITY

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Nonmetallic conduits, tubing, and fittings.

B. Related Requirements:

1. Section 26 05 33 "Raceways and Boxes for Electrical Systems" for conduits, wireways, surface raceways, boxes, enclosures, cabinets, handholes, and faceplate adapters serving electrical systems.
2. Section 26 05 43 "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.

1.02 RELATED DOCUMENTS

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

1.03 DEFINITIONS

- A. GRC: Galvanized rigid steel conduit.
- B. IMC: Intermediate metal conduit.

1.04 ACTION SUBMITTALS

- A. Product Data: For surface pathways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

PART 2 - PRODUCTS

2.01 METAL CONDUITS, TUBING, AND FITTINGS

- 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. Allied Tube & Conduit.
  2. Republic Conduit.
  3. Thomas & Betts Corporation.
  4. Western Tube and Conduit Corporation.

- B. General Requirements for Metal Conduits and Fittings:
  - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  - 2. Comply with TIA-569-B.
- C. GRC: Comply with ANSI C80.1 and UL 6.
- D. EMT: Comply with ANSI C80.3 and UL 797.
- E. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
  - 1. Fittings for EMT:
    - a. Material: Steel.
    - b. Type: Compression.
  - 2. Expansion Fittings: PVC or steel to match conduit type, complying with UL 467, rated for environmental conditions where installed, and including flexible external bonding jumper.
- F. 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.

## 2.02 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

- 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. Lamson & Sessions.
  - 2. Thomas & Betts Corporation.
  - 3. JM Eagle
- B. General Requirements for Nonmetallic Conduits and Fittings:
  - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  - 2. Comply with TIA-569-B.
- C. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. Solvent cements and adhesive primers 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."

## PART 3 - EXECUTION

## 3.01 PATHWAY APPLICATION

- A. Indoors: Apply pathway products as specified below unless otherwise indicated:
1. Exposed, Not Subject to Physical Damage: EMT.
  2. Exposed and Subject to Severe Physical Damage: GRC. Pathway locations include the following:
    - a. Vehicle Service Areas.
  3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
  4. Damp or Wet Locations: GRC.
- B. Minimum Pathway Size: 1/2-inch trade size. Minimum size for optical-fiber cables is 1 inch.
- C. Pathway Fittings: Compatible with pathways and suitable for use and location.
1. Rigid Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
  2. EMT: Use compression, steel fittings. Comply with NEMA FB 2.10.
  3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- D. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- E. Install surface pathways only where indicated on Drawings.
- F. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

## 3.02 INSTALLATION

- A. Comply with NECA 1, NECA 101, and TIA-569-B for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum pathways. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.
- B. Keep pathways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.
- C. Complete pathway installation before starting conductor installation.
- D. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for hangers and supports.
- E. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications wiring conduits for which only two 90-degree bends are allowed. Support within 12 inches of changes in direction.

- G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- H. Support conduit within 12 inches of enclosures to which attached.
- I. Pathways 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. Secure pathways to reinforcement at maximum 10-foot intervals.
  2. Arrange pathways to cross building expansion joints at right angles with expansion fittings.
  3. Arrange pathways to keep a minimum of 1 inch of concrete cover in all directions.
  4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
- J. Stub-ups to Accessible Spaces:
1. Use EMT, IMC, or RMC for pathways.
  2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- K. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of pathway and fittings before making up joints. Follow compound manufacturer's written instructions.
- L. Coat field-cut threads on PVC-coated pathway with a corrosion-preventing conductive compound prior to assembly.
- M. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install insulated bushings on conduits terminated with locknuts.
- N. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- O. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to conduit assembly to assure a continuous ground path.
- P. Cut conduit perpendicular to the length. For conduits of 2-inch trade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.
- Q. Install pull wires in empty pathways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground pathways designated as spare above grade alongside pathways in use.
- R. Pathways for Optical-Fiber and Communications Cable: Install pathways, metal and nonmetallic, rigid and flexible, as follows:
1. 3/4-Inch Trade Size and Smaller: Install pathways in maximum lengths of 50 feet.

2. 1-Inch Trade Size and Larger: Install pathways in maximum lengths of 75 feet.
  3. Install with a maximum of two 90-degree bends or equivalent for each length of pathway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
- S. Install pathway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed pathways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install pathway sealing fittings according to NFPA 70.
- T. Install devices to seal pathway 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 pathways at the following points:
1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
  2. Where an underground service pathway enters a building or structure.
  3. Where otherwise required by NFPA 70.
- U. Comply with manufacturer's written instructions for solvent welding PVC conduit and fittings.
- V. Expansion-Joint Fittings:
1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F., and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.
  2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
    - a. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F. temperature change.
    - b. Attics: 135 deg F. temperature change.
  3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
  4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
  5. 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.
- W. Flexible Conduit Connections: Comply with NEMA RV 3.
- X. 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.



- Y. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surface to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
  - Z. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
  - AA. 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.
  - BB. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
  - CC. Set metal floor boxes level and flush with finished floor surface.
  - DD. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.
- 3.03 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRONIC SAFETY AND SECURITY PENETRATIONS
- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 28 05 44 "Sleeves and Sleeve Seals for Electronic Safety and Security Pathways and Cabling."
- 3.04 FIRESTOPPING
- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 07 84 00 "Firestopping."
- 3.05 PROTECTION
- A. Protect coatings, finishes, and cabinets from damage and deterioration.
    - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

END OF SECTION

SECTION 28 05 44

SLEEVES AND SLEEVE SEALS FOR ELECTRONIC SAFETY  
AND SECURITY PATHWAYS AND CABLING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Sleeves for pathway and cable penetration of non-fire-rated construction walls and floors.
2. Grout.

B. Related Requirements:

1. Section 07 84 00 "Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.02 RELATED DOCUMENTS

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

1.03 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.01 SLEEVES

- A. Wall Sleeves: Steel Pipe; ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends
- B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

2.02 GROUT

- A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

### PART 3 - EXECUTION

#### 3.01 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Comply with NECA 1.
- B. Comply with NEMA VE 2 for cable tray and cable penetrations.
- C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
  - 1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
    - a. Seal annular space between sleeve and pathway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
    - b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
  - 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
  - 3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and pathway or cable unless sleeve seal is to be installed.
  - 4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
  - 5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.
- D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
  - 1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
  - 2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.
- E. Roof-Penetration Sleeves: Seal penetration of individual pathways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

END OF SECTION

## SECTION 28 23 00

## SECURITY CCTV VIDEO SURVEILLANCE

## PART 1 - GENERAL

## 1.01 SUMMARY

- A. This document covers the installation of a CCTV surveillance system which will also be able to share video information with the MDOT state wide security system.
- B. The CCTV surveillance system security access system shall incorporate the following:
  - 1. CCTV Cameras
  - 2. Camera Mounts
  - 3. Power Supplies
  - 4. Communication System
  - 5. Digital Video Recorder
- C. The Contractor shall provide and pay for all labor, materials, equipment, tools, utilities, construction equipment and machinery, transportation and other facilities and services necessary for the proper execution, operation and completion of the Work.
- D. Specification Language: Specifications and notes are written in imperative and abbreviated form. Imperative language of the technical specifications is directed at the Contractor, unless specifically noted otherwise. Incomplete sentences shall be completed by inserting "shall", "shall be", "the Contractor shall", and similar mandatory phrases by inference. The words "shall be" shall be supplied by inference where a colon (:) is used within product specifications.
- E. Drawings And Specifications:
  - 1. Contractor shall carefully study the Drawings and Specifications, and shall at once report any error, unforeseen circumstances, inconsistency or omission he may discover.

## 1.02 PROJECT DEFINITIONS

- A. General Definitions:
  - 1. CCTV: Closed-Circuit Television.
  - 2. DPDT: Double pole double throw switch
  - 3. DVR: Digital Video Recorder
  - 4. I/O: Input/Output.
  - 5. LAN: Local Area Network.
  - 6. NC: Normally closed contacts
  - 7. NO: Normally open contacts
  - 8. PDF: (Portable Document Format.) The file format used by the Acrobat document exchange system software from Adobe.
  - 9. RS-485: TIA/EIA standard for multipoint communications.
  - 10. SPST: Single pole single throw switch
  - 11. TCP/IP: Transport Control Protocol/Internet Protocol incorporated into Microsoft Windows.
  - 12. TPZ: Tilt Pan Zoon

- 13. UPS: Uninterruptible Power Supply.
- 14. Windows: Operating system by Microsoft Corporation.

B. Definitions Contract Language:

- 1. Words that are in common use are used throughout the Drawings and Specifications except:
  - a. Words which have well-known technical or trade meanings are used in accordance with such recognized meanings.
  - b. Whenever the following listed words and phrases are used, they shall be mutually understood to have the following respective meanings:
    - 1) The words "as indicated." means: as shown on the Drawings, and in accordance with the Specifications.
    - 2) The words "as required." means: as required to provide a complete and satisfactory Work in full conformance with the Drawings and Specifications.
    - 3) The word "Provide" means: furnish, install, connect, test and make ready for use.
    - 4) The word "Work": The Work is the completed construction required by the Drawings and Specifications, and includes all labor necessary to produce such construction, and all materials and equipment incorporated or to be incorporated in such construction.
    - 5) The word "Furnish" means: supply item as specified. Item to be installed by others.
    - 6) Subcontractor is a person or entity who has a direct contract with the Contractor to perform any of the Work at the site.
    - 7) Project Record Drawings or Record Drawings are drawings that completely record and document all aspects and features of the Work. (Also known as "as-built" drawings.)

1.03 REFERENCES

- A. NFPA 70 – National Electrical Code
- B. UL 1449 – Surge Protective Devices

1.04 SYSTEM DESCRIPTION

- A. This project shall include the installation of CCTV cameras, camera mounts, power supplies, cabling, digital video recorder, and monitors that shall be compatible with the MDOT security standard.
- B. The CCTV Surveillance System shall be controlled from the District Security Center with video transfer capability over the MDOT WAN to the MDOT security center in Jackson.

1.05 SUBMITTALS

- A. Product Data: Submit nine (9) sets of three binders of manufactures supplied data. Each binder shall contain:
  - 1. Specification/cut sheets for equipment provided
  - 2. Design guides
  - 3. Installation and operating instructions

- B. Shop Drawings: Submit nine (9) copies of each submittal.
1. Diagrams of cable layout with system labeling schedule.
  2. Wiring diagrams.
- C. Field quality-control test report showing all cameras and digital video recorders / devices are installed / tested and are functioning correctly.
- D. Project Record Drawings:
1. The purpose of Project Record Drawings is to provide factual information regarding all aspects of the Work, to enable future service, modifications, and additions to the Work
  2. Project Record Drawings are an important element of this Work. Contractor shall accurately maintain Project Record Drawings throughout the course of this project.
  3. Project Record Drawings shall include documentation of all Work, including the camera locations, of setup perimeters, equipment, wiring, and cable runs.
  4. The contractor will be furnished with two (2) sets of site plans for Contractor's use in preparing Project Record Drawings. One set shall be used as a working set, the other shall be used to prepare the final record set.
  5. Project Record Drawings shall accurately show the physical placement of the following:
    - a. Cameras, power supplies, and digital video recorders.
    - b. Cable runs
    - c. Pull box locations.
    - d. Project Record Drawings shall show the physical placement of each camera and conduit to be accurate to within one foot (1') of the nearest landmark. Where the site plan conflicts with actual conditions, Contractor shall amend site plan as required. Indicate exact description of conduit runs and cable tray runs
    - e. Project Record Drawings shall show wire and cable runs, camera zone numbers, electrical panel/circuit breaker numbers from which equipment is powered, and splice points. Such information may be shown on the site plans.
    - f. Upon completion of Work, and prior to Final Acceptance, Contractor shall prepare and submit final record set of Project Record Drawings. This set shall reflect the installed work.
    - g. All final Project Record Drawings shall be provided to the MDOT or MDOT's representative.
  6. Closeout Submittals:
    - a. Provide a set Project Record Drawings to the Project Engineer including:
      - 1) Project Record Drawings
      - 2) Product Data
      - 3) Installation Manuals
      - 4) Operating Manuals
      - 5) Maintenance/Service Manuals

## 1.06 QUALITY ASSURANCE

## A. Contractor Minimum Qualifications:

1. Contractor shall be an installation and service contractor regularly engaged in the sale, installation, maintenance and service of CCTV Surveillance System.
2. Contractor shall have five (5) years experience with the installation, start-up and programming of systems of a similar size and complexity to the one proposed.

## B. Supervision of Work: Contractor shall employ a competent Foreman to be in responsible charge of the Work. The Foreman shall be on the project site daily during the execution of the Work. The Foreman shall be a regular employee, principle, or officer of the Contractor, who is thoroughly experienced in managing projects of a similar size and type. Contractor shall not use contract employees or Subcontractors as Foremen.

## C. Qualifications Of Technicians:

1. All electronic systems Work shall be performed by electronic technicians thoroughly trained in the installation and service of CCTV systems.
2. Journeyman Wireman electrical workers may be used to install conduit, raceways, wiring, and the like, provided that final termination, hook-up, programming, and testing is performed by a qualified electronic technician, and that all such Work is supervised by the Contractor's Foreman.
3. All incidental Work, such as cutting and patching, lock hardware installation, painting, carpentry, and the like, shall be accomplished by skilled crafts persons regularly engaged in such type of work. All such Work shall comply with the highest standards applicable to that respective industry or craft.
4. All 120 VAC power wiring and connections are to be performed by a qualified Journeyman Wireman, licensed to perform such Work.

## D. Subcontractors:

1. Use of any Subcontractor is subject to the approval of the MDOT or MDOT's representative and shall be identified at the time of Bid submittal.
2. The Contractor shall make no substitution for any Subcontractor previously selected without MDOT approval.
3. Contractor's Foreman shall be on the project site daily during all periods when Subcontractors are performing any of the Work. Contractor's Foreman shall be in responsible charge of all Work, including any Work being performed by Subcontractors.
4. By an appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the contractor by the terms of the Drawings and Specifications, and to assume toward the Contractor all the obligations and responsibilities which the Contractor, by these documents, assumes.

## E. Supervision And Construction Procedures:

1. The Contractor shall supervise and direct the Work, using his best skill and attention. Contractor is solely responsible for all construction means, methods, and techniques.
2. The Contractor shall employ a competent foreman who shall be in attendance at the project site during the progress of the Work. The foreman shall represent the Contractor and all communications given to the foreman shall be as binding as if given to the Contractor.

## F. Regulatory Requirements and Permits:

1. All Work shall conform to all applicable building, fire, and electrical codes and ordinances. In case of conflict between the Drawings/Specifications and codes, the codes shall govern. The Contractor shall inform the MDOT's representative of any such conflicts.
2. Contractor shall secure and pay for all licenses, permits, plan reviews, engineering certifications, and inspections required by regulatory agencies. Contractor shall prepare, at Contractor's expense, any documents, including drawings, that may be required by regulatory agencies.
3. The Contractor shall make application for and obtain any and all permits required by federal, state, county, city, or other authority having jurisdiction over the work.

## G. 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.

## H. Comply with NFPA 70, "National Electrical Code."

## 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Security of Contractor's Tools and Equipment: The MDOT or the MDOT's representative is not responsible for the care, storage or security of any of the Contractor's tools or equipment.

## 1.08 PROJECT/SITE CONDITIONS

## A. Environmental Conditions:

1. Dust Control: Make provisions to control all dust, dirt, and foreign material caused by the performance of the Work.
2. Notify MDOT or MDOT's representative immediately of any damage or possible damage to any other equipment.

## B. Clean-Up:

1. Contractor shall clean-up, on a daily basis as the Work progresses, all dirt, dust and debris caused by Contractor's operations. Clean-up shall be completed by the end of each workday.
2. In the event that Contractor fails to clean-up, the MDOT or MDOT's representative may elect to have cleanup performed by others, with the costs of such clean-up being charged to the Contractor.



## C. Construction Aids:

1. Definition: Construction Aids are facilities and equipment required by personnel to facilitate the execution of the Work. Construction Aids include scaffolds, staging, ladders, platforms, hoists, cranes, lifts, trenchers, core drillers, protective equipment, and other such facilities and equipment.
2. Contractor shall provide all Construction Aids required in the execution of the Work. Construction Aids that are the property of MDOT or other contractors shall not be used without permission.
3. Storage of Construction Aids shall be coordinated with MDOT or MDOT's representative.

## D. Safety:

1. The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work.
2. Contractor shall comply with all local, state, and federal regulations and laws for the safety of the work place.

## E. Accident Reports:

1. Serious or fatal accidents shall be reported immediately by telephone or radio to the MDOT or MDOT's representative.

## 1.09 SEQUENCING

A. Description: This implementation plan describes the general approach that shall be followed in order to minimize the time for the CCTV Surveillance System to be operational.

B. Approach: Contractor shall plan and schedule all work in such a sequence as to minimize the time before the system is operational. The following is a suggested work sequence:

1. Order all equipment needed and notify any subcontractors to schedule their participation.
2. Insure there are an adequate number of power receptacles available to operate all CCTV equipment and coordinate with MDOT or MDOT's representatives to where power is available.
3. Perform all system layout work.
4. Provide shop drawings to verify location of all equipment, conduit runs, power connections, etc. Submit shop drawings to MDOT or MDOT's representative.
5. Coordinate with MDOT or MDOT's representatives the access to the indicated camera location.
6. Prepare and pre-test all video equipment, set back light compensation to the greatest extent possible.
7. Install all equipment.
8. Test and inspect all systems.
9. Perform all other Work as required.
10. Perform the Acceptance Test.
11. Provide training.
12. Provide as-built drawings.

## 1.10 COMMISSIONING

- A. After all Work is completed, and prior to requesting the Acceptance test, Contractor shall conduct a final inspection, and pre-test all equipment and system features. Contractor shall correct any deficiencies discovered as the result of the inspection and pre-test.
- B. Contractor shall submit a request for the Acceptance test in writing to the MDOT's representative no less than fourteen days prior to the requested test date. The request for Acceptance test shall be accompanied by a certification from Contractor that all Work is complete and has been pre-tested, and that all corrections have been made.
- C. During Acceptance test, Contractor shall demonstrate all video equipment and system features to MDOT. Any portions of the Work found to be deficient or not in compliance with the Project Drawing and Specifications may be rejected.
- D. Contractor shall promptly correct all deficiencies. Upon correction of deficiencies, Contractor shall submit a request in writing to MDOT or MDOT's representative for another Acceptance Test.
- E. The contractor shall bare the cost for the second acceptance test.

## 1.11 MAINTENANCE

- A. Provide full procedures for testing video quality and alignment.
- B. Provide full procedures for any other tasks that must be performed to ensure the warranty remains intact.

## PART 2 - PRODUCTS

### 2.02 EQUIPMENT AND MATERIALS

- A. Drawings and Specifications indicate major system components, and may not show every component, connector, module, or accessory that may be required to support the operation specified. Contractor shall provide all components needed for complete and satisfactory operation.
- B. All products not provided by MDOT shall be new and unused, and shall be of manufacturer's current and standard production.
- C. Where two or more equipment items of the same kind are provided, all shall be identical and provided by the same manufacturer.
- D. Product Availability:
  - 1. Contractor, prior to submitting a proposal, shall determine product availability and delivery time, and shall include such considerations into his proposed Contract Time.
  - 2. Certain products specified may only be available through factory authorized dealers and distributors. Contractor shall verify his ability to procure the products specified prior to submitting a proposal.

## 2.03 CAMERAS

## A. Available Manufacturers:

1. COHU
2. Hitachi Visual Technologies.
3. Honeywell
4. JVC Professional Products.
5. Panasonic Security Systems Group.
6. Pelco.
7. Philips Communication, Security & Imaging; Philips Electronics N.V.
8. Samsung Opto-Electronics America, Inc.
9. Sensormatic Electronics Corporation.
10. Toshiba Security Products.
11. Vicon Industries, Inc.
12. Watec America Corporation.

## B. Color Fixed Camera (All Interior Installations)

1. Type:
  - a. Normal Color Camera
  - b. Day Night camera with retractable IR cut filter for night operation
2. Imaging Device: 1/3 inch
3. Minimum Picture Elements:
  - a. Normal Color Camera: 768 (H) x 494 (V)
  - b. Day Night Color Camera: 720 (H) x 540 (V)
4. Scanning System: 2:1 Interlace.
5. Minimum Horizontal Resolution: 504 TV lines.
6. Signal-to-Noise Ratio: Not less than 50 dB, with the camera AGC off.
7. Sensitivity:
  - a. Normal Camera: .3 lux
  - b. Day Night Camera:
    - 1) Day (color): 0.8 lux
    - 2) Night (B/W) .08 lux
8. Sensitivity: Camera shall deliver 1-V peak-to-peak video signal at the minimum specified light level. The illumination for the test shall be with lamps rated at approximately 2200-K color temperature, and with the camera AGC off.
9. Manually selectable modes for backlight compensation or normal lighting.
10. White Balance: Auto-tracing white balance, with manually settable fixed balance option.

## C. Color Dome Fixed Camera: (All Exterior Installations)

Assembled and tested as a manufactured unit, containing a dome assembly, color camera, zoom lens, and receiver/driver.

1. Horizontal Resolution: 540 lines.
2. Signal-to-Noise Ratio: Not less than 50 dB, with the camera AGC off. With AGC, manually selectable on or off.
3. Sensitivity: Camera indicated shall be combination day/night cameras.
4. Sensitivity: Camera shall deliver 1-V peak-to-peak video signal at the minimum specified light level. The illumination for the test shall be with lamps rated at approximately 2200-K color temperature, and with the camera AGC off.

5. Manually selectable modes for backlight compensation or normal lighting.
  6. Preset positioning: minimum 8 user-definable scenes, each allowing 16-character titles. Controls shall include the following:
    - a. In "sequence mode," camera shall continuously sequence through preset positions, with dwell time and sequencing under operator control.
    - b. Motion detection shall be available at each camera position.
    - c. Up to four preset positions may be selected to be activated by an alarm. Each of the alarm positions may be programmed to output a response signal.
  7. White Balance: Auto-tracing white balance, with manually settable fixed balance option.
  8. Software: Shall include the vendor supplied software necessary to control the Zoom features.
- D. Lenses: Optical-quality coated optics, designed specifically for video surveillance applications, and matched to specified camera. Provide lenses for camera manufacture if available.
- E. CCTV Camera Mounting:
1. Parapet wall mount – Pelco model PP350 or equal
  2. Parapet rooftop mount – Pelco model PP351 or equal
  3. Wall mount – Pelco model WM2000 or equal
  4. Corner mount adaptor for WM2000 – Pelco model CM100 or equal.

#### 2.04 POWER SUPPLIES

- A. Power Supplies: Low-voltage power supplies matched for voltage and current requirements of cameras and accessories, type as recommended by camera manufacturer.
1. Acceptable Manufactures:
    - a. Pelco
    - b. Altronix
  2. Output Voltage: 24 or 28 Vac selectable
  3. Protection Individual camera fuse or circuit barker
  4. Enclosure: Power supplies used externally shall be NEMA Type 4X /IP66 rated.
  5. Current sized for application with minimal 20% safety factor.

#### 2.05 UTP Transceivers

- A. General Requirements:
1. Type: Passive
  2. Input:
    - a. BNC connector
    - b. Impedance: 75 Ohm
  3. Output:
    - a. RJ-45 connector or screw terminal
    - b. Impedance: 100 to 200 Ohm
  4. Bandwidth: DC to 8 MHz
  5. Max input voltage: 1.1 V p-p
  6. Maximum insertion Loss: 2 dB (DC to 8 MHz)

7. Minimum return loss: 15 dB (DC to 8 MHz)
8. Minimum common mode rejection: 40 dB
9. Drive capability:
  - a. 24 AWG twisted pair
  - b. Impedance: 100 to 200 Ohm
  - c. Capacitance: 20 pf/foot

B. UTP Transmitter:

1. Internal to camera UTP 200 ohm output
2. External transmitter: single channel Pelco TW3001P or equal

C. UTP Receivers:

1. Single Channel UTP/Coax Receiver: Pelco TW3001P or equal
2. 8 Channel UTP/Coax Receiver: Pelco TW3008P or equal
3. 16 Channel UTP/Coax Receiver: Pelco TW3016P or equal

## 2.06 DIGITAL VIDEO RECORDERS

A. Available Manufacturers:

1. Dedicated Micros USA.
2. Everfocus
3. Honeywell
4. Integral
5. JVC Professional Products.
6. Panasonic Security Systems Group.
7. Pelco.
8. Philips Communication, Security & Imaging; Philips Electronics N.V.
9. Samsung Opto-Electronics America, Inc.

B. Requirements:

1. Camera Inputs 16 Analog
2. Video input: 1 V p-p at 75 Ohm
3. Monitor Out: 1 BNC Composite 1 V p-p at 75 Ohm.
4. Video Format: NTSC
5. Recording Rate: 480 FPS (NTSC)
6. Compression: MPEG-4 or MJPEG
7. Storage of 500 GB minimum.
8. Storage External:
  - a. SCSI connector
  - b. Hot swapping
  - c. Capacity Minimum 4 position for 2 TB drives
9. Display Resolution: 720 by 480
10. Display Format: 1, 4 and 8 Multiscreen display.
11. Network Interface: Ethernet RJ-45 network connection
12. Intelligent motion detection with programmable area and programmable sensitivity.
13. Time and Date Generator: Records time (hr:min:sec) and date legend of each frame.
14. Watermark time and date stamp for exported files.
15. Title: Minimum 12 characters for each camera.

2.07 LCD MONITOR

- A. Type: Flat panel LCD
- B. Size: 19 inches minimum
- C. Input: VGA
- D. Resolution: Supports up to 1280 X 1024 for SXGA input
- E. Brightness: adjustable to 300 cd/m<sup>2</sup>
- F. Minimum Contrast Ratio: 500:1
- G. Maximum Response Time: 12 ms
- H. Industrial rated for 24 hour x7 days a week operation
- I. Power: 120 V ac @ 50 Watts

2.08 WIRE AND CABLE:

- A. General: Provide all wire and cable required to install systems as indicated.
  - 1. Video cable shall be sized to provide adequate video signal at the recording equipment. The maximum cable length are as follows:
    - a. RG-59 – 700 feet
    - b. RG-6 – 1200 feet
    - c. CAT 5e - 300 feet for network applications
    - d. CAT 5e - 750 feet for video and TPZ control
  - 2. Wire and cable shall be sized to provide adequate signal for the worst case distance.
- B. All cables shall be specifically designed for their intended use.
- C. Coax cable with only a foil shield and drain wire shall not be acceptable.
- D. Comply with equipment manufacturers recommendations for wire and cable size and type.
- E. Comply with all applicable codes and ordinances.

2.09 JUNCTION AND PULL BOXES:

- A. Interior Boxes: Sheet Metal Outlet Boxes: Sizes to be determined in accordance with code requirements for conductor fill. No box shall be smaller than a single gang 1-1/2" deep. Provide box covers as required.
- B. Exterior Boxes: Exterior boxes shall NEMA 4 or NEMA 3R, watertight and dust-tight.
- C. All interior and exterior boxes shall have their covers fastened using security screws.

D. Lightning Protection:

1. The Contractor shall provide suitable lightning protection for all security panels.
2. All lightning protection equipment shall be UL listed.

PART 3 - EXECUTION

3.01 FIELD INSTALLATION

- A. Field located security panels where indicated.
- B. Mount field camera and power and run connecting cables to indicated.
- C. Align cameras as indicated.
- D. Set focal length (variable focal length (VFL) lenses) as required to encompass indicated view.
- E. Set back light compensation. Use neutral density filters to simulate darkness to set with iris full open.
- F. Set focus and depth of field. Set focus to give desired depth of field in lowest light level.
- G. Check communication and operation of remote control (PTZ dome camera) Field locate cables from security panel to security work station.
- H. Field locate cable and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other adverse conditions affecting installation.

3.02 EXAMINATION

A. Junction and Pull Boxes:

1. Interior Boxes: Sheet Metal Outlet Boxes: Sizes to be determined in accordance with code requirements for conductor fill. No box shall be smaller than a single gang 1-1/2 inches deep. Provide box covers as required.
2. Exterior Boxes: Exterior boxes shall be NEMA 4 or NEMA 3R, watertight and dust-tight
3. All interior and exterior boxes shall have their covers fastened using security screws.

B. Lightning Protection:

1. The Contractor shall provide suitable surge protection at both the camera and at the recording equipment for exterior cameras.
2. Camera on poles or exposed in top of buildings shall have air terminals. The air terminals shall be bonded to the existing lightning protection system.
3. All lightning protection equipment shall be UL listed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.03 CABLING

- A. Layout, size, and plan new wire and cable runs as required.
- B. Wire and cable passing through metalwork shall be sleeved by an approved grommet or bushing.
- C. All splices shall be made in junction boxes (except at equipment). Power and CAT 5 splices shall be made with an approved crimp connection. Coax cable splices shall be made by first terminating the cable with a coax connector and then using barrel coax cable connectors to join the coax cables. Wire nuts shall not be used on any low-voltage wiring unless the device.
- D. Identify all wire and cable at terminations (both ends) and at every junction box. Identification shall be made with an approved permanent label, Brady or equal.
- E. Wiring Method: Install wiring in raceway and cable tray except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Use NRTL-listed plenum cable in environmental air spaces, including plenum ceilings. Conceal raceway and cables except in unfinished spaces.
- F. Install coax cables using techniques, practices, and methods that are consistent with coax video cable and that ensure coax video performance of completed and linked signal paths, end to end.
- G. Install LAN cables using techniques, practices, and methods that are consistent with Category 5E rating of components and that ensure Category 5E performance of completed and linked signal paths, end to end.
- H. Install cables without damaging conductors, shield, or jacket.
- I. Boxes and enclosures containing security system components or cabling, and which are easily accessible to employees or to the public, shall be provided with a lock. Boxes above ceiling level in occupied areas of the building shall not be considered to be accessible. Junction boxes and small device enclosures below ceiling level and easily accessible to employees or the public shall be covered with a suitable cover plate and secured with tamperproof screws.
- J. Wire and Cable Terminations:
  - 1. Identify all inputs and outputs on terminal strips with permanent marking labels.
  - 2. Neatly dress and tie all wiring. The length of conductors within enclosures shall be sufficient to neatly train the conductor to the terminal point with no excess. Run all wire and cable parallel or normal to walls, floors and ground.
  - 3. Install connectors as required by equipment manufacturers.
  - 4. Do not obstruct equipment controls or indicators with wire or cable.
  - 5. Route wire and cable away from heat producing components such as resistors, regulators, and the like.
  - 6. Comply with EIA/TIA-569, "Commercial Building Standard for Telecommunications Pathways and Spaces."
  - 7. Cable application requirements are minimum requirements and shall be exceeded if recommended or required by manufacturer of system hardware.



## K. Conduit and Raceway Installation:

1. Lay-out, size and plan conduit and raceway systems as indicated or as required which ever will allow for the greatest number of cables.
2. Route exposed conduit and raceway parallel and perpendicular to walls and adjacent piping.
3. Maintain minimum six (6) inch clearance between conduit and piping.
4. Group conduit in parallel runs where practical and use conduit rack constructed of steel channel with conduit straps or clamps.
5. Use conduit bodies to make sharp changes in direction, as around beams. Fasten conduits and raceways to structural steel using approved spring clips or clamps.
6. No exposed conduit, raceway, or junction box shall be installed within any populated area.
7. Install all boxes, card reader, intercoms and push buttons straight and plumb.
8. Do not support conduit from mechanical, plumbing, or fire sprinkler systems.
9. Do not use flexible conduit in lengths longer than six (6) feet.

## L. Penetrations: When penetrating a fire wall for passage of cables and/or conduit, provide a fire-stop system that complies with code and the local authority having jurisdiction.

## M. Camera:

1. Install number of conductor pairs recommended by manufacturer for the functions specified.
2. Install coax cable form the camera to the DVR where required.

## 3.04 IDENTIFICATION

- A. Label both ends of each cable. Use unique, alphanumeric designation for each cable, and label cable and jacks, connectors, and terminals to which it connects with same designation. Use logical and systematic designations for facility's architectural arrangement.
- B. Label each terminal strip and screw terminal or coax cable connector in each cabinet, rack, or panel.
  1. All wiring conductors connected to terminal strips shall be individually numbered, and each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with the name and number of the particular device as shown.
- C. At completion, cable and asset management software shall reflect as-built conditions.

## 3.05 SYSTEM SOFTWARE

- A. Provide and install the DVR software and the CCTV software. Configure software to the project requirements. Assign software licenses to MDOT.

3.06 FIELD QUALITY CONTROL

- A. Provide wiring diagrams and labeling charts to properly identify all wiring.
- B. Provide a screen capture of each CCTV view.
- C. If corrections are needed, the Contractor shall perform the needed corrections in a timely fashion.

3.07 DEMONSTRATION - TRAINING

- A. Engage authorized service representative to train MDOT's maintenance personnel to adjust, operate, and maintain CCTV camera system

END OF SECTION

SECTION 28 31 11

DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Fire-alarm control unit.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Heat detectors.
5. Notification appliances.
6. Remote annunciator.

B. Related Requirements:

1. Section 28 05 13 "Conductors and Cables for Electronic Safety and Security" for cables and conductors for fire-alarm systems.

1.02 RELATED DOCUMENTS

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

1.03 DEFINITIONS

- A. EMT: Electrical Metallic Tubing.
- B. FACP: Fire Alarm Control Panel.
- C. NICET: National Institute for Certification in Engineering Technologies.
- D. PC: Personal computer.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product, including furnished options and accessories.
1. Include construction details, material descriptions, dimensions, profiles, and finishes.
  2. Include rated capacities, operating characteristics, and electrical characteristics.
- B. Shop Drawings: For fire-alarm system.
1. Comply with recommendations and requirements in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
  2. Include plans, elevations, sections, details, and attachments to other work.

3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
4. Detail assembly and support requirements.
5. Include voltage drop calculations for notification-appliance circuits.
6. Include battery-size calculations.
7. Include input/output matrix.
8. Include statement from manufacturer that all equipment and components have been tested as a system and meet all requirements in this Specification and in NFPA 72.
9. Include performance parameters and installation details for each detector.
10. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
11. Provide program report showing that air-sampling detector pipe layout balances pneumatically within the airflow range of the air-sampling detector.
12. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale; coordinate location of duct smoke detectors and access to them.
  - a. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators.
  - b. Show field wiring required for HVAC unit shutdown on alarm.
  - c. Show field wiring and equipment required for HVAC unit shutdown on alarm and override by firefighters' control system.
  - d. Show field wiring and equipment required for HVAC unit shutdown on alarm and override by firefighters' smoke-evacuation system.
  - e. Locate detectors according to manufacturer's written recommendations.
13. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
14. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits and point-to-point wiring diagrams.

#### 1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.
  1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
    - a. Comply with the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
    - b. Provide "Fire Alarm and Emergency Communications System Record of Completion Documents" according to the "Completion Documents" Article in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
    - c. Complete wiring diagrams showing connections between all devices and equipment. Each conductor shall be numbered at every junction point with indication of origination and termination points.
    - d. Riser diagram.
    - e. Device addresses.
    - f. Air-sampling system sample port locations and modeling program report showing layout meets performance criteria.

- g. Record copy of site-specific software.
- h. Provide "Inspection and Testing Form" according to the "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:
  - 1) Equipment tested.
  - 2) Frequency of testing of installed components.
  - 3) Frequency of inspection of installed components.
  - 4) Requirements and recommendations related to results of maintenance.
  - 5) Manufacturer's user training manuals.
- i. Manufacturer's required maintenance related to system warranty requirements.
- j. Abbreviated operating instructions for mounting at fire-alarm control unit and each annunciator unit.

#### 1.06 QUALITY ASSURANCE

- A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
- B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level II technician.
- C. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.

#### 1.07 PROJECT CONDITIONS

- A. Perform a full test of the existing system prior to starting work. Document any equipment or components not functioning as designed.
- B. Use of Devices during Construction: Protect devices during construction unless devices are placed in service to protect the facility during construction.

#### 1.08 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Extent: All equipment and components not covered in the Maintenance Service Agreement.
  - 2. Warranty Period: Five years from date of Final Completion.

### PART 2 - PRODUCTS

#### 2.01 SYSTEM DESCRIPTION

- A. Source Limitations for Fire-Alarm System and Components: Components shall be compatible with, and operate as an extension of, existing system. Provide system manufacturer's certification that all components provided have been tested as, and will operate as, a system.

- B. Non-coded, addressable system, with multiplexed signal transmission and horn/strobe evacuation.
- C. Automatic sensitivity control of certain smoke detectors.
- D. All components provided shall be listed for use with the selected system.
- E. 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.

## 2.02 SYSTEMS OPERATIONAL DESCRIPTION

- A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:
  - 1. Manual stations.
  - 2. Heat detectors.
  - 3. Smoke detectors.
  - 4. Automatic sprinkler system water flow.
  - 5. Fire standpipe system.
  - 6. Dry system pressure flow switch.
- B. Fire-alarm signal shall initiate the following actions:
  - 1. Continuously operate alarm notification appliances.
  - 2. Identify alarm and specific initiating device at fire-alarm control unit and remote annunciators.
  - 3. Transmit an alarm signal to the remote alarm receiving station.
  - 4. Release fire and smoke doors held open by magnetic door holders.
  - 5. Record events in the system memory.
  - 6. Record events by the system printer.
- C. Supervisory signal initiation shall be by one or more of the following devices and actions:
  - 1. Valve supervisory switch.
  - 2. High- or low-air-pressure switch of a dry-pipe or preaction sprinkler system.
  - 3. User disabling of zones or individual devices.
  - 4. Loss of communication with any panel on the network.
- D. System trouble signal initiation shall be by one or more of the following devices and actions:
  - 1. Open circuits, shorts, and grounds in designated circuits.
  - 2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
  - 3. Loss of communication with any addressable sensor, input module, relay, control module, remote annunciator, printer interface, or Ethernet module.
  - 4. Loss of primary power at fire-alarm control unit.
  - 5. Ground or a single break in internal circuits of fire-alarm control unit.
  - 6. Abnormal ac voltage at fire-alarm control unit.
  - 7. Break in standby battery circuitry.

8. Failure of battery charging.
9. Abnormal position of any switch at fire-alarm control unit or annunciator.

E. System Supervisory Signal Actions:

1. Initiate notification appliances.
2. Identify specific device initiating the event at fire-alarm control unit and remote annunciators.
3. Record the event on system printer.
4. After a time delay of 200 seconds, transmit a trouble or supervisory signal to the remote alarm receiving station.
5. Transmit system status to building management system.
6. Display system status on graphic annunciator.

2.03 FIRE-ALARM CONTROL UNIT

A. Manufacturer: 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. Notifier.
2. SimplexGrinnell LP.
3. Edwards - EST

B. General Requirements for Fire-Alarm Control Unit:

1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864.
  - a. System software and programs shall be held in nonvolatile flash, electrically erasable, programmable, read-only memory, retaining the information through failure of primary and secondary power supplies.
  - b. Include a real-time clock for time annotation of events on the event recorder and printer.
  - c. Provide communication between the FACP and remote circuit interface panels, annunciators, and displays.
  - d. The FACP shall be listed for connection to a central-station signaling system service.
  - e. Provide nonvolatile memory for system database, logic, and operating system and event history. The system shall require no manual input to initialize in the event of a complete power down condition. The FACP shall provide a minimum 500-event history log.
2. Addressable Initiation Device Circuits: The FACP shall indicate which communication zones have been silenced and shall provide selective silencing of alarm notification appliance by building communication zone.
3. Addressable Control Circuits for Operation of Notification Appliances and Mechanical Equipment: The FACP shall be listed for releasing service.

- C. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
1. Annunciator and Display: Liquid-crystal type, 80 characters, minimum.
  2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.
- D. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
1. Annunciator and Display: Liquid-crystal type, two line(s) of 40 characters, minimum.
  2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.
- E. Initiating-Device, Notification-Appliance, and Signaling-Line Circuits:
1. Pathway Class Designations: NFPA 72, Class B.
  2. Pathway Survivability: Level 0.
  3. Install no more than 50 addressable devices on each signaling-line circuit.
- F. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.
- G. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory signals, supervisory and digital alarm communicator transmitters shall be powered by 24-V dc source.
1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.
- H. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.
1. Batteries: Sealed lead calcium.
- I. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.



## 2.04 MANUAL FIRE-ALARM BOXES

- A. Manufacturer: 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. Notifier.
  2. SimplexGrinnell LP.
  3. Edwards - EST
- B. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
1. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
  2. Station Reset: Key- or wrench-operated switch.

## 2.05 SYSTEM SMOKE DETECTORS

- A. Manufacturer: 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. Notifier.
  2. SimplexGrinnell LP.
  3. Edwards - EST
- B. General Requirements for System Smoke Detectors:
1. Comply with UL 268; operating at 24-V dc, nominal.
  2. Detectors shall be four-wire type.
  3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
  4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
  5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
  6. Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.
  7. Remote Control: Unless otherwise indicated, detectors shall be digital-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition.
    - a. Rate-of-rise temperature characteristic of combination smoke- and heat-detection units shall be selectable at fire-alarm control unit for 15 or 20 deg F per minute.
    - b. Fixed-temperature sensing characteristic of combination smoke- and heat-detection units shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F.

- c. Multiple levels of detection sensitivity for each sensor.
- d. Sensitivity levels based on time of day.

C. Photoelectric Smoke Detectors:

- 1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
- 2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
  - a. Primary status.
  - b. Device type.
  - c. Present average value.
  - d. Present sensitivity selected.
  - e. Sensor range (normal, dirty, etc.).

2.06 HEAT DETECTORS

- A. Manufacturer: 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. Notifier.
  - 2. System Sensor.
  - 3. Edwards - EST
- B. General Requirements for Heat Detectors: Comply with UL 521.
  - 1. Temperature sensors shall test for and communicate the sensitivity range of the device.
- C. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F or a rate of rise that exceeds 15 deg F per minute unless otherwise indicated.
  - 1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
  - 2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

2.07 NOTIFICATION APPLIANCES

- A. Manufacturer: 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. SimplexGrinnell LP.
  - 2. Notifier.
  - 3. Edwards - EST
- B. General Requirements for Notification Appliances: Individually addressed, connected to a signaling-line circuit, equipped for mounting as indicated, and with screw terminals for system connections.

- C. General Requirements for Notification Appliances: Connected to notification-appliance signal circuits, zoned as indicated, equipped for mounting as indicated, and with screw terminals for system connections.
  - 1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.

2.08 REMOTE ANNUNCIATOR

- A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.
  - 1. Mounting: Flush cabinet, NEMA 250, Type 1.
- B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.
  - 1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.
- B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 EQUIPMENT INSTALLATION

- A. Comply with NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."
  - 1. Devices placed in service before all other trades have completed cleanup shall be replaced.
  - 2. Devices installed but not yet placed in service shall be protected from construction dust, debris, dirt, moisture, and damage according to manufacturer's written storage instructions.
- B. Install wall-mounted equipment, with tops of cabinets not more than 78 inches above the finished floor.

## C. Manual Fire-Alarm Boxes:

1. Install manual fire-alarm box in the normal path of egress within 60 inches of the exit doorway.
2. Mount manual fire-alarm box on a background of a contrasting color.
3. The operable part of manual fire-alarm box shall be between 42 inches and 48 inches above floor level. All devices shall be mounted at the same height unless otherwise indicated.

## D. Smoke- or Heat-Detector Spacing:

1. Comply with the "Smoke-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for smoke-detector spacing.
2. Comply with the "Heat-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for heat-detector spacing.
3. Smooth ceiling spacing shall not exceed 30 feet.
4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Annex A or Annex B in NFPA 72.
5. Lighting Fixtures: Locate detectors not closer than 12 inches from any part of a lighting fixture and not directly above pendant mounted or indirect lighting.

E. Install a cover on each smoke detector that is not placed in service during construction. Cover shall remain in place except during system testing. Remove cover prior to system turnover.

F. Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location. Do not install smoke detectors in sprinklered elevator shafts.

G. Remote Status and Alarm Indicators: Install in a visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position.

H. Audible Alarm-Indicating Devices: Install not less than 6 inches below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Install all devices at the same height unless otherwise indicated.

I. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches below the ceiling. Install all devices at the same height unless otherwise indicated.

J. Device Location-Indicating Lights: Locate in public space near the device they monitor.

## 3.03 PATHWAYS

A. Pathways above recessed ceilings and in nonaccessible locations may be routed exposed.

1. Exposed pathways located less than 96 inches above the floor shall be installed in EMT.

B. Pathways shall be installed in EMT.

- C. Exposed EMT shall be painted red enamel.

#### 3.04 CONNECTIONS

- A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Section 087100 "Door Hardware." Connect hardware and devices to fire-alarm system.
  - 1. Verify that hardware and devices are listed for use with installed fire-alarm system before making connections.
- B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 36 inches from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
  - 1. Alarm-initiating connection to smoke-control system (smoke management) at firefighters' smoke-control system panel.
  - 2. Supervisory connections at valve supervisory switches.
  - 3. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.

#### 3.05 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- B. Install framed instructions in a location visible from fire-alarm control unit.

#### 3.06 GROUNDING

- A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.
- B. Ground shielded cables at the control panel location only. Insulate shield at device location.

#### 3.07 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of manufacturer's designated service organization. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
  - 1. Include visual inspections according to the "Visual Inspection Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
  - 2. Perform tests in the "Test Methods" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
  - 3. Perform tests per the "Testing Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

3.08 SOFTWARE SERVICE AGREEMENT

- A. Comply with UL 864.
- B. Technical Support: Beginning at Final Completion, service agreement shall include software support for two years.
- C. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.
  - 1. Upgrade Notice: At least 30 days to allow Owner to schedule access to system and to upgrade computer equipment if necessary.

3.09 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION

SECTION 31 23 11

EXCAVATION, FILLING AND GRADING FOR BUILDING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: The extent of excavation, filling and grading is shown on the Drawings.
  - 1. Preparation of subgrade for building slabs is included as part of this Work
  - 2. Backfilling for trenches within the building lines is included as part of this Work.
- B. Related Sections:
  - 1. Section 01 40 00 – Quality Requirements (For Testing Laboratory Services).

1.02 DEFINITIONS

- A. Backfill: Soil material used to fill an excavation.
  - 1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
  - 2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Base Course: Aggregate layer placed between the sub-base course and hot-mix asphalt paving.
- C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.
- D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.
- F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
  - 1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
  - 2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.
- G. Fill: Soil materials used to raise existing grades.

- H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- I. Sub-base Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
- J. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below sub-base, drainage fill, drainage course, or topsoil materials.
- K. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.03 SUBMITTALS

- A. Notification shall be provided to Project Engineer indicating source of borrow material in advance of start of Work and certification provided that proposed soil material is satisfactory for specified use.

1.04 QUALITY ASSURANCE

- A. Pre-Excavation Meeting: Conduct meeting at Project site.
- B. Perform excavation Work in compliance with applicable requirements of governing authorities having jurisdiction.
- C. Compaction density shall be 95 percent of the maximum dry density value as determined by ASTM D 698 (Standard Proctor Test) of AASHTO T-99.
- D. Soils compaction control tests shall be performed as specified herein and under Section 01 40 00 – Quality Requirements. Stability is defined as absence of significant yielding or pumping of soils under compaction effort.
- E. Number of Tests: Make test(s) in accordance with AASHTO T-99 for each class of material. Make in-place density tests in accordance with AASHTO T-238 (Nuclear Method) for density tests, as the fill and backfill work progresses. At least one test per lift of any isolated portions and each footing.
- F. Work on Non-Tested Areas: Placing permanent construction over fill that has not been tested and approved may require removal of permanent Work, re-compacting the fill and replacing the Work at no additional cost to the Owner.

1.05 PROJECT CONDITIONS

- A. Utility Locator Service: Notify utility locator service for area where Project is located before beginning earth moving operations.
  - 1. Locate existing underground utilities in the areas of Work.
  - 2. If utilities are to remain in place, provide adequate means of protection during earthwork operations.



- 3. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult the Utility Owner immediately for directions.
  - 4. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.
- B. Do not interrupt existing utilities serving facilities occupied and used by Owner or others except when permitted in writing by Project Engineer and then only after acceptable temporary utility services have been provided.
- 1. Demolish and completely remove from site existing underground utilities indicated "To Be Removed".
  - 2. Coordinate with utility companies for shut off of services if lines are active.

1.06 PROTECTION OF PERSONS AND PROPERTY

- A. Barricade open excavations occurring as part of this Work and post with warning lights.
- 1. Operate warning lights as recommended by authorities having jurisdiction.
  - 2. Protect structures, utilities, and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.

1.07 USE OF EXPLOSIVES

- A. The use of explosives is not permitted.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Backfill and Fill: Select fill shall be an approved select material free from trash, debris, stones larger than 3 inches, roots and other organic matter.
- C. Granular Fill:
- 1. Below existing natural grade line: Sandy clay with a liquid limit less than 45 and PI in range of 10 to 22, or clayey sand with PI not less than 7 and liquid limit not greater than 35.
  - 2. Above existing natural grade under slabs and footings: Silty or sandy clay as above or clayey-sand with LL less than 35 and PI of 3 to 15.

## PART 3 - EXECUTION

## 3.01 PREPARATION

- A. Examine the areas and conditions under which excavating, filling, and grading are to be performed and notify the Contractor, in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in an acceptable manner.

## 3.02 EXCAVATION

- A. Excavation consists of removal and disposal of material encountered when establishing required grade elevations.
- B. Earth excavation includes removal and disposal of pavements and other obstructions visible on ground surface, underground structures and utilities indicated to be demolished and removed, material of any classification indicated in data on subsurface conditions, and other materials encountered that are not classified as rock excavation or unauthorized excavation.
- C. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Project Engineer. Unauthorized excavation, as well as remedial Work directed by the Project Engineer, shall be at the Contractor's expense. Under footings, foundation bases, or retaining walls, fill unauthorized excavation by extending the indicated bottom elevation of the footing or base to the excavation bottom, without altering required top elevation. Lean concrete fill may be used to bring elevations to proper position, when acceptable to Project Engineer.
- D. Elsewhere, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by Project Engineer.
- E. Additional Excavation: When excavation has reached required subgrade elevations, notify the Project Engineer who will make an inspection of conditions. If unsuitable bearing materials are encountered at the required subgrade elevations, carry excavations deeper and replace the excavated material as directed by the Project Engineer. Removal of unsuitable material and its replacement as directed will be paid on the basis of contract conditions relative to changes in work.
- F. Stability of Excavations. Slope sides of excavations to comply with local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in a safe condition until completion of backfilling.
- G. Shoring and Bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers and cross braces, in good serviceable condition. Establish requirements for trench shoring and bracing to comply with local codes and authorities having jurisdiction. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses.

- H. 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.
1. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.
  2. Convey water removed from excavations and rainwater to collecting or run-off 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.

### 3.03 STORAGE OF SOIL MATERIALS

- A. Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade and shape stockpiles for proper drainage. Locate and retain soil materials away from edge of excavations. Dispose of excess soil material and waste materials as herein specified.

### 3.04 EXCAVATION FOR STRUCTURES

- A. Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 feet, and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection. In excavating for footings and foundations, take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed. Trim bottoms to required lines and grades to leave solid base to receive concrete.

### 3.05 EXCAVATION FOR TRENCHES

- A. Dig trenches to the uniform width required for the particular item to be installed, sufficiently wide to provide ample working room. Excavate trenches to the depth indicated or required. Carry the depth of trenches for piping to establish the indicated flow lines and invert elevations. Beyond the building perimeter, keep bottoms of trenches sufficiently below finish grade to avoid freeze-ups.
- B. Grade bottoms of trenches as indicated, notching under pipe bells to provide solid bearing for the entire body of the pipe. Backfill trenches with concrete where trench excavations pass within 18 inches of column or wall footings and which are carried below the bottom of such footings, or which pass under wall footings. Place concrete to the level of the bottom of adjacent footings.
- C. Do not backfill trenches until tests and inspections have been made and backfilling authorized by the Project Engineer. Use care in backfilling to avoid damage or displacement of pipe systems.

3.06 COLD WEATHER PROTECTION

- A. Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F.

3.07 UNAUTHORIZED EXCAVATION

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

3.08 COMPACTION

- A. Control soil compaction during construction providing minimum percentage of density specified for each area classification.
- B. Building Slab: Compact top 12 inches of subgrade and each layer of backfill or fill material at 95 percent maximum dry density.

3.09 SOIL MOISTURE CONTROL

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

3.10 BACKFILL AND FILL

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. Place acceptable soil material in layers to required subgrade elevations, for each area classification listed below.
- C. Under buildings use sub-base material, or satisfactory excavated or borrow material, or combination of both. Backfill excavations as promptly as work permits, but not until completion of the following:
  - 1. Acceptance by Project Engineer of construction below finish grade including, where applicable, dampproofing, waterproofing, and soil treatment.
  - 2. Inspection, testing, approval, and recording locations of underground utilities.
  - 3. Removal of concrete formwork, shoring and bracing, and backfilling of voids with satisfactory materials.
  - 4. Removal of trash and debris.

### 3.11 GROUND SURFACE PREPARATION

- A. When existing ground surface has a density less than that specified under "Compaction" for the particular area classification, break up the ground surface, pulverize, moisture condition to the optimum moisture content, and compact to required depth and percentage of maximum density.

### 3.12 PLACEMENT AND COMPACTION

- A. Place backfill and fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Before compaction, moisten or aerate each layer as necessary to provide the optimum moisture content. Compact each layer to required percentage of maximum dry density for each area classification. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
- C. Place backfill and fill materials evenly adjacent to structures, to required elevations. Take care to prevent wedging action of backfill against structures by carrying the material uniformly around structure to approximately same elevation in each lift.

### 3.13 GRADING

- A. Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades.
- B. Grading Outside Building Lines: Grade areas adjacent to building lines to drain away from structures and to prevent ponding. Finish surfaces free from irregular surface changes, and as follows:
- C. Grading Surface of Fill Under Building Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of 1/2 inch when tested with a 10-foot straightedge.

### 3.14 COMPACTION AFTER GRADING

- A. After grading, compact subgrade surfaces to the depth and percentage of maximum density for each area classification.

### 3.15 MAINTENANCE

- A. Protect newly graded areas from traffic and erosion. Keep free of trash and debris. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.
- B. Reconditioning Compacted Areas: Where subsequent construction operations or adverse weather disturbs completed compacted areas, scarify surface, re-shape, and compact to required density prior to further construction.

3.16 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
  - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.17 DISPOSAL OF SURPLUS AND WASTE MATERIALS

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

END OF SECTION

SECTION 31 31 16

TERMITE CONTROL

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Soil treatment for control of all species of subterranean termites including Formosan termites.

1.02 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical product data and application instructions prior to application for Project Engineer's approval. Include the EPA-Registered Label for termiticide products.
- B. Sample Warranty: Submit sample copies of the Termite Soil Treatment Guarantee form prior to application for Project Engineer's approval.
- C. Quality Control: Submit identification of at least 3 projects of similar scope along with name, address, and telephone number of the Architect, Owner and General Contractor.

1.03 INFORMATIONAL SUBMITTALS

- A. Product certificates.
- B. Soil Treatment Application Report: Include the following:
  - 1. Date and time of application.
  - 2. Moisture content of soil before application.
  - 3. Termiticide brand name and manufacturer.
  - 4. Quantity of undiluted termiticide used.
  - 5. Dilutions, methods, volumes used, and rates of application.
  - 6. Areas of application.
  - 7. Water source for application.

1.04 QUALITY ASSURANCE

- A. In addition to the requirements of these Specifications, comply with manufacturer's instructions and recommendations for the Work, including preparation of substrate and application.
- B. Installer Qualifications: Engage a professional pest control operator, licensed by the State of Mississippi, Mississippi Department of Agriculture and Commerce, Bureau of Plant Industry, and in accordance with regulations of governing authorities for application of soil treatment solution.
  - 1. The pest control operator is to have the aforementioned valid license, the company technician is to have a valid identification card for pest control, and the company vehicle is to be clearly marked with the company name.

2. The professional pest control operator specializing in Soil Treatment for Termite Control, with 5 years minimum experience, shall have completed work similar to that indicated for this Project and have a record of successful in-service performance.

- C. Regulatory Requirements: Formulate and apply termiticides and termiticide devices according to the EPA-Registered Label.
- D. Comply with Mississippi Regulations Governing Pest Control Operators in following the labels of the termiticide.
- E. Pre-Installation Meeting: Conduct meeting at Project site.

1.05 PROJECT CONDITIONS

- A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-Registered Label and requirements of authorities having jurisdiction.
- B. Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.
- C. Remove all non-pressure treated wood contacting soil. Remove grade stakes prior to applying horizontal barrier and all form boards, stakes and concrete over pour prior to applying vertical soil treatment.

1.06 WARRANTY

- A. Soil Treatment Special Warranty: Furnish 3 copies of written warranty certifying that the applied soil poisoning treatment will prevent the infestation of subterranean termites, including Formosan termites, and that termite contractor will re-treat the soil and also repair or replace damage caused by termite infestation WITHOUT EXPENSE to the Owner.
  - 1. Warranty Period: Provide warranty for a period of 5 YEARS from the date of treatment, signed by the Applicator and the Contractor.

1.07 MAINTENANCE SERVICE

- A. Continuing Service: Beginning at Final Completion, provide 12 months' continuing service including monitoring, inspection, and re-treatment for occurrences of termite activity. Provide a standard continuing service agreement. State services, obligations, conditions, terms for agreement period, and terms for future renewal options.



PART 2 - PRODUCTS

2.01 SOIL TREATMENT SOLUTION

- A. Termiticide: Use an emulsible concentrate insecticide for dilution with water specially formulated to prevent infestation by subterranean termites as recommended by the Southern Forest Experiment Station, Forest Insect Laboratory at Gulfport, Mississippi, and registered by the Bureau of Plant Industry for use in structural pest control work. Fuel oil will not be permitted as a diluent. Provide a working solution of one of the following chemical elements:
  - 1. Horizontal Barrier: Cypermethrin, Prevail or Talstar.
  - 2. Vertical Barrier: Fipronil.
- B. Other solutions may be used as recommended by Applicator and if acceptable to local and state governing authorities. Use soil treatment solutions that are not injurious to plants.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil per termiticide label requirements, interfaces with earthwork, slab and foundation work, landscaping, utility installation, and other conditions affecting performance of termite control.
- B. Proceed with application only after unsatisfactory conditions have been corrected.

3.02 APPLICATION, GENERAL

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

3.03 APPLYING SOIL TREATMENT

- A. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.
  - 1. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

- B. Prior to each application, the applicator shall notify the Contractor of the intended application and instruct the responsible person to notify construction workers and other site individuals to leave the treated area and not to return until chemical has been installed into the soil.
  - 1. Post warning signs in areas of application warning workers that soil poisoning has been applied. Remove signs when areas are covered by other construction.
  
- C. Application: Mix soil treatment termiticide solution to a uniform consistency. Use COLOR DYE MARKING AGENT to insure the area is treated. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute treatment evenly.
  - 1. Slabs-on-Grade and Basement Slabs: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
  - 2. Foundations: Adjacent soil, including soil along the entire inside perimeter of foundation walls; along both sides of interior partition walls; around plumbing pipes and electric conduit penetrating the slab; around interior column footers, piers, and chimney bases; and along the entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.
  - 3. Masonry: Treat voids.
  - 4. Penetrations: At areas where slabs will be penetrated.
  
- D. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.
  - 1. Allow a minimum of 12 hours for drying after application, before beginning concrete placement or other construction activities.
  
- E. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.
  
- F. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION

## MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-246-3

CODE: (SP)

DATE: 11/08/2010

SUBJECT: Sandbags and Rockbags

Section 907-246, Sandbags and Rockbags, is hereby added to and made a part of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction as follows.

### SECTION 907-246 -- SANDBAGS AND ROCKBAGS

**907-246.01--Description.** This item of work shall consist of the furnishing, installing, and maintaining sandbags and rockbags for the purpose of temporary erosion control by intercepting and slowing the flow of sediment-laden runoff water, or for use as a temporary dam.

**907-246.02--Materials.** The filler material for sandbags shall consist of a fine aggregate meeting the requirements of Subsection 703.02. The filler material for rockbags shall consist of a size 57 aggregate meeting the requirements of Subsection 703.03.

The bag material shall be woven polypropylene, polyethylene or polyamide fabric with a minimum unit weight of four (4) ounces per square yard. The bags shall be a minimum of 21 inches in length, 12 inches in width, and four (4) in thickness when filled.

**907-246.03--Construction Requirements.** Sandbags and rockbags shall be used to construct a berm/dam which will intercept sediment-laden storm water runoff from disturbed areas, create a retention pond, detain sediment, and release water in sheet flow. Sand or rock shall be placed in the bag so that at least the top six (6) inches of the bag is unfilled to allow for proper tying of the open end. Any subsequent rows of bags shall be offset one-half the length of the preceding row to provide a layered brick-type arrangement.

The sandbag and rockbag berm/dam installation shall be maintained in good condition by the Contractor. All necessary work and materials to maintain the integrity of the installation shall be provided until earthwork construction is complete and permanent erosion-control features are in place. The maintenance of the bags will not be paid for separately and will be included in the cost for sandbags or rockbags.

**907-246.04--Method of Measurement.** Sandbags and rockbags will be measured per linear foot or each.

Sandbags and rockbags measured by the linear foot shall be in accordance with the details in the erosion control drawing. The length of the sandbag or rockbag berm/dam will be measured end-to-end along the cross-section of the ditch in accordance with the erosion control drawing.

**907-246.05--Basic of Payment.** Sandbags and rockbags, measured as prescribed above, will be

paid for per linear foot or each, which prices shall be full compensation for furnishing bags, fine aggregate, size 57 aggregate, placement of bags, maintenance of the installation, removal and disposal of the sediment deposits and removal after construction has been completed, and for all labor, tools, equipment and incidentals necessary to complete the work.

Payment will be made under:

907-246-A: Sandbags - per linear foot or each

907-246-B: Rockbags - per linear foot or each

## MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-290-3

CODE: (SP)

DATE: 01/08/2009

SUBJECT: Flagpole

Section 907-290, Flagpole, is added to and made part of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction as follows:

### SECTION 907-290--FLAGPOLE

**907-290.01--Description.** This work shall consist of furnishing all materials and erecting a flagpole as indicated on the plans or established.

#### **907-290.02--Materials.**

**907-290.02.1--General.** Unless otherwise stipulated, the materials used in this construction, in addition to the general requirements of this Special Provision, shall conform to the applicable sections of the Standard Specifications.

**907-290.02.2--Concrete for Flagpole Footing.** Concrete for the flagpole footing shall conform to Class "B" Concrete, meeting the requirements of applicable subsections of Section 804 of the Standard Specifications.

**907-290.02.3--Flagpole.** The flagpole shall be an approved tapered aluminum flagpole, having an approximate 30-foot exposed height. The pole shall be complete with a 14 gauge aluminum ball gold finish finial, umbrella type revolving truck, tiedown cleat with matching (material) cover capable of being padlocked in position over the tiedown cleat, two No. 10 (5/16") polypropylene halyards with solid bronze swivel snaps per halyard, and ornamental base collar.

The pole shall be made from 6063T6 extruded aluminum tubing with approximately one inch every five to six feet straight taper, with a butt diameter of approximately six inches and top diameter of approximately three and one half inches and have an approved satin finish.

**907-290.02.4--Descriptive Data.** Six (6) copies of material descriptive data, in the form of brochures or shop drawings, shall be submitted for review and approval prior to installation of the materials.

**907-290.03--Construction Requirements.** The flagpole shall be erected plumb in an approved manner to the satisfaction of the Engineer and in accordance with the manufacturer's details and recommendations. Material excavated in flagpole construction shall be disposed of as directed by the Engineer.

**907-290.04--Method of Measurement.** Flagpole, complete in place and accepted, will be measured per each. Separate measurement for payment will not be made of any individual unit, operation, or incidental item involved in this construction.

**907-290.05--Basis of Payment.** Flagpole, measured as provided in Subsection 907-290.04, will be paid for at the contract unit price per each complete unit, which price shall be full compensation for furnishing all materials and supplies, for all excavation, backfilling and disposal of surplus material, and for any other work required to complete the flagpole installation.

Payment will be made under:

907-290-A: Flagpole - per each

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-304-13

CODE: (SP)

DATE: 06/06/2012

SUBJECT: Granular Courses

Section 907-304, Granular Courses, of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows.

**907-304.02--Materials.** After the first paragraph of Subsection 304.02.1 on page 183, add the following.

Crushed concrete meeting the requirements of Subsection 907-703.04.3 may be used in lieu of granular courses or crushed stone courses specified in the contract. This applies to base courses, shoulders, or other required construction on a prepared foundation.

**907-304.03--Construction Requirements.**

**907-304.03.5--Shaping, Compacting and Finishing.** Delete the sixth paragraph of Subsection 304.03.5 on page 185.

Delete the first table in Subsection 304.03.5 on page 186 and substitute the following.

Granular Material Class	Lot Average	Individual Test
7,8,9 or 10	97.0	93.0
5 or 6	99.0	95.0
3 or 4	100.0	96.0
1 or 2	102.0	98.0
Crushed Courses*	99.0	95.0

\* When placed on filter fabric on untreated subgrade, the individual tests and the average of the five (5) tests shall equal or exceed the following values.

Lot Average	Individual Test
96.0	92.0

**907-304.05--Basis of Payment.** Add the “907” prefix to the pay items listed on page 187.

**MISSISSIPPI DEPARTMENT OF TRANSPORTATION**

**SUPPLEMENT TO SPECIAL PROVISION NO. 907-401-2**

**DATE:** 12/17/2013

**SUBJECT:** Hot Mix Asphalt (HMA)

Before the first sentence on page 1, add the following.

**907-401.02.3.1–General.** Delete the second paragraph of Subsection 401.02.3.1 on page 239, and substitute the following.

The total amount of crushed limestone aggregate for mixtures, excluding shoulders, when used in the top lift, shall not exceed 50 percent of the total combined aggregate by weight.

Delete the table in Subsection 401.02.3.1 on page 240 and substitute the following.

Asphalt Mixture	Maximum Percentage of RAP by total weight of mix
4.75 mm	0
9.5 mm	20*
12.5 mm Surface Lift	20*
12.5 mm Underlying Lift	30
19 mm	30
25 mm	30

\* At a minimum, RAP shall be processed and/or screened such that the RAP material size does not exceed the nominal maximum sieve size for the mixture specified.

**907-401.02.4--Substitution of Mixture.** Delete the table in Subsection 401.02.4 on page 242, and substitute the following.

Mixture	Single Lift Laying Thickness Inches	
	Minimum	Maximum
25 mm	3	4
19 mm	2¼	3½
12.5 mm	1½	2½
9.5 mm	1	1½
4.75 mm	½	¾

After Subsection 907-401-02.6.2 on page 2, add the following.

**907-401.02.6.4.1--Roadway Density.** Delete subparagraphs 1., 2., & 3. on page 251 and substitute the following.



1. For all leveling lifts, when full lane width and with a thickness as specified in the table in Subsection 401.02.4, the required lot density shall be 92.0 percent of maximum density.
2. For all single lift overlays, with or without leveling and/or milling, the required lot density shall be 92.0 percent of maximum density.
3. For all multiple lift overlays of two (2) or more lifts excluding leveling lifts, the required lot density of the bottom lift shall be 92.0 percent of maximum density. The required lot density for all subsequent lifts shall be 93.0 percent of maximum density.
4. For all pavements on new construction, the required lot density for all lifts shall be 93.0 percent of maximum density.

Delete Subsections 401.02.6.5 and 401.02.6.6 on pages 253 thru 257 and substitute the following.

**907-401.02.6.5--Blank.**

**907-401.02.6.6--Blank.**

**907-401.02.6.7--Surface Correction.** Delete the paragraph in Subsection 401.02.6.7 on page 257, and substitute the following.

Corrective work to sections exceeding short continuous interval thresholds reported by ProVal, as described in Subsection 907-403.03.2.1, shall consist of diamond grinding in accordance with these specifications or methods approved by the Engineer. All surface areas corrected by grinding shall be sealed with a sealant approved by the Engineer.

**907-401.02.6.8--Acceptance Procedure for Pavement Smoothness Using Mean Roughness Index (MRI).** When compaction is completed, the lift shall have a uniform surface and be in reasonably close conformity with the line, grade and cross section shown on the plans.

The smoothness of the surface lift will be determined by using an Inertial Profiling System (IPS) to measure and record roughness data in each designated location. Roughness data for each longitudinal profile will be reported as a Mean Roughness Index (MRI). MRI is calculated by averaging the International Roughness Index (IRI) values from the two individual wheelpath profiles. The surface shall be tested and corrected to a smoothness index as described herein with the exception of those locations or specific projects that are excluded from smoothness testing with an IPS.

The smoothness of the surface lift will be determined for traffic lanes, auxiliary lanes, climbing lane and two-way turn lanes. Areas excluded from a smoothness test with the IPS are acceleration and deceleration lanes, tapered sections, transition sections for width, shoulders, crossovers, ramps, side street returns, etc. The roadway pavement on bridge replacement projects having 1,000 feet or less of pavement on each side of the structure will be excluded from a smoothness test. Pavement on horizontal curves having a radius of less than 1,000 feet at the centerline and pavement within the super elevation transition of such curves are excluded from smoothness testing. Smoothness testing shall terminate 264 feet from each transverse joint that

separates the pavement from a bridge deck, bridge approach slab or existing pavement not constructed under the contract. This shall apply to any other exceptions including, but not limited to, railroad crossings and manholes. Segments containing a considerable amount of encroachments such as intersections, manholes, curb and gutter sections, etc. may be excluded at the Project Engineer's discretion.

Initial smoothness measurements shall take place no more than 72 hours following placement of surface and must be performed at the posted speed limit or 50 miles per hour ( $\pm 5$  mile per hour), whichever is lower. This speed requirement will be waived for all lightweight profilers. Measurements will be made in both wheel paths of exterior and interior lanes. The wheel paths shall be designated as being located three feet (3') and nine feet (9') from centerline or longitudinal joint, respectively. Beginning and ending latitude and longitude coordinates shall be required on each smoothness surface test. Testing will also be required on sections that have been surface corrected. No smoothness testing shall be performed when there is moisture of any kind on the pavement surface. Any additional testing shall meet the requirements of Subsection 907-403.03.2.

The surface lift will be accepted on a continuous interval basis for pavement smoothness. Continuous reporting is based upon all MRI values for a specified running interval. These values are averaged and presented at the midpoint of the specified running interval. The last 15 feet of a day's lift may not be obtainable until the lift is continued and for this reason may be included in the subsequent section.

Areas of localized roughness exceeding the continuous 25-foot interval threshold described in Subsection 907-403.03.2.1 shall be corrected regardless of the 528-foot interval MRI value of the section. Surface correction by grinding shall be performed in accordance with Subsection 401.02.6.7. The Contractor shall also make other necessary surface corrections to ensure that the final mean roughness index of the section meets the requirements of Subsection 907-403.03.2.

Continuous sections exceeding the accepted long interval MRI value shall be corrected as specified in Subsection 403.03.4. All such corrections shall be performed at no additional costs to the State. Scheduling and traffic control will be the responsibility of the Contractor with approval of the Engineer. All tests and corrections shall be in accordance with AASHTO R 54-10, Accepting Pavement Ride Quality When Measured Using Inertial Profiling Systems.

#### **907-401.02.6.9--High Speed Inertial Profiling System.**

**907-401.02.6.9.1--General.** The IPS, furnished and operated by the Contractor under the supervision of the Engineer or the Engineer's representative, shall be a dual laser high speed or lightweight vehicle meeting the requirements of AASHTO M 328-10, Standard Specification for Inertial Profiler.

**907-401.02.6.9.2--Mechanical Requirements.** The IPS should function independent of vehicle suspension and speed with an operational range of 15-70 mph (for high speed profilers only) and must collect data at a sample interval of no more than three inches (3"). All IPSs, operators, and combinations thereof shall be verified in accordance with AASHTO R 56-10, Standard Practice for Certification of Inertial Profiler Systems and AASHTO R 57-10, Operating Inertial Profiler Systems.

**907-401.02.6.9.3--Computer Requirements.** The computer measurement program must be menu driven, Windows compatible, and able to produce unfiltered profiler runs in any one of the following file formats: University of Michigan's Transportation Research Institute's (UMTRI) Engineering Research Division (\*.erd) file, ProVAL's Pavement Profile (\*.ppf) file, or Ames Engineering's (\*.adf) file format. The computer shall have the ability to display and print data on site for verification and shall have the ability to save and transfer data via Universal Serial Bus (USB) flash drive, which shall be provided by the Contractor.

All profiler runs must be named in the following format for acceptance by the Project Engineer:

- County\_Route\_Direction\_Lane\_BeginStation\_EndStation

In addition to manufacturers software; the latest version of FHWA's ProVAL software shall be installed on the IPS computer. ProVAL software is available for free download at <http://www.roadprofile.com>.

**907-401.03.1.2--Tack Coat.** Delete the three sentences of Subsection 401.03.1.2 on page 259, and substitute the following.

Tack coat shall be applied to previously placed HMA and between lifts, unless otherwise directed by the Engineer. Tack coat shall be applied with a distributor spray bar. A hand wand will only be allowed for applying tack coat on ramp pads, irregular shoulder areas, median crossovers, turnouts, or other irregular areas. Bituminous materials and application rates for tack coat shall be as specified in Table 410-A on page 293. Construction requirements shall be in accordance with Subsection 407.03 of the Standard Specifications.

**907-401.03.1.4--Density.** Delete the first sentence of the first paragraph of Subsection 401.03.1.4 on page 259 and substitute the following.

The lot density for all dense graded pavement lifts, except as provided below for preleveling, wedging [less than fifty percent (50%) of width greater than minimum lift thickness], ramp pads, irregular shoulder areas, median crossovers, turnouts, or other areas where the established rolling pattern cannot be performed, shall not be less than the specified percent (92.0% or 93.0%) of the maximum density based on AASHTO Designation: T 209 for the day's production. For all leveling lifts, when full lane width and with a thickness as specified in the table in Subsection 401.02.4, the required lot density shall be 92.0 percent of maximum density.

**907-401.03.9--Material Transfer Equipment.** Delete the paragraph in Subsection 401.03.9 on page 264 and substitute the following.

Excluding the areas mentioned below, the material transferred from the hauling unit when placing the top lift, or the top two (2) lifts of a multi-lift HMA pavement with density requirements, shall be remixed prior to being placed in the paver hopper or insert by using an approved Materials Transfer Device. Information on approved devices can be obtained from the State Construction Engineer. Areas excluded from this requirement include: leveling courses, temporary work of short duration, detours, bridge replacement projects having less than 1,000 feet of pavement on each side of the structure, acceleration and deceleration lanes less than 1,000 feet in length, tapered sections, transition sections for width, shoulders less than 10 feet in width, crossovers, ramps, side street returns and other areas designated by the Engineer.

After Subsection 401.03.13 on page 266, add the following.

**907-401.03.14--Shoulder Wedge.** The Contractor shall attach a device to the screed of the paver that confines the material at the end gate and extrudes the asphalt material in such a way that results in a compacted wedge shape pavement edge of approximately 30 degrees, but not steeper than 35 degrees. The device shall maintain contact between itself and the road shoulder surface and allow for automatic transition to cross roads, driveways, and obstructions. The device shall be used to constrain the asphalt head reducing the area by 10% to 15% increasing the density of the extruded profile. Conventional single plate strike off shall not be used.

The device shall be TransTech Shoulder Wedge Maker, the Advant-Edge, or a similar approved equal device that produces the same wedge consolidation results. Contact information for these wedge shape compaction devices is the following:

1. TransTech Systems, Inc.  
1594 State Street  
Schenectady, NY 12304  
800-724-6306  
[www.transtechsys.com](http://www.transtechsys.com)
  
2. Advant-Edge Paving Equipment, LLC  
P.O. Box 9163  
Niskayuna, NY 12309-0163  
518-280-6090  
Contact; Gary D. Antonelli  
Cell: 518-368-5699  
email: [garya@nycap.rr.com](mailto:garya@nycap.rr.com)  
Website: [www.advantedgepaving.com](http://www.advantedgepaving.com)

Before using a similar device, the Contractor shall provide proof that the device has been used on previous projects with acceptable results, or construct a test section prior to the beginning of work and demonstrate wedge compaction to the satisfaction of the Engineer. Short sections of handwork will be allowed when necessary for transitions and turnouts, or otherwise authorized by the Engineer.

## MISSISSIPPI DEPARTMENT OF TRANSPORTATION

**SPECIAL PROVISION NO. 907-401-2**

**CODE: (IS)**

**DATE: 11/04/2005**

**SUBJECT: Hot Mix Asphalt (HMA)**

Section 401, Hot Mix Asphalt (HMA) - General, of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows:

Delete in toto Subsection 401.02.6.2 on pages 248 and 249, and substitute:

**907-401.02.6.2--Assurance Program for Mixture Quality.** The Engineer will conduct a quality assurance program. The quality assurance program will be accomplished as follows:

- 1) Conducting verification tests.
- 2) Validate Contractor test results.
- 3) Periodically observing Contractor quality control sampling and testing.
- 4) Monitoring required quality control charts and test results.
- 5) Sampling and testing materials at any time and at any point in the production or laydown process.

The rounding of all test results will be in accordance with Subsection 700.04.

The Engineer will conduct verification tests on samples taken by the Contractor under the direct supervision of the Engineer at a time specified by the Engineer. The frequency will be equal to or greater than ten percent (10%) of the tests required for Contractor quality control and the data will be provided to the Contractor within two asphalt mixture production days after the sample has been obtained by the Engineer. At least one sample shall be tested from the first two days of production. All testing and data analysis shall be performed by a Certified Asphalt Technician-I (CAT-I) or by an assistant under the direct supervision of the CAT-I. Certification shall be in accordance with the *MDOT HMA Technician Certification Program* chapter in the Materials Division Inspection, Testing, and Certification Manual. The Department shall post a chart giving the names and telephone numbers for the personnel responsible for the assurance program.

The Engineer shall be allowed to inspect Contractor testing equipment and equipment calibration records to confirm both calibration and condition. The Contractor shall calibrate and correlate all testing equipment in accordance with the latest versions of the Department's Test Methods and AASHTO Designation: R 18.

Random differences between the Engineer's verification tests and the current running average of four quality control tests at the time of obtaining the verification sample will be considered acceptable if within the following limits:

Item	Allowable Differences
Sieve - % Passing	
3/8-inch and above	6.0
No. 4	5.0
No. 8	4.0
No. 16, for 4.75 mm mixtures ONLY	3.5
No. 30	3.5
No. 200	2.0
AC Content	0.4
Specimen Bulk SG, Gmb @ $N_{Design}$	0.030
Maximum SG, Gmm	0.020

If four quality control tests have not been tested prior to the time of the first verification test, the verification test results will be compared to the average of the preceding quality control tests. If the verification test is the first material tested on the project or if a significant process adjustment was made just prior to the verification test, the verification test results will be compared to the average of four subsequent quality control test results. For all other cases after a significant process adjustment, the verification test results will be compared to the average of the preceding quality control tests (taken after the adjustment) as in the case of a new project start-up when four quality control tests are not available.

In the event that; 1) the comparison of the Contractor’s running average quality control data and Engineer’s quality assurance verification test results are outside the allowable differences in the above table, or 2) if a bias exists between the results, such that one of the results is predominately higher or lower than the other, and the Engineer’s results fail to meet the JMF control limits, the Engineer will investigate the reason immediately. As soon as the need for an investigation becomes known, the Engineer will increase the quality assurance sampling rate to the same frequency required for Contractor testing. The additional samples obtained by the Engineer may be used as part of the investigation process or for routine quality assurance verification tests. The Engineer's investigation may include testing of the remaining quality control split samples, review and observation of the Contractor's testing procedures and equipment, and a comparison of split sample test results by the Contractor quality control laboratory, Department quality assurance laboratory and the Materials Division laboratory. The procedures outlined in the latest edition of MDOT’s Field Manual for HMA may be used as a guide for the investigation. In the event that the Contractor’s results are determined to be incorrect, the Engineer's results will be used for the quality control data and the appropriate payment for the mixture will be based on the procedures specified in Subsection 401.02.5.8(j).

The Engineer will periodically witness the sampling and testing being performed by the Contractor. The Engineer, both verbally and in writing, will promptly notify the Contractor of any observed deficiencies. When differences exist between the Contractor and the Engineer which cannot be resolved, a decision will be made by the State Materials Engineer, acting as the referee. The Contractor will be promptly notified in writing of the decision. If the deficiencies are not corrected, the Engineer will stop production until corrective action is taken.

## MISSISSIPPI DEPARTMENT OF TRANSPORTATION

**SPECIAL PROVISION NO. 907-401-6**

**CODE: (SP)**

**DATE: 08/21/2012**

**SUBJECT: Warm Mix Asphalt (WMA)**

Section 401, Hot Mix Asphalt (HMA) - General, of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction as amended by this special provision is applicable to Warm Mix Asphalt Only.

### **907-401.01--Description.**

These specifications include general requirements that are applicable to Warm Mix Asphalt (WMA).

This work consists of the construction of one or more lifts of WMA in accordance with Section 401 for Hot Mix Asphalt, with the exceptions set forth in this special provision. The WMA shall meet the specific requirements for the mixture to be produced and placed in reasonably close conformity with the lines, grades, thicknesses and typical sections shown on the plans or established by the Engineer.

### **907-401.02--Materials.**

**907-401.02.2--WMA Products and Processes.** The Department will maintain a list of qualified WMA products and processes. No product or process shall be used unless it appears on this list.

The Contractor may propose other products or processes for approval by the Product Evaluation Committee. Documentation shall be provided to demonstrate laboratory performance, field performance, and construction experience.

### **907-401.03--Construction Requirements.**

**907-401.03.1.1--Weather Limitations.** The air and pavement temperature at the time of placement shall equal or exceed 40°F, regardless of compacted lift thickness.

**907-401.03.8--Preparation of Mixture.** Warm mix asphalt is defined as a plant produced asphalt mixture that can be produced and constructed at lower temperatures than typical hot mix asphalt. Typical temperature ranges of non-polymer modified, WMA produced by foaming the asphalt binder at the plant are typically 270°F to 295°F at the point of discharge of the plant. Typical temperature ranges of polymer modified, WMA produced by foaming the asphalt binder at the plant are typically 280°F to 305°F at the point of discharge of the plant. WMA produced by addition of a terminal blended additive may allow the producer to reduce the temperatures below 270°F as long as all mixture quality and field density requirements are met. Production temperatures at the plant may need to be increased or decreased due to factors such as material

characteristics, environmental conditions, and haul time to achieve mixture temperatures at the time of compaction in which uniform mat density can be achieved.



**MISSISSIPPI DEPARTMENT OF TRANSPORTATION**

**SUPPLEMENT TO SPECIAL PROVISION NO. 907-403-4**

**DATE:**        **12/17/2013**

**SUBJECT:**   **Hot Mix Asphalt (HMA)**

Before Subsection 907-403.05.2 on page 1, add the following:

**907-403.03--Construction Requirements.**

**907-403.03.2--Smoothness Tolerances.** Delete the table, footnotes, and first six paragraphs of Subsection 403.03.2 on page 266 & 267, and substitute the following.

	Lower* & Leveling Lifts	Lower* Intermediate Lift	Top Intermediate Lift	Surface Lift
Maximum deviation from grade and cross section at any point .....	1/2"	3/8"	1/4"	1/4"
Maximum deviation from A 10 foot straight edge.....	3/8"	1/4"	1/8"	1/8"

Note: Where more than four (4) lifts of HMA are required, all lifts, excluding the top three (3) lifts, shall meet the requirements of the lower lift.

\* When tested longitudinally from a stringline located equidistant above points 50 feet apart, the distance from the stringline to the surface at any two points located 12 1/2 feet apart shall not vary one from the other more than the maximum deviation allowed above from a 10-foot straight edge.

Delete the last paragraph of Subsection 403.03.2 at the bottom of page 268, the table at the top of page 269, and the first, second and third full paragraphs on page 269, and substitute the following.

Sections(s) or portions thereof representing areas excluded from a smoothness test with the High Speed Inertial Profiling System (IPS) shall also be excluded from consideration for a contract price adjustment for rideability.

Any contract price adjustment for rideability will be applied on a continuous basis to the pay tonnage, determined in accordance with Subsections 907-401.02.6.8 and 403.04, for the section(s) or portions thereof for which an adjustment is warranted.

Contract price adjustments for rideability shall only be applicable to the surface lift and furthermore to only the long continuous section(s) or portions of the long continuous section(s) of the surface lift that require smoothness be determined by using a profiling device.

**907-403.03.2.1--Smoothness Tolerances for Mean Roughness Index (MRI).** Smoothness tolerances shall be applied to asphalt pavements based on the following pavement categories.

**Category A** applies to the following pavement constructions:

- New construction
- Construction with three (3) or more lifts
- Mill and two (2) or more lifts

**Category B** applies to the following pavement constructions:

- Mill and one (1) lift
- Two (2) lift overlays without milling

**Category C** applies to the following pavement constructions:

- Single lift overlay without milling

**NOTE:** Spot Leveling does not count as a lift. Full width / continuous leveling courses will be considered a lift. Leveling lifts that do not have a minimum thickness of 3/4" across the entire lane width will not be considered a lift.

For all projects, the surface lift smoothness data shall be reported by two MRI methods:

1. A continuous 528-foot long interval MRI report
2. A continuous 25-foot short interval MRI report

Areas of the surface lift with localized roughness greater than 160 inches per mile as determined by the continuous short interval report will be identified for correction by the Project Engineer.

**Category A** projects shall have a long interval surface MRI of not more than 60 inches per mile.

**Category B** projects shall have a long interval surface MRI of not more than 70 inches per mile.

**Category C** projects shall have the existing surface profiled at no additional cost to the State. The finished surface lift shall meet the following requirements:

- A 50% improvement in MRI from the existing surface
- or
- 80 inches per mile long interval surface MRI value whichever value is higher.

In the case that 50% of the existing surface MRI is greater than 80 inches per mile, the short continuous threshold shall be increased from 160 inches per mile by the difference between 50% of the existing surface MRI and 80 inches per mile.

When a project has multiple lifts, the lift underlying the surface lift shall have a MRI of no more than 10 inches/mile more than the surface lift threshold for both long and short continuous intervals. Category B projects containing multiple lifts must meet the Category C percent improvement requirement for the underlying lift. Corrective action must be taken on those segments that do not meet this requirement. No unit price adjustment will be applied on any underlying lift.

For Category A and B projects, a unit price increase will be added when the MRI for the final surface lift is less than or equal to fifty inches per mile (50.0 inches / mile) on the long interval report. These Projects will be considered for incentive pay based on the following guidelines for the long interval surface lift MRI.

Mean Roughness Index inches / mile	Contract Price Adjustment percent of Asphalt unit bid price
Less than 35.0	108
35.1 to 40.0	106
40.1 to 45.0	104
45.1 to 50.0	102
50.1 to Required Surface MRI	100

For Category C projects, a unit price increase will be added when the MRI for the final surface lift is less than or equal to fifty inches per mile (50.0 inches / mile) on the long interval report. These Projects will be considered for incentive pay based on the following guidelines for the long interval surface lift MRI.

Mean Roughness Index inches / mile	Contract Price Adjustment percent of HMA unit bid price
Less than or equal to 50.0	103
50.1 to Required Surface MRI	100

No incentive will be allowed if the MRI value from the newly paved surface is greater than the existing surface.

In addition to the above pay incentive factors, a project may be subject to a disincentive when the Long Continuous Interval MRI for the surface exceeds the allowable tolerance. This applies to all project categories and will correlate to the maximum allowed Long Continuous Interval MRI.

Mean Roughness Index inches / mile	Contract Price Adjustment percent of HMA unit bid price
Above 20.0 Over	Remove And Replace
15.1 to 20.0 Over	80
10.1 to 15.0 Over	85
5.1 to 10.0 Over	90
0.1 to 5.0 Over	95
Required Surface MRI	100

Segment(s) or portions thereof representing areas excluded from a smoothness test shall also be excluded from consideration for a contract price adjustment for rideability. Corrective action must be taken on those sections that exceed the 'Remove and Replace' threshold on the Long Continuous Interval as directed by the Project Engineer. Sections that fall into this requirement may also need corrective action on both the preceding and following 264-foot sections as to conform to a complete 528-foot Long Continuous Interval. The minimum remove and replace length will be 528 feet (0.1 mile). Additional smoothness testing shall be required on sections following replacement and will be required to meet *at least* the maximum surface MRI short of 'Remove and Replace'.

The above pay factors will be applied in conjunction with the Long Continuous Histogram Chart from ProVAL's Smoothness Assurance Module. The price adjustments for rideability will be tabulated in MDOT's Pay Incentive spreadsheet on the basis of a theoretical tonnage of 110 lbs/yd<sup>2</sup>\*inch thickness (pounds per square yard \* inch thickness) and 12-foot travel lanes, determined in accordance with Subsections 401.02.6.5 and 403.04, for the segment(s) or portions thereof for which an adjustment is warranted.

Delete Subsection 403.03.5.5 on page 273 and substitute the following.

**907-403.03.5.5--Preliminary Leveling.** All irregularities of the existing pavement, such as ruts, cross-slope deficiencies, etc., shall be corrected by spot leveling, skin patching, feather edging or a wedge lift in advance of placing the first overall lift.

**907-403.04--Method of Measurement.** After the first paragraph of Subsection 403.04 on page 274, add the following.

The pay quantities for each individual job mix formula (JMF) will be calculated using the approved JMF maximum specific gravity (Gmm) and the following formulas.

When the composite mixture has a maximum specific gravity of 2.540 or less,

$$T_p = T_w$$

When the composite mixture has a maximum specific gravity greater than 2.540,

$$T_p = T_w((100-(((Gmm*A*B)-C)/(Gmm*A*B))*100))/100$$

Where:

- Tp = Total tonnage for payment
- Tw = Total tonnage weighed, used and accepted
- Gmm = Maximum Specific Gravity of the approved composite asphalt mixture
- A = 46.725 lbs/yd<sup>2</sup>/in
- B = 0.93 = 93% density
- C = 110.374 lbs/yd<sup>2</sup>/in = Theoretical density at 2.540 Gmm

**MISSISSIPPI DEPARTMENT OF TRANSPORTATION**

**SPECIAL PROVISION NO. 907-403-4**

**CODE: (IS)**

**DATE: 11/04/2005**

**SUBJECT: Hot Mix Asphalt (HMA)**

Section 403, Hot Bituminous Pavement, of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows:

**907-403.05.2--Pay Items.** Add the "907" prefix to the pay items listed on page 275 & 276.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-403-12

CODE: (SP)

DATE: 08/21/2012

SUBJECT: Warm Mix Asphalt (WMA)

Section 403, Hot Bituminous Pavement, of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction as amended by this special provision is applicable to Warm Mix Asphalt Only.

**907-403.01--Description.** This work consists of constructing one or more lifts of Warm Mix Asphalt (WMA) pavement in accordance with the requirements of Section 403 for Hot Mix Asphalt, with the exceptions set forth in this special provision. The WMA shall meet the requirements of this section and placed in reasonably close conformity with the lines, grade, thicknesses, and typical cross sections shown on the plans or established by the Engineer.

**907-403.04--Method of Measurement.** Warm mix asphalt will be measured by the ton. The weight of the composite mixture shall be determined in accordance with the provisions of Subsection 401.03.2.1.11.

**907-403.05--Basis of Payment.** Subject to the adjustments set out in Subsections 401.02.6.3, 401.02.6.4, 401.02.6.5, 401.02.6.6 & 403.03.2, warm mix asphalt, measured as prescribed above, will be paid for at the contract unit price per ton for each lift of pavement specified in the bid schedule and shall be full compensation for completing the work.

**907-403.05.2--Pay Items.** After the last pay item listed on page 276, add the following:

907-403-M: Warm Mix Asphalt, (1), (2) - per ton  
Type Mixture

907-403-N: Warm Mix Asphalt, (1), (3), Leveling - per ton  
Type Mixture

907-403-O: Warm Mix Asphalt, (1), (4), Trench Widening - per ton  
Type Mixture

907-403-P: Warm Mix Asphalt, HT, (3), Polymer Modified - per ton  
Mixture

907-403-Q: Warm Mix Asphalt, HT, (3), Polymer Modified, Leveling - per ton  
Mixture

**MISSISSIPPI DEPARTMENT OF TRANSPORTATION**

**SPECIAL PROVISION NO. 907-407-1**

**CODE: (SP)**

**DATE: 02/26/2008**

**SUBJECT: Tack Coat**

Section 407, Tack Coat, of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows:

**907-407.02.1--Bituminous Material.** Delete the second sentence of the first paragraph of Subsection 407.02.1 on page 281, and substitute the following:

When not specified, the materials shall be as specified in Table 410-A on page 293.

**907-407.03.3--Application of Bituminous Material.** Delete the first paragraph of Subsection 407.03.3 on page 281, and substitute the following.

Tack coat shall be applied with a distributor spray bar. A hand wand will only be allowed for applying tack coat on ramp pads, irregular shoulder areas, median crossovers, turnouts, or other irregular areas. Bituminous materials and application rates for tack coat shall be as specified in Table 410-A on page 293. Tack coat shall not be applied during wet or cold weather, after sunset, or to a wet surface. Emulsions shall be allowed to "break" prior to superimposed construction.

**907-407.05--Basis of Payment.** Delete the pay item at the end of Subsection 407.05 on page 282, and substitute the following:

907-407-A: Asphalt for Tack Coat \*

- per gallon

\* Grade may be specified



**MISSISSIPPI DEPARTMENT OF TRANSPORTATION**

**SPECIAL PROVISION NO. 907-601-1**

**CODE: (IS)**

**DATE: 08/29/2007**

**SUBJECT: Structural Concrete**

Division 600, Incidental Construction, of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows:

After the heading **DIVISION 600 - INCIDENTAL CONSTRUCTION**, add the following:

Unless otherwise specified, all testing of Portland cement concrete in Division 600 shall be in accordance with the requirements of Subsection 907-601.02.1.

**907-601.02--Materials.**

**907-601.02.1--General.** Delete the second and third sentence of the first paragraph of Subsection 601.02.1 on page 348, and substitute the following:

Sampling and testing will be in accordance with TMD-20-04-00-000 or TMD-20-05-00-000, as applicable.

**907-601.03.6.3--Removal of Falsework, Forms, and Housing.** Delete the first paragraph, the table and second paragraph of Subsection 601.03.6.3 on pages 349 and 350, and substitute the following:

The removal of falsework, forms, and the discontinuance of heating, shall be in accordance with the provisions and requirements of Subsection 907-804.03.15, except that the concrete shall conform to the following compressive strength requirements:

Wingwall and Wall Forms not Under Stress .....	1000 psi
Wall Forms under Stress .....	2200 psi
Backfill and Cover clear .....	2400 psi

In lieu of using concrete strength cylinders to determine when falsework, forms, and housings can be removed, an approved maturity meter may be used to determine concrete strengths by inserting probes into concrete placed in a structure. The minimum number of maturity meter probes required for each structural component shall be in accordance with Subsection 907-804.03.15. Procedures for using the maturity meter and developing the strength/maturity relationship shall follow the requirements of Subsection 907-804.03.15. Technicians using the maturity meter or calculating strength/maturity graphs shall meet the requirements of Subsection 907-804.03.15.

**907-601.05--Basis of Payment.** Add the “907” prefix to the pay items listed on page 352.

## MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-603-8

CODE: (IS)

DATE: 05/12/2008

SUBJECT: Culverts and Storm Drains

Section 603, Culverts and Storm Drains, of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows.

### **907-603.03--Construction Requirements.**

**907-603.03.2--Bedding.** After the first paragraph of the Subsection 603.03.2 on page 356, add the following:

Non-rigid pipe used in cross drains and storm drains shall have a Class B bedding. Non-rigid pipe used in side drains shall have a Class C bedding. No separate measurement will be made for pipe bedding. Costs associated with pipe bedding shall be included in the cost of the pipe.

### **907-603.03.4--Joining Conduit.**

**907-603.03.4.1--Storm Drainage.** Delete the first sentence of the seventh paragraph of Subsection 603.03.4.1 on page 358, and substitute the following:

Flexible steel conduits shall be firmly joined by coupling bands.

**907-603.03.7--Backfilling.** After the first paragraph of the Subsection 603.03.7 on page 360, add the following:

Backfill of non-rigid corrugated polyethylene and poly (vinyl chloride) (PVC) pipe used in cross drains and storm drains shall be performed using one of the following methods:

1. Flowable fill meeting the requirements of Section 631 of the Standard Specifications. If flowable fill is used, care shall be taken to prevent the pipe from “floating”.
2. Crushed stone aggregate meeting the requirements of Subsection 703.04.3 of the Standard Specification.

No separate measurement will be made for backfilling pipe. Costs associated with backfilling pipe will be included in the cost of the pipe.

**907-603.05--Basis of Payment.** Add the “907” prefix to pay item nos. 603-ALT, 603-MA thru 603-MH, 603-NA thru 603-NL, 603-PE, and 603-PVC on pages 364 thru 366.

**MISSISSIPPI DEPARTMENT OF TRANSPORTATION**

**SPECIAL PROVISION NO. 907-618-9**

**CODE: (IS)**

**DATE: 11/08/2012**

**SUBJECT: Placement of Temporary Traffic Stripe**

Section 618, Maintenance of Traffic and Traffic Control Plan, of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows.

**907-618.03.3--Safe Movement of Traffic.** Delete subparagraphs (2) and (3) of Subsection 618.03.3 on page 416, and substitute the following.

- (2) Temporary edge lines on projects requiring shoulders constructed of granular material may be delayed for a period not to exceed three (3) days.

Temporary edge lines placed on the final pavement course of projects requiring paved shoulders with surface treatment may be placed on the adjacent shoulder in as near the permanent location as possible until the surface treatment is placed. When the edge lines are obliterated by the placement of the surface treatment, the edge lines shall be placed in the permanent stripe location. The replacement of edge lines may be delayed for a period not to exceed three (3) days for a two or three-lane roads.

Delete the first sentence of next to last paragraph of Subsection 618.03.3 on page 416 and substitute the following.

Permanent pavement markings are to be applied no sooner than 10 days nor later than 45 days after placement of the final lift of pavement.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-626-24

CODE: (SP)

DATE: 11/08/2011

SUBJECT: Thermoplastic Blue ADA Markings

Section 626, Thermoplastic Traffic Markings, of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows:

**907-626.02--Materials.** After the first paragraph of Subsection 626.02.1 on page 443, add the following:

Blue-ADA thermoplastic marking material shall meet the requirements of Subsection 720.02 with the exception that the color shall be blue-ADA. In lieu of the above material requirements, the Contractor may use hot applied thermoplastic materials meeting the satisfaction of the Engineer.

**907-626.04--Method of Measurement.** After the last paragraph of Subsection 626.04 on page 446, add the following:

For pay items indicated to be 4-inch equivalents, the detail traffic stripe will be measured by the linear foot from end-to-end of individual stripes. Measurements will be made along the surface of each stripe and will exclude skip intervals where skips are specified. Stripes more than four inches in width will be converted to equivalent lengths of four-inch stripe. Legend, which is to include railroad markings, pedestrian crosswalks and stop lines, will be measured by the square foot or linear foot. Pay areas of individual letters and symbols will usually be shown on the plans and measured by the square foot. Transverse railroad bands, pedestrian crosswalks and stop lines will generally be measured by the linear foot, in which case, stripes more than four inches in width will be converted to equivalent lengths of four-inch widths. Cold Plastic Legend, Handicap Symbol of the color specified will be measured per each as determined by actual count in place.

**907-626.05--Basis of Payment.** Delete the first sentence under Subsection 626.05 on page 446 and substitute the following:

Thermoplastic traffic markings will be paid for at the contract unit price per mile, linear foot, square foot or each, as applicable, which shall be full compensation for completing the work.

Add the following pay items after pay item 626-G on page 446.

- 907-626-G: Thermoplastic Detail Stripe, Blue-ADA - per linear foot
- 907-626-H: Thermoplastic Legend, Blue-ADA - per square foot
- 907-626-H: Thermoplastic Legend, Handicap Symbol, Color - per each

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-626-25

CODE: (IS)

DATE: 11/13/2012

SUBJECT: Thermoplastic Traffic Markings

Section 626, Thermoplastic Traffic Markings, of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows.

**907-626.01--Description.** After the last sentence of the first paragraph of Subsection 626.01 on page 443, add the following.

All pavement marking material, excluding edge lines over rumble strips, shall be applied using the extrusion/ribbon method. Edge lines placed over rumble strips shall be applied using the atomization/spray method.

**907-626.03.1.1--Equipment.** After the second paragraph of Subsection 626.03.1.1 on page 444, add the following.

When edge lines are placed over rumble strips, the equipment must be able to apply the marking material using the atomization/spray method instead of extrusion/ribbon method.

**907-626.03.1.2--Construction Details.** Delete the second sentence of the first full paragraph of Subsection 626.03.1.2 on page 445, and substitute the following.

Unless otherwise specified in the plans or contract documents, the thickness shall be 90 mils for edge lines, center lines, lane lines, barrier lines and detail stripe including gore markings, and 120 mils for crosswalks, stop lines, and railroad, word and symbol markings.

After the last sentence of the third full paragraph of Subsection 626.03.1.2 on page 445, add the following.

When double drop thermoplastic stripe is called for in the contract, additional beads by the drop-on method shall be applied as follows.

Class A glass beads at a rate of not less than three pounds of beads per 100 feet of six-inch stripe.  
Class B glass beads at a rate of not less than three pounds of beads per 100 feet of six-inch stripe.

The Class B glass beads shall be applied to the newly placed stripe first, followed by the application of the Class A glass beads.

**907-626.05--Basis of Payment.** Delete the pay items listed on page 446 and substitute the following.

907-626-A: 6" Thermoplastic* Traffic Stripe, Skip White	- per linear foot or mile
907-626-B: 6" Thermoplastic* Traffic Stripe, Continuous White	- per linear foot or mile
907-626-C: 6" Thermoplastic* Edge Stripe, Continuous White	- per linear foot or mile
907-626-D: 6" Thermoplastic* Traffic Stripe, Skip Yellow	- per linear foot or mile
907-626-E: 6" Thermoplastic* Traffic Stripe, Continuous Yellow	- per linear foot or mile
907-626-F: 6" Thermoplastic* Edge Stripe, Continuous Yellow	- per linear foot or mile
907-626-G: Thermoplastic* Detail Stripe, <u>Color</u>	- per linear foot
907-626-H: Thermoplastic* Legend, White	- per linear foot or square foot

\* Indicate Double Drop if applicable

# MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-699-5

CODE: (SP)

DATE: 12/17/2013

SUBJECT: Construction Stakes

Section 699, Construction Stakes, of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby deleted and replaced as follows.

## SECTION 907-699 - CONSTRUCTION STAKES

**907-699.01--Description.** This work consists of performing all calculations and other work necessary to establish and/or verify all horizontal and vertical control data; and furnishing, placing and maintaining roadway construction stakes or bridge construction stakes, or both, necessary for the proper prosecution of all features and items of the work under contract. This shall include, but not be limited to, grades and drainage structure locations, lengths, elevations and skews. When the contract includes a pay item for roadway construction stakes as provided herein, any references in other sections of the Standard Specifications to establishment of control points or construction staking "by the Department" shall be construed to mean "by the Contractor".

This work may be performed utilizing Automated Machine Guidance technologies and systems in accordance with the standard specifications and contract documents. Automated Machine Guidance (AMG) is defined as the utilization of positioning technologies such as Global Positioning Systems (GPS), Robotic Total Stations, lasers, and sonic systems to automatically guide and adjust construction equipment according to the intended design requirements. Global Positioning Systems (GPS) shall NOT be used for determining any points above the subgrade line. The Contractor may use any type of AMG system(s) that result in compliance with the contract documents and applicable Standard Specifications.

Automated Machine Guidance (AMG) is not a mandatory requirement. Automated Machine Guidance (AMG), conventional staking, or a combination of both may be used at the Contractor's option for staking on this project.

**907-699.02--Materials.** The Contractor shall furnish all personnel, materials, equipment and devices necessary for determining, establishing, setting, checking and maintaining points, lines, grades and layout of the work. All surveying equipment shall be properly adjusted and suited for performing the work required. Traffic control necessary for the proper execution of the work shall be furnished by the Contractor without separate measurement for payment. Stakes shall be of sufficient length, thickness and quality to serve the purpose for which they are being used.

All equipment required to accomplish automated machine guidance shall be provided by the Contractor. The Contractor may use any type of AMG equipment that achieves compliance with the contract documents and applicable Standard Specifications.

The Contractor shall provide the Department with an acceptable portable grade-verification device (Rover) to be used by the Department during the duration of the contract. On large projects with high production rates, the Contractor may have to provide more than one device. At the end of the contract, the device will be returned to the Contractor. This device shall have the same capabilities as the unit used by the Contractor.

**907-699.03--Construction Requirements.**

**907-699.03.1--General.** The Department will establish, one time only, secondary control points with elevations at distances not to exceed 1500 feet or that minimum distance necessary to maintain inter-visibility. For bridge work, the Engineer's field control will consist of a stationed baseline reference point near each end of the bridge(s) and one accessible bench mark near each bridge site. For the purpose of determining responsibility for construction stakes, lines and grades, a box bridge will not be considered as a bridge. The Contractor shall verify the accuracy of the control points before proceeding with the layout for construction.

When errors are discovered and control points do not agree with the plans, the Contractor shall promptly notify the Engineer in writing, and explain the problem in detail. The Engineer will advise the Contractor within five (5) working days of any corrective actions which may be deemed necessary.

The Contractor will be responsible for verifying and modifying, as necessary to best fit existing field conditions, lengths, locations, elevations and skew angles of all drainage structures shown on the construction plans. All junction box and inlet locations and heights shall also be verified and modified as necessary to fit existing field conditions. Modifications to the plans shall not be made without the consent of the Project Engineer. The Contractor will not be responsible for determining the size of drainage structures, but should immediately report any suspected error to the Engineer. Heights of fill over drainage structures shall be checked to verify class of pipe, bedding and the appropriate standard and/or modified standard drawing(s) required in the construction with any differences from the plans being reported to the Engineer.

The Contractor shall perform work necessary to verify alignment and plan grades on all roadway intersections and tie-ins. Any discrepancies in grades, alignment, location and or dimension detected by the Contractor shall immediately be brought to the attention of the Project Engineer.

The Contractor shall employ sufficient qualified personnel experienced in highway surveying and layout to complete the work accurately. The Contractor shall also determine and provide all additional grade controls and staking operations necessary to secure a correct layout and construction of the work. All minor variations in layout and grades required to meet field conditions shall be resolved with the Engineer and shall not be considered justification for adjusting contract price or time.

Examples of minor variations in layout and grades are:

- (a) Adjustment of drainage or other structure length, alignment, and flow line elevation.



- (b) The adjustment of grades and alignment at roadway intersections, cross-overs, railroad crossings, interchanges, existing bridges and roadways.
- (c) Adjustment of curve data.

The Contractor will be responsible for calculating and laying out all additional lines, grades, elevations and dimensions necessary to construct the work required in the plans. All grades and other layout data computed by the Contractor shall be recorded and a copy of this data shall be furnished, with sufficient time for checking, to the Engineer before field work is started. The originals of all data shall be furnished to the Engineer on or before final inspection for the Department's permanent file. The Contractor shall also furnish personnel to assist the Engineer in taking tolerance verification checks or other notes to determine whether specified tolerances are met. Any inspection or checking of the Contractor's layout by the Engineer and the approval of all or any part of it will not relieve the Contractor of the responsibility to secure proper dimensions, grades, and elevations of the several parts of the work.

Prior to beginning construction on any structure which is referenced to an existing structure or topographical feature, the Contractor shall check the pertinent location and grades of the existing structures or topographical features to determine whether the location and grade shown on the plans are correct.

The Contractor shall stake centerline control at each station, BOP, EOP, PC, PT, SC, CS, TS, ST, and equations just before field cross sectioning by the Department for both original and final cross sections.

The Contractor shall furnish "as built" finish centerline elevations to the Project Engineer prior to final inspection of the project.

The Contractor shall set stakes and/or flags on the right-of-way line at each station and right-of-way break or as directed by the Engineer before clearing operations are started on any section of roadway.

Regardless of the method used, the Contractor shall meet the surface tolerances addressed in Section 321.

The Contractor shall exercise care in the preservation of stakes and bench marks and shall reset them when they are damaged, lost, displaced or removed. The Contractor shall use competent personnel and suitable equipment for the layout work required and shall provide that it be performed under the supervision of, or directed by, a Registered Professional Engineer or Registered Land Surveyor who is duly registered and entitled to practice as a Professional Engineer or Professional Land Surveyor in the State of Mississippi. The duties performed by said Registrant shall conform to the definitions under the "practice of engineering" and practice of "land surveying" in Mississippi Law and the latest edition of the MDOT Survey Manual. The MDOT Survey Manual can be obtained online at the following address.

<http://sp.mdot.ms.gov/RoadwayDesign/Pages/MDOT-Survey-Manual.aspx>

The Contractor shall not engage the services of any person in the employ of the Department for the performance of any of the work covered by this Section or any person who has been employed by the Department within the past six months except those who have legitimately retired from service with the Department during this period.

All cross sections, measurements, and tickets required for determining pay quantities will be the responsibility of the Department.

The Department reserves the right to check for accuracy any or all of the Contractor's layout work and shall be assisted by the Contractor's personnel in such checking. When errors or discrepancies are found, the Contractor will take measures necessary to correct, at no expense to the State, any construction that has been performed using the improper layout. Any inspection, checking and approval thereof by the Engineer of work for which the Contractor is responsible will not relieve the Contractor of responsibility to secure correct dimensions, grades, elevations, alignments and locations of the work for satisfactory completion of the project and as a condition for final acceptance by the Department.

**907-699.03.2--Conventional Staking.** In addition to the requirements set forth in Subsection 907-699.03.1, the following shall be required when using the conventional staking method.

On grading projects, the Contractor shall set slope stakes at each station and at the beginning and end of spirals and curves. Closer intervals will be required for sharp changes in grades or alignment, widening and certain other geometric details.

The Contractor shall set subgrade blue tops on centerline, break points and at the left and right subgrade shoulder lines at intervals of not more than 100 feet on tangents and intervals of not more than 50 feet in curves. Closer intervals will be required for sharp changes in grades or alignment, widening, or super elevation.

The Contractor shall furnish personnel to assist the Engineer in taking stringline and other notes to determine whether specified tolerances are met.

On paving contracts, the Contractor shall set subgrade, base and paving blue tops. The base and pavement grade stakes shall be set on intervals in accordance with the applicable requirements of Sections 321, 403 and 501.

**907-699.03.3--Automated Machine Guidance.** In addition to the requirements set forth in Subsection 907-699.03.1, the following shall be required when using the automated machine grading method.

**907-699.03.3.1--Automated Machine Guidance Work Plan.** The Contractor shall submit a comprehensive written Automated Machine Guidance Work Plan to the Engineer for review at least 30 days prior to use. The Project Engineer will have to concur with the Plan prior to the Contractor performing any AMG work. The submittal of an AMG Work Plan shall be an indication of the Contractor's intention to utilize AMG instead of conventional methods on the

project areas and elements stated in the Work Plan. The Engineer shall review the Automated Machine Guidance Work Plan to ensure that the requirements of this special provision are addressed. The Contractor shall assume total responsibility for the performance of the system utilized in the Work Plan. Any update or alteration of the Automated Machine Guidance Work Plan in the course of the work shall be approved and submitted to MDOT for determination of conformance with requirements of this special provision.

The Automated Machine Guidance Work Plan shall describe how the automated machine guidance technology will be integrated into other technologies employed on the project. This shall include, but not limited to, the following:

1. A description of the manufacturer, model, and software version of the AMG equipment.
2. Information on the Contractor's experience in the use of Automated Machine Guidance system (or Related Technologies) to be used on the project, including formal training and field experience of project staff.
3. A single onsite staff person as the primary contact, and up to one alternate contact person for Automated Machine Guidance technology issues.
4. A definition of the project boundaries and scope of work to be accomplished with the AMG system.
5. A description of how the project proposed secondary control(s) is to be established. It shall also include a list and map detailing control points enveloping the site.
6. A description of site calibration procedures including, but not limited to, equipment calibration and the frequency of calibration as well as how the equipment calibration and information will be documented to MDOT and the Project Engineer. The documentation shall contain a complete record of when and where the tests were performed and the status of each equipment item tested within or out of the ranges of required tolerances.
7. A description of the Contractor's quality control procedures for checking mechanical calibration and maintenance of equipment. It shall also include the frequency and type of checks to be performed.
8. A description of the method and frequency of field verification checks and the submission schedule of results to the Project Engineer.
9. A description of the Contractor's contingency plan in the event of failure/outage of the AMG system.
10. A schedule of Digital Terrain Models (DTM) intended for use on the project. This shall be submitted to the Engineer for review, feedback, and communication.

**907-699.03.3.2--State's Responsibilities.** The District Surveyor will set the primary horizontal and vertical control points in the field for the project as per latest edition of the MDOT Survey Manual. The control points shall be in Mississippi State Plane coordinate system.

MDOT will provide an electronic alignment file and primary control file for the project. This file will be based on the appropriate Mississippi State Plane Coordinate Zone either West or East. These files will be created with the computer software applications MicroStation (CADD software) and GEOPAK (civil engineering software). The data files will be provided in the native formats. The Contractor shall perform necessary conversion of the files for their selected grade control equipment, field verify the data for accuracy, and immediately report any errors to

MDOT.

MDOT will provide design data, if available, in an electronic format to the Contractor. These files will be created with the computer software applications MicroStation (CADD software) and GEOPAK (civil engineering software). The data files will be provided in the native formats as specified in the Data Format section of this specification. No guarantee is made to the data accuracy or completeness, or that the data systems used by MDOT will be directly compatible with the systems used by the Contractor. Information shown on the paper plans marked with the seal (official plans as advertised) shall govern.

The Engineer will perform spot checks as necessary of the Contractor's machine control grading results, surveying calculations, records, field procedures, and actual staking. If the Engineer determines that the work is not being performed in accordance with the Specifications, the Engineer shall order the Contractor to re-construct the work to the requirements of the contract documents at no additional cost to the Department.

**907-699.03.3.3--Contractor's Responsibilities.** The Contractor shall provide formal training, as requested, on the use of the Automated Machine Guidance Equipment, including Rover, and the Contractor's systems to MDOT project personnel prior to the start of construction activities utilizing AMG. This training is for providing MDOT project personnel with an understanding of the equipment, software, and electronic data being used by the Contractor.

The Contractor shall use the alignment and control data provided by MDOT.

The Contractor shall bear all costs, including but not limited to the cost of actual reconstruction work that may be incurred due to errors in application of Automated Machine Guidance techniques or manipulation of MDOT design data in Digital Terrain Models (DTM). The Contractor shall also bear all costs associated with any graphical grading outside the model / typical section, such as tying to existing grades at the beginning or end of a project.

The Contractor shall be responsible for converting the information on the plans and/or electronic data file provided by MDOT into a format compatible with the Contractor's AMG system.

The Contractor shall establish secondary control points at locations along the length of the project and outside the project limits and/or where work is performed beyond the project limits as required by the Automated Machine Guidance system utilized. The Contractor shall establish this secondary control using survey procedures as outlined in the latest edition of the MDOT Survey Manual. A copy of all new control point information shall be provided to the Engineer prior to construction activities. The Contractor shall be responsible for all errors resulting from their efforts and shall correct deficiencies to the satisfaction of the Engineer and at no additional cost to the State.

The Contractor shall preserve all reference points and monuments that are established by the District Surveyor outside the construction limits. If the Contractor fails to preserve these items, they shall be re-established by the Contractor to their original quality at no additional cost to the State.

The Contractor shall set grade stakes at the top of the finished sub-grade and base course at all hinge points on the typical sections at 1000-foot maximum intervals on mainline, critical points such as, but not limited to, PC's, PT's, beginning and ending super elevation transition sections, middle of the curve, and at least two locations on each of the side roads and ramps, and at the beginning and end of each cross slope transition where Automated Machine Guidance is used. These grade stakes shall be established using conventional survey methods for use by the Engineer to check the accuracy of the construction.

On grading projects, the Contractor shall set slope stakes and centerline stationing every 500 feet and at the beginning and end of spirals and curves. Closer intervals will be required for sharp changes in grades or alignment, widening and certain other geometric details.

The staking requirements for pavement grade stakes addressed in Sections 403 and 501 will not apply. The Contractor shall furnish an acceptable portable grade-verification device(s) (Rover) to verify grade tolerances.

The Contractor will be required to set 20 grade points (hubs) per mile at locations determined by the Engineer for field verification. If tolerances are not met, additional grade points may be required by the Engineer.

The Contractor shall furnish personnel to assist the Engineer in taking tolerance verification checks as necessary to determine whether specified tolerances are met.

The Contractor shall meet the same accuracy requirements as detailed in the Mississippi Standard Specifications for Road and Bridge Construction.

The Contractor shall be responsible for implementing the AMG system using the Mississippi State Plane Coordinate System. No localization methods will be accepted.

**907-699.03.3.4--Data Format.** It is the Contractor's responsibility to produce the Digital Terrain Model(s) and/or 3D line work needed for Automated Machine Guidance. MDOT does not produce this data in its design process. MDOT does provide CADD files created in the design process to the Contractor. The CADD files provided by MDOT are provided in the native software application formats in which they are created with no conversions, and their use in developing 3D data for machine guidance is at the discretion of the Contractor. The CADD files that may be available are listed below. Cross-Sections are one of the items provided but are not necessarily created at critical design locations. Therefore their use in Digital Terrain Models (DTM) for AMG is limited.

1. Project Control - Microstation DGN file and ASCII file
2. Existing Topographic Data - Microstation DGN file(s)
3. Preliminary Surveyed Ground Surface - GeoPak TIN, if available
4. Horizontal and Vertical alignment information - GeoPak GPK file and/or Microstation DGN file(s)
5. 2D Design line work (edge of pavement, shoulder, etc.) - Microstation DGN file(s)

- 6. Cross sections - Microstation DGN file(s), GeoPak format
- 7. Superelevation - Microstation DGN file(s), GeoPak format
- 8. Form Grades - Microstation DGN file(s)
- 9. Design Drainage - Microstation DGN file(s)

It is expressly understood and agreed that MDOT assumes no responsibility in respect to the sufficiency or accuracy of these CADD files. These files are provided for convenience only and the contract plans are the legal document for constructing the project.

**907-699.04--Method of Measurement.** Construction stakes will be measured as a lump sum quantity. When Pay Item No. 907-699-A, Roadway Construction Stakes, is provided in the contract, measurement shall include the staking of all bridges, including detour bridges, which are a part of the contract.

**907-699.04.1--Roadway Construction Stakes.** Roadway Construction Stakes will be measured for payment in accordance with the following schedule:

- (a) When one percent of the original contract amount is earned from all direct pay items, 10 percent of the amount bid for Roadway Construction Stakes will be paid.
- (b) When five percent of the original contract amount is earned from all direct pay items, 25 percent of the amount bid for Roadway Construction Stakes will be paid.
- (c) When 20 percent of the original contract amount is earned from all direct pay items, 50 percent of the amount bid for Roadway Construction Stakes will be paid.
- (d) After the Contractor has earned 50 percent of the original value of all direct pay items, the amount paid will be based on the contract percent complete.

**907-699.04.2--Bridge Construction Stakes.** Bridge Construction Stakes will be measured for payment in accordance with the following schedule:

- (a) When one percent of the original contract value of all bridge items is earned, 10 percent of the amount bid for Bridge Construction Stakes will be paid.
- (b) When five percent of the original contract value of all bridge items is earned, 25 percent of the amount bid for Bridge Construction Stakes will be paid.
- (c) When 20 percent of the original contract value of all bridge items is earned, 50 percent of the amount bid for Bridge Construction Stakes will be paid.
- (d) After the Contractor has earned 50 percent of original contract value of all bridge items, the amount paid will be based on the percentage of work completed on all bridge items.

**907-699.05--Basis of Payment.** Construction stakes, measured as prescribed above, will be paid for at the contract lump sum price, which shall be full compensation for completing the work.

Payment will be made under:

907-699-A: Roadway Construction Stakes - lump sum

907-699-B: Bridge Construction Stakes - lump sum

## MISSISSIPPI DEPARTMENT OF TRANSPORTATION

| SPECIAL PROVISION NO. 907-701-4

CODE: (IS)

| DATE: 11/09/2010

**SUBJECT: Hydraulic Cement**

Section 701, Hydraulic Cement, of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows:

Delete Subsection 701.01 on pages 595 & 596, and substitute the following:

**907-701.01--General.** The following requirements shall be applicable to hydraulic cement:

Only hydraulic cements conforming to Section 701 shall be used. Hydraulic cements shall not be listed or designated as meeting more than one AASHTO or Department type.

Different brands of hydraulic cement, or the same brand of hydraulic cement from different mills, shall not be mixed or used alternately in any one class of construction or structure, without written permission from the Engineer; except that this requirement will not be applicable to hydraulic cement treatment of design soils, or bases.

The Contractor shall provide suitable means for storing and protecting the hydraulic cement against dampness. Hydraulic cement, which for any reason, has become partially set or which contains lumps of caked hydraulic cement will be rejected. Hydraulic cement salvaged from discarded or used bags shall not be used.

The temperature of bulk hydraulic cement shall not be greater than 165°F at the time of incorporation in the mix.

Acceptance of hydraulic cement will be based on the certification program as described in the Department's Materials Division Inspection, Testing, and Certification Manual and job control sampling and testing as established by Department SOP.

Retests of hydraulic cement may be made for soundness and expansion within 28 days of test failure and, if the hydraulic cement passes, it may be accepted. Hydraulic cement shall not be rejected due to failure to meet the fineness requirements if upon retests after drying at 212°F for one hour, it meets such requirements.

Delete Subsection 701.02 on page 596, and substitute the following:

**907-701.02--Portland Cement.**

**907-701.02.1--General.**

**907-701.02.1.1--Types of Portland Cement.** Portland cement (cement) shall be either Type I or Type II conforming to AASHTO Designation: M85 or Type I(MS), as defined by the description below Table 1. Type III cement conforming to AASHTO Designation: M85 or Type III(MS), as defined by the description below Table 1, may be used for the production of precast or precast-prestressed concrete members.

**907-701.02.1.2--Alkali Content.** All cement types in this Subsection shall meet the Equivalent alkali content requirement for low-alkali cements listed in AASHTO Designation: M85, Table 2.

**907-701.02.2--Replacement by Other Cementitious Materials.** The maximum replacement of cement by weight is 25% for fly ash or 50% for ground granulated blast furnace slag (GGBFS). The minimum tolerance for replacement shall be 5% below the maximum replacement content. Replacement contents below this minimum tolerance by fly ash or GGBFS may be used, but shall not be given any special considerations, like the maximum acceptance temperature for Portland cement concrete containing pozzolans. Special considerations shall only apply for replacement of cement by fly ash or GGBFS.

**907-701.02.2.1--Portland Cement Concrete Exposed to Soluble Sulfate Conditions or Seawater.** When Portland cement concrete is exposed to moderate or severe soluble sulfate conditions, or to seawater, cement types and replacement of cement by Class F fly ash, GGBFS, or silica fume shall be as follows in Table 1.

**Table 1- Cementitious Materials for Soluble Sulfate Conditions**

Sulfate Exposure	Water-soluble sulfate (SO <sub>4</sub> ) in soil, % by mass	Sulfate (SO <sub>4</sub> ) in water, ppm	Cementitious material required*
Moderate and Seawater	0.10 - 0.20	150 - 1,500	Type II **, ***, **** cement, or Type I cement with one of the following replacements of cement by weight: 25% Class F fly ash, 50% GGBFS, or 8% silica fume
Severe	0.20 - 2.00	1,500 - 10,000	Type I cement with a replacement by weight of 50% GGBFS, or Type II ** cement with one of the following replacements of cement by weight: 25% Class F fly ash, 50% GGBFS, or 8% silica fume



- \* The values listed in this table for replacement of Portland cement by the cementitious materials listed are maximums and shall not be exceeded. The minimum tolerance for replacement shall be 0.5% below the maximum replacement content. Replacement contents below this minimum tolerance by the cementitious materials listed in this table do not meet the requirements for the exposure conditions listed and shall not be allowed.
- \*\* Type I cement conforming to AASHTO Designation: M85 with a maximum 8% tricalcium aluminate (C<sub>3</sub>A) may be used in lieu of Type II cement; this cement is given the designation "Type I(MS)". Type III cement conforming to AASHTO Designation: M85 with a maximum 8% tricalcium aluminate (C<sub>3</sub>A) may be used in lieu of Type II cement as allowed in Subsection 907-701.02.1; this cement is given the designation "Type III(MS)".
- \*\*\* Blended cement meeting the sulfate resistance requirements of Subsection 907-701.04 may be used in lieu of Type II as allowed in Subsection 907-701.04. No additional cementitious materials shall be added to or as a replacement for blended cement.
- \*\*\*\* Class F fly ash or GGBFS may be added as a replacement for cement as allowed in Subsection 907-701.02.2.

Class C fly ash shall not be used as a replacement for cement in any of the sulfate exposure conditions listed above.

**907-701.02.2.2--Cement for Soil Stabilization Exposed to Soluble Sulfate Conditions or Seawater.** When Portland cement for use in soil stabilization is exposed to moderate or severe soluble sulfate conditions, or to seawater, cement types and replacement of cement by Class F fly ash or GGBFS shall meet the requirements of Subsection 907-701.02.2.1. Neither metakaolin nor silica fume shall be used to bring the cementitious materials into compliance with the requirements of Table 1.

Delete Subsection 701.03 on page 596, and substitute the following:

**907-701.03--Masonry Cement.** Masonry cement shall conform to ASTM Designation: C 91 and shall only be used in masonry applications.

Delete Subsection 701.04 on page 596, and substitute the following:

**907-701.04--Blended Hydraulic Cement.**

**907-701.04.1--General.**

**907-701.04.1.1--Types of Blended Cement.** Blended hydraulic cements (blended cements) shall be of the following types and conform to AASHTO Designation: M 240:

- Type I(SM) – Slag-modified Portland cement
- Type IS – Portland blast-furnace slag cement
- Type I(PM) – Pozzolan-modified Portland cement
- Type IP – Portland-pozzolan cement

Blended cement for use in Portland cement concrete or soil stabilization exposed to the moderate soluble sulfate condition or exposure to seawater as defined in Table 1 shall meet the Sulfate resistance requirement listed in AASHTO Designation: M 240, Table 2 and the "(MS)" suffix shall be added to the type designation.

**907-701.04.1.2--Alkali Content.** All blended cement types in this Subsection shall meet the Mortar expansion requirements listed in AASHTO Designation: M 240, Table 2.

**907-701.04.2--Replacement by Other Cementitious Materials.** No additional cementitious materials, such as Portland cement, performance hydraulic cement, fly ash, GGBFS, metakaolin, or others, shall be added to or as a replacement for blended cement.

**907-701.04.3--Exposure to Soluble Sulfate Conditions or Seawater.** When Portland cement concrete or blended cement for soil stabilization is exposed to moderate soluble sulfate conditions or to seawater, where the moderate soluble sulfate condition is defined in Table 1, the blended cement shall meet the sulfate resistance requirement listed in AASHTO Designation: M 240, Table 2.

When Portland cement concrete or blended cement for soil stabilization is exposed to severe soluble sulfate conditions, where the severe soluble sulfate condition is defined in Table 1, blended cements shall not be used.

**MISSISSIPPI DEPARTMENT OF TRANSPORTATION**

**SPECIAL PROVISION NO. 907-702-3**

**CODE: (SP)**

**DATE: 05/08/2012**

**SUBJECT: Polyphosphoric Acid (PPA) Modification of Petroleum Asphalt Cement**

Section 702.05, Petroleum Asphalt Cement, of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows:

**907-702.05--Petroleum Asphalt Cement.** Delete the third paragraph of Subsection 702.05 on page 598, and substitute the following.

The bituminous material used in all types of asphalt mixtures shall conform to AASHTO Designation: M 320, Performance Grade PG 67-22, as modified in the table below, except that Polyphosphoric Acid (PPA) may be used at low dosage rates as a modifier to enhance the physical properties of a base binder to meet the requirements for Performance Grade PG 67-22. In addition, PPA may be used as a catalyst or mixing agent at low dosage rates in the production of Polymer Modified, Performance Grade PG 76-22.

When PPA is used as a modifier, in no case shall the PPA modifier be used to adjust the physical properties of the binder a full binder grade. For example: the base binder (unmodified) is graded as a PG 64-22 and should only be modified by the addition of PPA to a modified binder grade of PG 67-22.

When petroleum asphalt cement is modified by PPA, the following dosage limits shall be applied.

<b>Grade</b>	<b>Dosage Limit</b>
PG 67-22	0.75% by weight of binder
PG 76-22	0.50% by weight of binder

# MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-703-11

CODE: (IS)

DATE: 05/22/2013

SUBJECT: Aggregates

Section 703, Aggregates, of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows:

**907-703.03.2.4--Gradation.** Delete the last sentence of the last paragraph of Subsection 703.03.2.4 on page 611.

**907-703.04--Aggregate for Crushed Stone Courses.**

**907-703.04.1--Coarse Aggregate.** Delete the first paragraph of Subsection 703.04.1 on page 611, and substitute the following.

Coarse aggregate, defined as material retained on No. 8 sieve, shall be either crushed limestone, steel slag, granite, concrete, or combination thereof. Crushed concrete is defined as recycled concrete pavement, structural concrete, or other concrete sources that can be crushed to meet the gradation requirements for Size No. 825B as modified below. In no case shall waste from concrete production (wash-out) be used as a crushed stone base.

**907-703.04.2--Fine Aggregate.** Delete the first sentence of the first paragraph of Subsection 703.04.2 on page 612, and substitute the following.

Fine aggregate, defined as material passing the No. 8 sieve, shall be material resulting from the crushing of limestone, steel slag, granite, concrete, or combination thereof.

Delete the third paragraph of Subsection 703.04.2 on page 612.

**907-703.04.3--Gradation.** In the table of Subsection 703.04.3 on page 613, change the requirement for the 1-inch sieve under Size No. 825 B from “75 - 98” to “75 - 100”.

After the table in Subsection 703.04.3 on page 613, add the following.

If crushed concrete is used, the crushed material shall meet the gradation requirements of Size No. 825 B with the exception that the percent passing by weight of the No. 200 sieve shall be 2 – 18.

**907-703.06--Aggregates for Hot Mix Asphalt.**

**907-703.06.1--Coarse Aggregates.** Delete the third paragraph of Subsection 703.06.1 on page 613, and substitute the following.

When tested in accordance with AASHTO Designation: T 19, the dry rodded unit weight of all aggregates except expanded clay and shale shall not be less than 70 pounds per cubic foot.

**907-703.06.1.2--Fine Aggregates.** Delete the last sentence of Subsection 703.06.1.2 on page 614.

**907-703.14--Aggregates for Bituminous Surface Treatments.**

**907-703.14.2--Detail Requirements.**

**907-703.14.2.1--Gradation.** In the table entitled “Gradation Requirements For Cover Aggregate” in Subsection 703.14.2.1 on page 622, delete the requirement for the No. 16 sieve for Size No. 7 under the column “Slag or Expanded Clay”.

**907-703.20.3--Gradation.** Delete the table and notes in Subsection 703.20.3 at the top of page 626, and substitute the following.

**PERCENT PASSING BY WEIGHT**

Square Mesh Sieves	Shell	Coarse			Medium	Fine
		Size I	Size II Note (1)	Size III Note (3)		
3 inch	90-100			100		
2 1/2 inch				90-100		
2 inch		100				
1 1/2 inch		90-100	100	25-60		
1 inch		80-100	97-100			
3/4 inch		55-100	55-100	0-10		
1/2 inch		35-85	35-85	0-5	100	
3/8 inch	12-65	12-65		97-100		
No. 4, Note (2)	0-30	0-30		92-100		
No. 10	0-8	0-8		80-100	100	
No. 40				10-40	80-100	
No. 60				0-20	30-100	
No. 100					15-80	
No. 200	0-5	0-4	0-4	0-5	0-30	
PI Material Passing No. 40				6 or less	0	

Note (1): Size II is intended for use in bases in which portland cement is used.

Note (2): Ground shell shall contain at least 97% passing the No. 4 sieve.

Note (3): Size III is intended for use in stabilized construction entrances.

## MISSISSIPPI DEPARTMENT OF TRANSPORTATION

| SPECIAL PROVISION NO. 907-708-6

CODE: (IS)

| DATE: 05/01/2013

SUBJECT: Non-Metal Drainage Structures

Section 708, Non-Metal Structures and Cattlepasses, of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows.

**907-708.02.1.2--Fly Ash.** In the first sentence of Subsection 708.02.1.2 on page 639, change “20 percent” to “25%”.

| **907-708.02.1.4--Coarse Aggregate.** Delete the last sentence of Subsection 708.02.1.4 on page 639.

**907-708.02.3.2--Marking.** Delete the second sentence of Subsection 708.02.3.2 on page 640, and substitute the following.

Machine made pipe shall be marked in accordance with one of the following methods: 1) the pipe shall be inscribed on the outside of the pipe and stenciled on the inside of the pipe, or 2) the pipe shall be inscribed on the inside of the pipe, only. All other pipe may be stenciled.

**907-708.17--Corrugated Plastic Pipe Culverts.**

**907-708.17.1--Corrugated Polyethylene Pipe Culverts.** Delete the first sentence of the first paragraph of Subsection 708.17.1 on page 645 and substitute the following.

Corrugated polyethylene pipe shall conform to the requirements of AASHTO Designation: M 294, Type S and/or SP, as applicable, and shall have soil tight joints, unless otherwise specified.

Delete the last sentence of the second paragraph of Subsection 708.17.1 on page 645.

After Subsection 708.17.1 on page 645, add the following.

**907-708.17.1.1--Inspection and Final Acceptance of Corrugated Polyethylene Pipe Culverts.**

Approximately 50% of the installed length of corrugated polyethylene pipe shall be inspected for excess deflection no sooner than 30 days after the embankment material over the pipe is placed to the required subgrade elevation or the maximum required fill height. The inspection shall be performed using either electronic deflectometers, calibrated television or video cameras, or a “go, no-go” mandrel that has an effective diameter of 95% of the nominal inside diameter of the pipe.

Pipe found to have deflection values greater than 5% shall be removed and replaced at no cost to the State.

**907-708.17.2--Corrugated Poly (Vinyl Chloride) (PVC) Pipe Culverts.** Delete the first sentence of the first paragraph of Subsection 708.17.2 on page 645 and substitute the following.

Corrugated poly (vinyl chloride) (PVC) pipe shall conform to the requirements of AASHTO Designation: M 304 and shall have soil tight joints, unless otherwise specified. Non-perforated PVC pipe used in underdrains shall either be manufactured with an ultra-violet light inhibitor or be fully coated with an ultra-violet light inhibitor.

After Subsection 708.17.2 on page 645, add the following.

**907-708.17.2.1--Inspection and Final Acceptance of Poly (Vinyl Chloride) (PVC) Pipe Culverts.** Approximately 50% of the installed length of PVC pipe shall be inspected for excess deflection no sooner than 30 days after the embankment material over the pipe is placed to the required subgrade elevation or the maximum required fill height. The inspection shall be performed using either electronic deflectometers, calibrated television or video cameras, or a “go, no-go” mandrel that has an effective diameter of 95% of the nominal inside diameter of the pipe.

Pipe found to have deflection values greater than 5% shall be removed and replaced at no cost to the State.

**907-708.18--Sewer Pipe Used for Underdrains.**

**907-708.18.1--General.** After the second paragraph of Subsection 708.18.1 on page 645 add the following.

In lieu of the pipe listed in this subsection, pipe meeting the requirements of Subsection 708.19 may also be used for plastic underdrain pipe.

**907-708.18.3--Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe.** After the first sentence of Subsection 708.18.3 on page 645, add the following.

Non-perforated PVC pipe shall either be manufactured with an ultra-violet light inhibitor or be fully coated with an ultra-violet light inhibitor.

**907-708.18.4--Poly (Vinyl Chloride) (PVC) Corrugated Sewer Pipe.** Delete the paragraph in Subsection 708.18.4 on page 645 and substitute the following.

This pipe shall conform to the following requirements. For pipe sizes less than or equal to six inches ( $\leq 6''$ ), the pipe shall be Class PS46 meeting the requirements of AASHTO Designation: M 278. For pipe sizes greater than six inches ( $> 6''$ ), the pipe shall meet the requirements of AASHTO Designation: M 304. Non-perforated PVC pipe shall either be manufactured with an ultra-violet light inhibitor or be fully coated with an ultra-violet light inhibitor.

Delete Subsection 708.19 on page 645 and substitute the following.

**907-708.19--Corrugated Polyethylene Pipe.** This pipe shall be high density polyethylene pipe or drainage tubing meet the requirements of AASHTO Designation: M 294, Type S or SP, or AASHTO Designation: M 252, Type S or Type SP, as applicable.

**907-708.22.2--Exceptions to AASHTO.** Delete the sixth paragraph of Subsection 708.22.2 on page 647.



## MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-709-1

CODE: (IS)

DATE: 05/05/2008

SUBJECT: Metal Pipe

Section 709, Metal Pipe, of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows:

After Subsection 709.02 on page 649, add the following:

**907-709.02.1--Aluminized Corrugated Metal Culvert Pipe and Pipe Arches.** All aluminized metal pipe and arches shall be manufactured from Type 2 corrugated metal pipe and arches in accordance with the requirements of Subsection 709.02.

**907-709.03--Bituminous Coated Corrugated Metal pipe and Pipe Arches.**

**907-709.03.1--Materials.** Delete the first sentence of the first paragraph of Subsection 709.03.1 on page 649, and substitute the following:

Bituminous coated corrugated metal pipe and arches shall conform to the requirements of AASHTO Designation: M 190 and be completely coated inside and out with an asphalt cement which will meet the performance requirements hereinafter set forth.

**907-709.05--Polymer Coated Corrugated Metal Pipe and Pipe Arches.** Delete the first sentence of the first paragraph of Subsection 709.05 on pages 649 and 650, and substitute the following:

Polymer coated corrugated metal pipe and arches shall conform to the requirements of AASHTO Designation: M 245, except the minimum gauge thickness shall be as shown on the plans or in the contract; however, corrugated metal pipe manufactured from sheets thicker than that specified will be acceptable when approved by the Engineer. The internal diameter of corrugated metal pipe will be determined by inside measurement between the crests of the corrugations. Corrugations greater than 3" x 1" will not be allowed in arch pipe.

**907-709.06--Corrugated Metal Pipe for Underdrains.** Delete the sentence in Subsection 709.06 on page 650, and substitute the following:

Corrugated metal pipe shall conform to AASHTO Designation: M 36, Type III. Type I pipe which has been perforated to permit the in-flow or out-flow of water may be used in lieu of Type III pipe.

**907-709.06.1--Aluminized Corrugated Metal Culvert Pipe For Underdrains.** All aluminized corrugated metal pipe for underdrains shall be manufactured from Type 2 corrugated metal pipe

and arches in accordance with the requirements of AASHTO Designation: M 36, Type III. Manufacturer must repair any damaged coating caused from perforating the pipe.

**907-709.07--Bituminous Coated Corrugated Metal Pipe for Underdrains.** Delete the sentence in Subsection 709.07 on page 650, and substitute the following:

Bituminous coated corrugated metal pipe shall conform to the requirements of AASHTO Designation: M 190, Type A with a bituminous coating applied in accordance with the requirements of Subsection 709.03. Manufacturer must repair any damaged coating caused from perforating the pipe.

**907-709.08--Polymer Coated Corrugated Metal Pipe for Underdrains.** Delete the sentence in Subsection 709.08 on page 650, and substitute the following:

The metal pipe for underdrains shall conform to the requirements of AASHTO Designation: M 245, Type III and the polymer coating shall conform to the requirements of Subsection 709.05. Type I pipe which has been perforated to permit the in-flow or out-flow of water may be used in lieu of Type III pipe. Manufacturer must repair any damaged coating caused from perforating the pipe.

**907-709.09--Corrugated Aluminum Alloy Culvert Pipe and Arches.** Delete the first sentence in Subsection 709.09 on page 650, and substitute the following:

Corrugated aluminum culvert pipe and arches shall conform to the requirements of AASHTO Designation: M 196, Type IA.

**907-709.10--Corrugated Aluminum Alloy Pipe for Underdrains.** Delete the first sentence in Subsection 709.10 on page 650, and substitute the following:

Corrugated aluminum pipe underdrains shall conform to the requirements of AASHTO Designation: M 196, Type III. Type I pipe which has been perforated to permit the in-flow or out-flow of water may be used in lieu of Type III pipe.

**907-709.11--Bituminous Coated Corrugated Aluminum Alloy Culvert Pipe and Arches.** Delete the sentence in Subsection 709.11 on page 650, and substitute the following:

Bituminous coated aluminum culvert pipe and arches shall conform to AASHTO Designation: M 196, Type IA, and in addition shall be coated inside and out as specified in Subsection 709.03. Manufacturer must repair any damaged coating caused from perforating the pipe.

**907-709.13--Bituminous Coated Corrugated Aluminum Alloy Pipe for Underdrains.** Delete the sentence in Subsection 709.13 on page 650, and substitute the following:

This pipe shall conform to AASHTO Designation: M 196, Type III, and shall be coated with bituminous material conforming to AASHTO Designation: M 190, type coating as specified. Manufacturer must repair any damaged coating caused from perforating the pipe.

## MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-710-1

CODE: (SP)

DATE: 06/24/10

SUBJECT: Fast Dry Solvent Traffic Paint

Section 710, Paint, of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is amended as follows:

After Subsection 710.05 on Page 661, add the following:

**907-710.06--Fast Dry Solvent Traffic Paint.** Fast dry solvent traffic paints intended for use under this specification shall include products that are single packaged and ready mixed. Upon curing, these materials shall produce an adherent, reflective pavement marking capable of resisting deformation by traffic. The manufacturer shall have the option of formulating the material according to their own specifications. However, the requirements delineated in this specification, Section 619 and Section 710 shall apply regardless of the formulation used. The material shall be free from all skins, dirt and foreign objects.

**907-710.06.1--Composition.**

**907-710.06.1.1--Percent Pigment.** The percent pigment by weight shall be not less than 51% nor more than 58% when tested in accordance with ASTM D 3723.

**907-710.06.1.2--Viscosity.** The consistency of the paint shall be not less than 75 nor more than 95 Krebs Units (KU) when tested in accordance with ASTM D 562.

**907-710.06.1.3--Weight per Gallon.** The paint shall weigh a minimum 11.8 pounds per gallon and the weight of the production batches shall not vary more than +/- 0.5 pounds per gallon from the weight of the qualification samples when tested in accordance with ASTM D 1475.

**907-710.06.1.4--Total Solids.** The percent of total solids shall not be less than 70% by weight when tested in accordance with ASTM D 2369.

**907-710.06.1.5--Dry Time (No pick-up).** The paint shall dry to a no tracking condition in a maximum of 10 minutes.

**907-710.06.1.6--Volatile Organic Content.** The volatile organic content (VOC) shall contain a maximum of 1.25 pounds of volatile organic matter per gallon of total non-volatile paint material when tested in accordance with ASTM D 3960.

**907-710.06.1.7--Bleeding.** The paint shall have a minimum bleeding ratio of 0.95 when tested in accordance with Federal Specification TT-P-115D.

**907-710.06.1.8--Color.** The initial daytime chromaticity for yellow materials shall fall within the box created by the following coordinates:

**Initial Daytime Chromaticity Coordinates (Corner Points)**

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
<b>x</b>	<b>0.53</b>	<b>0.51</b>	<b>0.455</b>	<b>0.472</b>
<b>y</b>	<b>0.456</b>	<b>0.485</b>	<b>0.444</b>	<b>0.4</b>

The initial daytime chromaticity of white materials shall fall within the box created by the following coordinates:

**Initial Daytime Chromaticity Coordinates (Corner Points)**

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
<b>x</b>	<b>0.355</b>	<b>0.305</b>	<b>0.285</b>	<b>0.355</b>
<b>y</b>	<b>0.355</b>	<b>0.305</b>	<b>0.325</b>	<b>0.375</b>

**907-710.06.2--Environmental Requirements.** All yellow materials using lead chromate pigments shall meet the criteria of non-hazardous waste as defined by 40 CFR 261.24 when tested in accordance with EPA Test Method 1311, Toxicity Characteristics Leaching Procedures (TCLP). The striping and marking material , upon preparation and installation, shall not exude fumes which are toxic, or detrimental to persons or property. All material using lead free pigments shall NOT contain either lead or other Resource Conservation and Recovery Act (RCCA) materials in excess of the standard defined by EPA Method 3050 and 6010.

**907-710.06.3--Acceptance Procedures.** Acceptance of all fast dry solvent based traffics paint will be based on the Manufacturer's Certification and Certified Test Results. The Contractor shall furnish the Engineer with three copies of the manufacturer's certification stating that each lot of material in a shipment complies with the requirements of this contract. In addition, the Contractor shall provide Certified Test Reports for all tests required by this specification. The test results shall be representative of the material contained with the shipment.

## MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-711-4

CODE: (IS)

DATE: 06/26/2009

SUBJECT: Synthetic Structural Fiber Reinforcement

Section 711, Reinforcement and Wire Rope, of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows:

After Subsection 711.03.4.3 on page 665, add the following:

**907-711.04--Synthetic Structural Fiber.** The synthetic structural fibers shall be approved for listing in the Department's "Approved Sources of Materials" prior to use. The synthetic structural fibers shall be added to the concrete and mixed in accordance with the manufacturer's recommended methods.

**907-711.04.1--Material Properties.** The fibers shall meet the requirements of ASTM Designation: C 1116, Section 4.1.3. The fibers shall be made of polypropylene, polypropylene/polyethylene blend, nylon, or polyvinyl alcohol (PVA).

**907-711.04.2--Minimum Dosage Rate.** The dosage rate shall be such that the average residual strength ratio ( $R_{150,3.0}$ ) of fiber reinforced concrete beams is a minimum of 20.0 percent when the beams are tested in accordance with ASTM Designation: C 1609. The dosage rate for fibers shall be determined by the following.

The fiber manufacturer shall have the fibers tested by an acceptable, independent laboratory acceptable to the Department and regularly inspected by the Cement and Concrete Reference Laboratory of the National Institutes of Standards and Technology and approved to perform ASTM Designations: C 39, C 78, and C192.

The laboratory shall test the fibers following the requirements of ASTM Designation: C 1609 in a minimum of three (3) test specimens cast from the same batch of concrete, molded in 6 x 6 x 20-inch standard beam molds meeting the requirements of ASTM Designation: C 31. The beams shall be tested on an 18-inch span. The tests for  $R_{150,3.0}$  shall be performed when the average compressive strength of concrete used to cast the beams is between 3500 and 4500 psi. The tests for compressive strength shall follow the requirements of ASTM Designation: C 39. The average compressive strength shall be determined from a minimum of two (2) compressive strength cylinders.

The value for  $R_{150,3}$  shall be determined using the following equation:

$$R_{150,3.0} = \frac{f_{150,3.0}}{f_1} \times 100$$

The residual flexural strength ( $f_{150,3.0}$ ) shall be determined using the following equation:

$$f_{150,3.0} = \frac{P_{150,3.0} \times L}{b \times d^2}$$

where:

$f_{150,3.0}$  is the residual flexural strength at the midspan deflection of  $L/150$ , (psi),

$P_{150,3.0}$  is the residual load capacity at the midspan deflection of  $L/150$ , (lbf),

$L$  is the span, (in),

$b$  is the width of the specimen at the fracture, (in), and

$d$  is the depth of the specimen at the fracture, (in).

For a 6 x 6 x 20-inch beam, the  $P_{150,3.0}$  shall be measured at a midspan deflection of 0.12 inch.

Additionally,  $R_{150,3.0}$ ,  $f_{150,3.0}$ , and  $P_{150,3.0}$  may also be referred to as  $R_{150}^{150}$ ,  $f_{150}^{150}$ , and  $P_{150}^{150}$  respectively.

At the dosage rate required to achieve the minimum  $R_{150,3}$ , the mixture shall both be workable and the fibers shall not form clumps.

The manufacturer shall submit to the State Materials Engineer certified test reports from the independent laboratory showing the test results of each test specimen.

**907-711.04.3--Job Control Requirements.** The synthetic structural fibers shall be one from the Department's "Approved Sources of Materials."

At the required dosage rate, the mixture shall both be workable and the fibers shall not form clumps to the satisfaction of the Engineer. If the mixture is determined by the Engineer to not be workable or have clumps of fibers, the mixture may be rejected.

## MISSISSIPPI DEPARTMENT OF TRANSPORTATION

**SPECIAL PROVISION NO. 907-713-3**

**CODE: (IS)**

**DATE: 05/01/2013**

**SUBJECT: Admixtures for Concrete**

Section 713, Concrete Curing Materials and Admixtures, of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows.

After the second paragraph of Subsection 713.01.2 on page 676, add the following.

Type 1-D compound may be used on bridge rails, median barriers, and other structures requiring a spray finish. When Type 1-D compound is used, it will be the **responsibility of the Contractor** to assure that the compound has dissipated from the structure prior to applying the spray finish and that the spray finish adheres soundly to the structure.

Delete Subsection 713.02 on pages 676 & 677, and substitute the following.

**907-713.02--Admixtures for Concrete.** Air-entraining admixtures used in Portland cement concrete shall comply with AASHTO Designation: M 154. Set-retarding, accelerating, and/or water-reducing admixtures shall comply with AASHTO Designation: M 194. Water-reducing admixture shall meet the minimum requirements for Type A. Set-retarding admixtures shall meet the minimum requirements for Type D. **Admixtures providing a specific performance characteristic(s) other than those of water reduction or set retardation shall meet the minimum requirements for Type S. For admixtures meeting the requirements for Type S, the manufacturer shall provide data to substantiate the specific performance characteristic(s) to the satisfaction of the State Materials Engineer.**

In order to obtain approval of an admixture, the State Materials Engineer shall have been furnished certified test reports, made by an acceptable independent laboratory regularly inspected by the Cement and Concrete Reference Laboratory of the National Institutes of Standards and Technology, which show that the admixture meets all the requirements of the applicable AASHTO Standard Specification.

The Department reserves the right to sample, for check tests, any shipment or lot of admixture delivered to a project.

The Department reserves the right to require tests of the material to be furnished, using the specific cement and aggregates proposed for use on the project, as suggested in AASHTO Designation: M 154 and outlined in AASHTO Designation: M 194.

After an admixture has been approved, the Contractor shall submit to the State Materials Engineer, with each new lot of material shipped, a certification from the manufacturer in accordance with the requirements of Subsection 700.05.1 and stating the material is of the same

composition as originally approved and has not been changed or altered in any way. The requirement in Subsection 700.05.1(b) is not required on the certification from the manufacturer.

Admixtures containing chlorides will not be permitted.

Failure to maintain compliance with any requirement of these specifications shall be cause for rejection of any previously approved source or brand of admixture.

Admixtures shall only be used in accordance with the manufacturer's recommended dosage range as set forth in the manufacturer's approval request correspondence. When an admixture is used in Portland cement concrete, it shall be the responsibility of the Contractor to produce satisfactory results.

**907-713.02.1--Source Approval.** In order to obtain approval of an admixture, the Producer/Suppliers shall submit to the State Materials Engineer the following for review: certified test reports, made by an acceptable independent laboratory regularly inspected by the Cement and Concrete Reference Laboratory of the National Institutes of Standards and Technology, which show that the admixture meets all the requirements of the applicable AASHTO or Department Specification for the specific type and the dosage range for the specific type of admixture.

**907-713.02.2--Specific Requirements.** Admixtures containing chlorides will not be permitted.

**907-713.02.3--Acceptance.** The Department reserves the right to sample, for check tests, any shipment or lot of admixture delivered to a project.

The Department reserves the right to require tests of the material to be furnished, using the specific cement and aggregates proposed for use on the project, as suggested in AASHTO Designation: M 154 and outlined in AASHTO Designation: M 194.

Failure to maintain compliance with any requirement of these specifications shall be cause for rejection of any previously approved source or brand of admixture.

With each new lot of material shipped the Contractor shall submit to the State Materials Engineer, a notarized certification from the manufacturer showing that the material complies with the requirements of the applicable AASHTO or Department Specification.

When an admixture is used, it shall be the responsibility of the Contractor to produce satisfactory results.



## MISSISSIPPI DEPARTMENT OF TRANSPORTATION

| SPECIAL PROVISION NO. 907-714-8

CODE: (IS)

| DATE: 05/01/2013

**SUBJECT: Miscellaneous Materials**

Section 714, Miscellaneous Materials, of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows.

**907-714.05--Fly Ash.** Delete Subsections 714.05.1 & 714.05.2 on pages 680 & 681, and substitute the following.

**907-714.05.1--General.** The fly ash source must be approved for listing in the Department's "Approved Sources of Materials" prior to use. The acceptance of fly ash shall be based on certified test reports, certification of shipment from the supplier, and tests performed on samples obtained after delivery in accordance with the Department's Materials Division Inspection, Testing, and Certification Manual and Department SOP.

Different classes of fly ash or different sources of the same class shall not be mixed or used in the construction of a structure or unit of a structure without written permission from the Engineer.

The Contractor shall provide suitable means for storing and protecting the fly ash from dampness. Separate storage silos, bins, or containers shall be provided for fly ash. Fly ash which has become partially set or contains lumps of caked fly ash shall not be used.

The temperature of the bulk fly ash shall not be greater than 165°F at the time of incorporation into the work.

All classes of fly ash shall meet the supplementary option chemical requirement for available alkalis listed in AASHTO Designation: M 295, Table 2. Class F fly ash shall have a calcium oxide (CaO) content of less than 6.0%. Class C fly ash shall have a CaO content of greater than or equal to 8.0%.

The replacement of Portland cement with fly ash shall be in accordance with the applicable replacement content specified in Subsection 907-701.02.2.

In addition to these requirements, fly ash shall meet the following specific requirements for the intended use.

**907-714.05.2--Fly Ash for Use in Concrete.** When used with Portland cement in the production of concrete or grout, the fly ash shall meet the requirements of AASHTO Designation: M 295, Class C or F, with the following exception:

The loss on ignition shall not exceed 6.0 percent.

No additional cementitious materials, such as blended hydraulic cement, GGBFS, metakaolin, or others, shall be added to or as a replacement for Portland cement when used with fly ash.

**907-714.06--Ground Granulated Blast Furnace Slag (GGBFS).** Delete Subsection 714.06.1 on page 681, and substitute the following.

**907-714.06.1--General.** The GGBFS source must be approved for listing in the Department's "Approved Sources of Materials" prior to use. The acceptance of GGBFS shall be based on certified test reports, certification of shipment from the supplier, and tests performed on samples obtained after delivery in accordance with the Department's Materials Division Inspection, Testing, and Certification Manual and Department SOP.

The Contractor shall provide suitable means for storing and protecting the GGBFS against dampness and contamination. Separate storage silos, bins, or containers shall be provided for GGBFS. GGBFS which has become partially set, caked or contains lumps shall not be used.

The State Materials Engineer shall be notified in writing of the nature, amount and identity of any processing or other additions made to the GGBFS during production.

GGBFS from different mills shall not be mixed or used alternately in any one class of construction or structure without written permission from the Engineer; except that this requirement will not be applicable to cement treatment of design soils or bases.

No additional cementitious materials, such as blended hydraulic cement, fly ash, metakaolin, or others, shall be added to or as a replacement for Portland cement when used with GGBFS in the production of concrete. The replacement of Portland cement with GGBFS shall be in accordance with the applicable replacement content specified in Subsection 907-701.02.2.

Delete Subsection 714.07 on page 682, and substitute the following.

**907-714.07--Additional Cementitious Materials.**

**907-714.07.1--Metakaolin.**

**907-714.07.1.1--General.** Metakaolin shall only be used as a supplementary cementitious material in Portland cement concrete for compliance with the requirements for cementitious materials exposed to soluble sulfate conditions. Metakaolin from different sources shall not be mixed or used alternately in any one class of construction or structure without written permission from the Engineer. No additional cementitious materials, such as blended hydraulic cement, fly ash, GGBFS, or others, shall be added to or as a replacement for Portland cement when used with metakaolin in the production of concrete.

The State Materials Engineer shall be notified in writing of the nature, amount and identity of any processing, or other additions made to the metakaolin during production.

**907-714.07.1.2--Source Approval.** The approval of each metakaolin source shall be on a case

by case basis as determined by the State Materials Engineer. In order to obtain approval of a metakaolin source, the Producer/Suppliers shall submit to the State Materials Engineer the following for review: certified test reports, made by an acceptable, independent laboratory regularly inspected by the Cement and Concrete Reference Laboratory of the National Institutes of Standards and Technology, which show that the metakaolin meets all the requirements of AASHTO Designation: M295, including the Effectiveness in contributing to sulfate resistance, Procedure A, listed in AASHTO Designation: M295, Table 4 for Supplementary Optional Physical Requirements, and other requirements listed herein.

In order to demonstrate effectiveness in contributing to sulfate resistance, included in this test data shall be results of metakaolin from the proposed source tested in accordance with ASTM Designation: C 1012. There shall be two sets of test specimens per the following:

- a. One set of test specimens shall be prepared using a Type I Portland cement meeting the requirements of AASHTO Designation: M85 and having a tricalcium aluminate ( $C_3A$ ) content of more than 8.0%,
- b. One set of test specimens shall be prepared using a Type II Portland cement meeting the requirements of AASHTO Designation: M85.
- c. The proposed metakaolin shall be incorporated at the rate of 10% cement replacement in each set of test specimens and shall meet both of the acceptance criteria listed below for source approval.

The requirement for acceptance of the test sample using Type I Portland cement is an expansion of 0.10% or less at the end of six months. The requirement for acceptance of the test sample using Type II Portland cement is an expansion of 0.05% or less at the end of six months.

**907-714.07.1.3--Storage.** The Contractor shall provide suitable means for storing and protecting the metakaolin against dampness and contamination. Metakaolin which has become partially set, caked, or contains lumps shall not be used.

**907-714.07.1.4--Specific Requirements.** Metakaolin shall meet the requirements of AASHTO Designation: M 295, Class N with the following modifications:

1. The sum of  $SiO_2 + Al_2O_3 + Fe_2O_3$  shall be at least 85%. The Material Safety Data Sheet shall indicate that the amount of crystalline silica, as measured by National Institute of Occupation Safety and Health (NIOSH) 7500 method, after removal of the mica interference, is less than 1.0%.
2. The loss on ignition shall be less than 3.0%.
3. The available alkalies, as equivalent  $Na_2O$ , shall not exceed 1.0%.
4. The amount of material retained on a No. 325 mesh sieve shall not exceed 1.0%.
5. The strength activity index at seven (7) days shall be at least 85%.

**907-714.07.1.5--Acceptance.** With each new lot of material shipped the Contractor shall submit to the State Materials Engineer a certified test report from the manufacturer showing that the material meets the requirements AASHTO Designation: M295, Class N and the requirements of this Subsection.

The Department reserves the right to sample, for check tests, any shipment or lot of metakaolin delivered to a project.

**907-714.07.2--Silica Fume.**

**907-714.07.2.1--General.** Silica fume shall only be used as a supplementary cementitious material in Portland cement concrete for compliance with the requirements for cementitious materials exposed to soluble sulfate conditions. Silica fume from different sources shall not be mixed or used alternately in any one class of construction or structure without written permission from the Engineer. No additional cementitious materials, such as blended hydraulic cement, performance hydraulic cement, fly ash, GGBFS, or others, shall be added to or as a replacement for Portland cement when used with silica fume in the production of concrete.

The State Materials Engineer shall be notified in writing of the nature, amount and identity of any processing, or other additions made to the silica fume during production.

**907-714.07.2.2--Source Approval.** The approval of each silica fume source shall be on a case by case basis as determined by the State Materials Engineer. In order to obtain approval of a silica fume source, the Producer/Suppliers shall submit to the State Materials Engineer the following for review: certified test reports, made by an acceptable, independent laboratory regularly inspected by the Cement and Concrete Reference Laboratory of the National Institutes of Standards and Technology, which show that the silica fume meets all the requirements of AASHTO Designation: M307, Table 3, including the Sulfate resistance expansion, listed in the table for Optional Physical Requirements, and other requirements listed herein.

In order to demonstrate effectiveness in contributing to sulfate resistance, included in this test data shall be results of silica fume from the proposed source tested in accordance with ASTM Designation: C 1012. There shall be two sets of test specimens per the following:

- a. One set of test specimens shall be prepared using a Type I Portland cement meeting the requirements of AASHTO Designation: M85 and having a tricalcium aluminate ( $C_3A$ ) content of more than 8.0%,
- b. One set of test specimens shall be prepared using a Type II Portland cement meeting the requirements of AASHTO Designation: M85.
- c. The proposed silica fume shall be incorporated at the rate of 8% cement replacement in each set of test specimens and shall meet both of the acceptance criteria listed below for source approval.

The requirement for acceptance of the test sample using Type I Portland cement is an expansion of 0.10% or less at the end of six months. The requirement for acceptance of the test sample using Type II Portland cement is an expansion of 0.05% or less at the end of six months.

**907-714.07.2.3--Storage.** The Contractor shall provide suitable means for storing and protecting the silica fume against dampness and contamination. Silica fume which has become partially set, caked, or contains lumps shall not be used.

**907-714.07.2.4--Acceptance.** With each new lot of material shipped, the Contractor shall submit to the State Materials Engineer a certified test report from the manufacturer showing that the material meets the Chemical and Physical Requirements of AASHTO Designation: M307.

The Department reserves the right to sample, for check tests, any shipment or lot of silica fume delivered to a project.

Delete Subsection 714.11.6 on pages 690 and 691, and substitute the following.

**907-714.11.6--Rapid Setting Cementitious Patching Compounds for Concrete Repair.**

Rapid setting concrete patching compounds must be approved for listing in the Department's "Approved Sources of Materials" prior to use. Upon approval, a product must be recertified every four (4) years to remain on the "Approved Sources of Materials" list. Each product shall be pre-measured and packaged dry by the manufacturer. All liquid solutions included by the manufacturer as components of the packaged material shall be packaged in a watertight container. The manufacturer may include aggregates in the packaged material or recommend the addition of Contractor furnished aggregates.

The type, size and quantity of aggregates, if any, to be added at the job site shall be in accordance with the manufacturer's recommendations and shall meet the requirements of Subsection 703.02 for fine aggregate and Subsection 703.03 for coarse aggregate. Required mixing water to be added at the job site shall meet the requirements of Subsection 714.01.2.

Only those bonding agents, if any, recommended by the manufacturer of the grout or patching compounds may be used for increasing the bond to old concrete or mortar surfaces.

Patching compounds containing soluble chlorides will not be permitted when in contact with steel.

Site preparation, proportioning of materials, mixing, placing and curing shall be performed in accordance with the manufacturer's recommendation for the specific type of application, and the Contractor shall furnish a copy of these recommendations to the Engineer.

Rapid setting cementitious concrete patching compounds, including components to be added at the job site, shall conform to the following physical requirements:

Non-shrink cementitious grouts shall not be permitted for use.

Compressive strength shall equal or exceed 3000 psi in 24 hours in accordance with ASTM C 928 for Type R2 concrete or mortar.

Bond strength shall equal or exceed 1000 psi in 24 hours in accordance with ASTM C 928 for Type R2 concrete or mortar.

The material shall have a maximum length change of  $\pm 0.15\%$  in accordance with ASTM C 928 for Type R2 concrete or mortar.

The Contractor shall furnish to the Engineer three copies of the manufacturer's certified test report(s) showing results of all required tests and certification that the material meets the specifications when mixed and placed in accordance with the manufacturer's instructions. When the mixture is to be placed in contact with steel, the certification shall further state that the packaged material contains no chlorides. Certified test report(s) and certification shall be furnished for each lot in a shipment.

The proportioning of materials must be approved by the State Materials Engineer and any subsequent change in proportioning must also be approved. A sample of each component shall be submitted to the Engineer along with the quantity or percentage of each to be blended. At least 45 days must be allowed for initial approval.

The proportioning of materials for subsequent lots may be approved by the State Materials Engineer upon receipt of certification from the manufacturer that the new lot of material is the same composition as that originally approved by the Department and that the material has not been changed or altered in any way.

**907-714.11.7--Commercial Grout for Anchoring Doweled Tie Bars in Concrete.** Before Subsection 714.11.7.1 on page 691, add the following.

Approved Non-“Fast Set” Epoxy anchor systems as specified below may be used for the repair of concrete pavements that do not involve permanent sustained tension applications or overhead applications.

“*Fast Set Epoxy*” may not be used for any Adhesive Anchor Applications. Adhesive Anchor Systems (Fast Set epoxy or otherwise) shall not be used for permanent sustained tension applications or overhead applications. “Fast Set Epoxy” refers to an epoxy produced by the Sika Corporation called Sikadur AnchorFix-3 and repackaged for sale under a variety of names/companies listed at the Federal Highway Administration web site at the following link:

<http://www.fhwa.dot.gov/Bridge/adhesives.cfm>

**907-714.11.7.4--Acceptance Procedure.** After the last sentence of the first paragraph of Subsection 714.11.4 on page 691, add the following.

Upon approval, a product must be recertified every four (4) years to remain on the “Approved Sources of Materials” list.

**907-714.11.8--Epoxy Joint Repair System.**

**907-714.11.8.1--General.** After the last sentence of the first paragraph of Subsection 714.11.8.1 on page 692, add the following.

Upon approval, a product must be recertified every four (4) years to remain on the “Approved Sources of Materials” list.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-715-4

CODE: (IS)

DATE: 05/01/2013

SUBJECT: Roadside Development Materials

Section 715, Roadside Development Materials, of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows.

**907-715-02.2.1--Agricultural Limestone.** Delete the first sentence of Subsection 715-02.2.1 on page 704 and substitute the following.

Agricultural limestone shall be either a hard-rock limestone material or a marl or chalk agricultural liming material as addressed in the latest amendment to the Mississippi Agricultural Liming Material Act of 1993, published by the Mississippi Department of Agriculture and Commerce.

**907-715.02.2.1.1--Screening Requirements.** Delete the first sentence of Subsection 715.02.2.1.1 on page 704.

Delete Subsection 715.02.2.1.2 on page 704 and substitute the following.

**907-715-02.2.1.2--Calcium Carbonate Equivalent.** Marl or chalk liming material shall not have less than 70% calcium and magnesium carbonate calculated as calcium carbonate equivalent when expressed on a dry weight basis.

**907-715-02.2.1.3--Neutralizing Values.** Hard-rock limestone material shall have a minimum Relative Neutralizing Value (RNV) of 63.0%, which is determined as follows.

% RNV = CCE x (% passing #10 mesh + % passing #50 mesh)/2

Where: CCE = Calcium Carbonate Equivalent

**907-715.03--Seed.**

**907-715.03.2--Germination and Purity Requirements.** Add the following to Table B on page 705.

Name (Kind)	Name (Variety)	Percent Germination	Percent Purity
<b>GRASSES</b>			
Rye Grass	Annual	80	98
Wheat	-	80	98



MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-720-2

CODE: (IS)

DATE: 05/01/2013

SUBJECT: Pavement Marking Materials

Section 720, Pavement Marking Materials, of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows.

**907-720.01--Glass Beads.** After the first sentence of Subsection 720.01 on page 729, add the following.

The glass beads shall contain no more than 200 ppm (mg/kg) total concentration for lead, arsenic, or antimony. The manufacture shall furnish the Engineer with a certified test report indicating that the glass beads meet the above requirement.

**907-720.02--Thermoplastic Pavement Markings.** Delete the first paragraph of Subsection 720.02 on page 730 and substitute the following.

The thermoplastic material shall be lead free and conform to AASHTO Designation: M 249 except the glass beads shall be moisture resistant coated.

After the first sentence of the second paragraph of Subsection 720.02 on page 730, add the following.

In addition, the certification for the thermoplastic material shall state that the material is lead free.



# MISSISSIPPI DEPARTMENT OF TRANSPORTATION

## SUPPLEMENT TO SPECIAL PROVISION NO. 907-804-13

| **DATE:** 04/23/2013

**SUBJECT:** Concrete Bridges And Structures

After the second paragraph of Subsection 907-804.02.10 on page 2, add the following.

After the first paragraph of Subsection 804.02.10 on page 850, add the following.

If the Contractor chooses to cure the concrete in accordance with the requirements listed under **Length of Time Defined by Development of Compressive Strength** in Subsection 907-804.03.17, the compressive strength/maturity relationship shall be developed for the mixture design for a minimum of 28 days following the requirements of Subsection 907-804.03.15. The compressive strength/maturity relationship information shall be submitted with the mixture design information.

In the \*\* Note of Subsection 907-804.02.10 on page 2, delete “metakaolin” from the list of other cementitious materials.

After the first sentence of the last paragraph of Subsection 907-804.02.10 on page 3, add the following.

Mixture designs containing accelerating admixtures will not be approved. Admixtures providing a specific performance characteristic other than those of water reduction or set retardation may be used in accordance with the manufacturer’s recommended dosage range.

After Subsection 907-804.02.10.1.1 on page 3, add the following.

**907-804.02.10.1.2--Proportioning on the Basis of Laboratory Trial Mixtures.** Delete subparagraph d) of Subsection 804.02.10.1.2 on pages 852 & 853, and substitute the following.

- d) For each proposed mixture, at least three compressive test cylinders shall be made and cured in accordance with AASHTO Designation: T 126. Each change of water-cementitious ratio shall be considered a new mixture. The cylinders shall be tested for strength in accordance with AASHTO Designation: T 22 and shall be tested at 28 days.

After Subsection 907-804.02.10.3 on page 4, add the following.

After Subsection 804.02.10.3 on page 853, add the following.

**907-804.02.10.3.1--Slump Retention of Class DS Concrete Mixture Designs.** Prior to concrete placement, the Contractor shall provide test results of a slump loss test using approved methods to demonstrate that the mixture meets the four hour requirement in Subsection 907-803.02.7.1. These tests shall be conducted successfully by an approved testing laboratory within

30 days prior to installation of the trial shaft, with personnel from the Department's Central Laboratory present. The slump loss test shall be conducted at temperatures and conditions similar to those expected at the job site at the time of the installation of the trial shaft. The sample for the slump loss test shall be from a minimum batch size of four cubic yards of concrete. If the time between the previous successful slump loss test and the installation of the trial shaft exceeds 30 days, another successful slump loss test shall be performed on the first truckload of concrete as part of the installation of the trial shaft. This requirement limiting the time between the previous slump loss test and an installation of the trial shaft also applies to Class DS concrete mixture designs being transferred from another project. During any shaft installation a slump loss test shall be conducted by the Contractor at the direction of the Engineer from the concrete at the site for verification of slump loss requirements using a sample from a minimum batch size of four cubic yards of concrete.

Before Subsection 907-804.02.12.3 on page 5, add the following.

**907-804.02.12.1.1--Elements of Plan.** After item 3) in Subsection 804.02.12.1.1 on page 855, add the following.

4) Job Site Batch Adjustments by Addition of Chemical Admixtures:

The Plan shall address if the Contractor intends to adjust either the slump and/or total air content of a batch on the job site by adding chemical admixture(s) to a batch. The Contractor shall include the names of the personnel designated to perform this batch adjustment, the equipment used to add the chemical admixture(s), and the procedure by which the batch adjustment will be accomplished. Only the Contractor's designated personnel shall adjust a batch. Only calibrated dispensing equipment shall be used to add chemical admixture(s) to a batch. Only the procedure described in section of the Plan shall be utilized.

If the maximum permitted slump or total air content is exceeded after the addition of admixtures at the job site, the concrete shall be rejected.

If the Contractor elects to utilize Job Site Batch Adjustments by Addition of Chemical Admixture within Item 2, Procedures for Corrective Actions for Non Compliance of Specifications, to adjust batches which do not meet the minimum specification requirements for slump and/or total air content, no more than three batches on any one project shall be allowed to be adjusted.

5) Construction of Concrete Bridge Decks, including the following:

- the description of the equipment used for placing concrete on the bridge deck in accordance with Subsection 907-804.03.6 and, as applicable, Subsections 907-804.03.7 and 907-804.03.8 including any accessories added to the pump to ensure the entrained air in the concrete mixture remains entrained during pumping and depositing of the concrete mixture,
- the description of and the number of pieces of equipment used to consolidate the concrete in accordance with Subsection 907-804.03.6.2,

- the description of the equipment used to finish the bridge deck in accordance with Subsection 907-804.03.19.7,
- the plan for ensuring a continuous rate of finishing the bridge deck without delaying the application of curing materials within the time specified in Subsection 907-804.03.17, including ensuring a continuous supply of concrete throughout the placement with an adequate quantity of concrete to complete the deck and filling diaphragms and end walls in advance of deck placement,
- the plan for applying the curing materials within the time specified in Subsection 907-804.03.17,
- the description of the powered fogging equipment in accordance with Subsection 907-804.03.17,
- a sample of the documentation used as the daily inspection report for ensuring maintenance of the continuous wet curing in accordance with Subsection 907-804.03.17, as required,
- the description of the equipment used to apply the liquid membrane, including but not limited to, the nozzles, pumping/pressurization equipment, and liquid membrane tanks, in accordance with Subsection 907-804.03.17,
- the method for determining the rate of applied liquid membrane meets the application rate requirements in accordance with Subsection 907-804.03.17,
- a sample of the documentation used for the application rate verification of the liquid membrane in accordance with Subsection 907-804.03.17.

After Subsection 907-804.03.6.2 on page 7, add the following.

**907-804.03.8--Pumping Concrete.** Delete the second paragraph of Subsection 804.03.8 on page 866, and substitute the following.

Where concrete mixture is conveyed and placed by mechanically applied pressure (pumping), the equipment shall be suitable in kind and adequate in capacity for the work. The Contractor shall select concrete mixture proportions such that the concrete mixture is pumpable and placeable with the selected equipment.

The pumping equipment shall be thoroughly cleaned prior to concrete placement. Excess form release agent shall be removed from the concrete pump hopper. The Contractor shall prime the pump at no additional cost to the Department by pumping and discarding enough concrete mixture to produce a uniform mixture exiting the pump. At least 0.25 cubic yard of concrete mixture shall be pumped and discarded to prime the pump. This shall be accomplished by using the pump to fill a commercially-available six (6) cubic foot wheelbarrow to overflowing or filling a commercially-available eight (8) cubic foot wheel barrow to level. Only concrete mixture shall be added directly into the concrete pump hopper after placement has commenced. If anything other than concrete mixture is added to the concrete pump hopper, all concrete mixture in the concrete pump hopper and pump line shall be discarded and the pump re-primed at no additional cost to the Department.

The discharge end of the pump shall be of such a configuration that the concrete does not move in the pump line under its own weight. The intent of this requirement is to ensure that entrained air in the concrete mixture remains entrained during pumping and depositing the concrete mixture. This shall be accomplished with one or both of the following:

- a minimum 10-foot flexible hose attached to the discharge end of a steel reducer having a minimum length of three (3) feet and a minimum reduction in area of 20% which is attached to the discharge end of the pump line, or
- a flexible reducing hose to the discharge end of the pumpline with a minimum reduction in area of 20% over a minimum 10-foot hose length.

Regardless of the configuration chosen, the Contractor shall ensure that the concrete is pumped and does not free-fall more than five (5) feet within the entire length of pump line and after discharge from the end of pump line.

The Contractor shall not have any type of metal elbow, metal pipe, or other metal fitting within five (5) feet of any person during discharge of concrete mixture.

Boom pumps shall have a current Concrete Pump Manufacturers Association's ASME/ANSI B30.27 certification. Equipment added to the boom and pump line shall meet the pump manufacturer's specifications and shall not exceed the manufacturer's maximum recommended weight limit for equipment added to the boom and pump line.

The operation of the pump shall be such that a continuous stream of concrete without air pockets is produced. When pumping is completed, the concrete remaining in the pipe line, if it is to be used, shall be ejected in such a manner that there will be no contamination of the concrete or separation of the ingredients. After this operation, the entire equipment shall be thoroughly cleaned.

Before Subsection 907-804.03.15 on page 7, add the following.

**907-804.03.14.2--Stay-In-Place Metal Forms.** Delete the sentence in Subsection 804.03.14.2 on page 871 and substitute the following.

Stay-in-place (SIP) metal forms are corrugated metal sheets permanently installed between the supporting superstructure members. After the concrete has cured, these forms shall remain in place as permanent, non-structural members of the bridge.

Pay quantities for bridge deck concrete will be computed from the dimensions shown in the Contract Plans with no allowance for changes in deflection and /or changes in dimensions necessary to accommodate the SIP metal forms.

There will be no direct payment for the cost of the forms and form supports, or any material, tools, equipment, or labor incidental thereto, but the cost shall be considered absorbed in the contract unit price for bridge deck concrete.

Before fabricating any material, three (3) complete sets of SIP metal form shop drawings and design calculations, bearing the Design Engineer's Seal, shall be submitted to the Director of Structures, State Bridge Engineer, through the Project Engineer, for review. The Contractor's SIP metal form Design Engineer shall be a MS Registered Professional Engineer who is knowledgeable in the field of structural design.

In no case shall additional dead load produced by the use of SIP metal forms overstress any bridge component. Design calculations shall indicate any additional dead load from SIP metal form self-weight, form support hangers, concrete in flutes, concrete due to form deflection, etc. not included in the Contract Plans. The additional dead loads shall be clearly labeled and tabulated on the shop drawings. Bridge Division will evaluate the additional load for overstress of the bridge components. In the event that the additional dead load produces an overstress in any bridge component, Bridge Division will reject the Contractor's design. Deflection and loads produced by deflection of the SIP metal forms shall be considered and indicated in the design calculations.

The cambers and deflections provided in the Contract Plans do not consider the effects of SIP metal forms. The Contractor's Engineer shall take into account the weight of the forms and any additional dead load when developing the "Bridge Superstructure Construction Plan".

For the purpose of reducing any additional dead load produced by the SIP metal forms, the flutes of SIP metal forms may be filled with polystyrene foam. When polystyrene foam is used to fill the forms, the form flutes shall be filled completely; no portion of the polystyrene foam shall extend beyond the limits of the flutes. The Contractor shall ensure that the polystyrene foam remains in its required position within flutes during the entire concrete placement process. The Contractor shall not use reinforcing steel supports or other accessories in such a manner as to cause damage to the polystyrene foam. All damaged polystyrene foam shall be replaced to the satisfaction of the Project Engineer. All welding of formwork shall be completed prior to placement of polystyrene foam.

For bridges not located in horizontal curves, the Contractor may reduce the additional dead load by matching the flute spacing with the transverse steel spacing of the bottom layer. The bottom longitudinal layer of steel shall have one (1) inch of minimum concrete cover measured from the bottom of the reinforcing to the top of the flute. The Contractor will not be allowed to vary the reinforcing steel spacing or size from the Contract Plans for the purpose of matching flute spacing.

**907-804.03.14.2.1--Materials.** SIP metal forms and supports shall meet the requirements of ASTM Designation: A653 having a coating designation G165. Form materials that are less than 0.03-inch uncoated thickness shall not be allowed.

**907-804.03.14.2.2--Certification.** The Contractor shall provide written certification from the manufacturer stating the product meets the requirements of this specification to the Project Engineer along with the delivery of the coated forms to the job site.

All welds shall be performed by certified welders meeting the requirements of the approved shop drawings.

**907-804.03.14.2.3--Polystyrene Foam.** The polystyrene foam shall be comprised of expanded polystyrene manufactured from virgin resin of sufficient density to support the weight of concrete without deformation. The polystyrene foam shall be extruded to match the geometry of the flutes and provide a snug fit. The polystyrene foam shall have a density of not less than 0.8 pounds per cubic foot. The polystyrene foam shall have water absorption of less than 2.6% when tested according to ASTM Designation: C272. The Contractor shall provide written certification

from the manufacturer stating the polystyrene foam product meets the requirements of this specification to the Project Engineer along with the delivery of the coated forms to the job site.

**907-804.03.14.2.4--Design.** The design of the SIP metal forms shall meet the following criteria.

1. The maximum self-weight of the stay in place metal forms, plus the weight of the concrete or expanded polystyrene required to fill the form flutes (where used), shall not exceed 20 psf.
2. The forms shall be designed on the basis of dead load of form, reinforcement, and plastic concrete plus 50 pounds per square foot for construction loads. The design shall use a unit working stress in the steel sheet of not more than 0.725 of the specified minimum yield strength of the material furnished, but not to exceed 36,000 psi.
3. Deflection under the weight of the forms, reinforcement, and plastic concrete shall not exceed 1/180 of the form span or 1/2 inch, whichever is less, for form spans of 10 feet or less, or 1/240 of the form span or 3/4 inch, whichever is less, for form spans greater than 10 feet.
4. The design span of the form shall equal the clear span of the form plus two (2) inches. The span shall be measure parallel to the form flutes.
5. Physical design properties shall be computed in accordance with requirements of the AISI Specifications for the Design of Cold Formed Steel Structural Members, latest published edition.
6. The design concrete cover required by the plans shall be maintained for all reinforcement.
7. The plan dimensions of both layers of primary deck reinforcement from the top surface of the concrete deck shall be maintained.
8. The SIP metal form shall not be considered as lateral bracing for compression flanges of supporting structural members.
9. SIP metal forms shall not be used under closure pours or in bays where longitudinal slab construction joints are located. SIP metal forms shall not be used under cantilevered slabs such as the overhang outside of fascia members.
10. Forms shall be secured to the supporting members by means other than welding directly to the member. Welding to the top flanges of steel stringers and/or girders shall not be allowed. Alternate installation procedures shall be submitted addressing this condition.

**907-804.03.14.2.5--Construction.** SIP metal form sheets shall not rest directly on the top of the stringer or floor beam flanges. Sheets shall be fastened securely to form supports, and maintain a minimum bearing length of one (1) inch at each end for metal forms. Form supports shall be placed in direct contact with the flange of the stringer or floor beam. All attachments for coated metal forms shall be made by bolts, clips, screws, or other approved means.

**907-804.03.14.2.6--Form Galvanizing Repairs.** Where forms or their installation are unsatisfactory in the opinion of the Project Engineer, either before or during placement of the concrete, the Contractor shall correct the defects before proceeding with the construction work. The cost of such corrective work shall be at the sole expense of the Contractor. Minor heat discoloration in areas of welds shall not be touched up.

**907-804.03.14.2.7--Placing of Concrete.** The Contractor shall insure that concrete placement does not damage the SIP metal forms. The concrete shall be vibrated to avoid honeycomb and voids, especially at construction joints, expansion joints, valleys and ends of form sheets. Approved pouring sequences shall be used. Calcium chloride or any other admixture containing chloride salts shall not be used in the concrete. The completed SIP metal form system shall be sufficiently tight to prevent leakage of mortar or concrete.

**907-804.03.14.2.8--Inspection.** The Project Engineer will observe the Contractor's method of construction during all phases of the construction of the bridge deck slab, including the installation of the SIP metal form system; location and fastening of the reinforcement; composition of concrete items; mixing procedures, concrete placement, and vibration; and finishing of the bridge deck. Should the Project Engineer determine that the procedures used during the placement of the concrete warrant inspection of the underside of the deck, at least one section of the metal forms shall be removed in each span for this purpose. This shall be done as soon after placing the concrete as practical in order to provide visual evidence that the concrete mix and the procedures are obtaining the desired results. An additional section shall be removed in any span if the Project Engineer determines that there has been any change in the concrete mix or in the procedures warranting additional inspection.

If, in the Project Engineer's judgment, inspection is needed to check for defects in the bottom of the deck or to verify soundness, the SIP metal forms shall be sounded with a hammer after the deck concrete has been in place a minimum of two days. If sounding discloses areas of doubtful soundness to the Project Engineer, the SIP metal forms shall be removed from such areas for visual inspection after the concrete has attained adequate strength. The SIP metal bridge deck forms shall be removed at no expense to the State.

At locations where sections of the metal forms have been removed, the Project Engineer will not require the Contractor to replace the metal forms. The adjacent metal forms and supports shall be repaired to present a neat appearance and to ensure their satisfactory retention. As soon as the form is removed, the Project Engineer will examine the concrete surfaces for cavities, honeycombing, and other defects. If irregularities are found and the Project Engineer determines that these irregularities do not justify rejection of the work, the concrete shall be repaired as directed by the Project Engineer. If the Project Engineer determines that the concrete where the form is removed is unsatisfactory, additional metal forms as necessary shall be removed to inspect and repair the slab, and the Contractor's method of construction shall be modified as required to obtain satisfactory concrete in the slab. All unsatisfactory concrete shall be removed and replaced as directed at no expense to the State.

If the method of construction and the results of the inspections as outlined above indicate that sound concrete has been obtained throughout the slabs, the amount of sounding and form removal may be reduced when approved by the Project Engineer.

The Contractor shall provide a safe and convenient means of conducting of the inspection.

Delete Table 6 of Subsection 907-804.03.15 on page 8, and substitute the following.

**Table 6**  
**Minimum Compressive Strength Requirements for Form Removal**

**Forms:**

Columns .....	1000 psi
Side of Beams .....	1000 psi
Walls not under pressure .....	1000 psi
Other Parts .....	1000 psi

**Centering:**

Under Beams .....	2400 psi
Under Bent Caps .....	2000 psi

**Limitation for Placing Beams on:**

Pile Bents, pile under beam .....	2000 psi
Frame Bents, two or more columns .....	2200 psi
Frame Bents, single column .....	2400 psi

Forms for bridge deck slabs overhead and bridge deck slabs between beams shall be removed with the approval of the Engineer, between two weeks and four weeks after the removal of the wet burlap applied in accordance with Subsection 907-804.03.17.1, or application of liquid membrane applied in accordance with Subsection 907-804.03.17.2.

Delete the second paragraph of Subsection 907-804.03.16.1 on page 9, and substitute the following.

At the option of the Contractor with the approval of the Engineer, when concrete is placed during cold weather and there is a probability that the ambient temperatures will be lower than 40°F, an approved maturity meter may be used to determine concrete strengths by inserting probes into concrete placed in a structure. The minimum number of maturity meter probes required for each structural component shall be in accordance with Table 7. An approved insulating blanketing material shall be used to protect the work when ambient temperatures are less than 40°F and shall remain in place until the required concrete strength in Table 6 is achieved. Within 30 minutes of removal of the insulating blanketing material in any area, the Contractor shall have curing of the concrete established in accordance with the requirements in Subsection 907-804.03.17. Procedures for using the maturity meter and developing the strength/maturity relationship shall follow the requirements of AASHTO Designation: T 325 and ASTM Designation: C 1074 specifications. Technicians using the maturity meter or calculating strength/maturity graphs shall be required to have at least two hours of training prior to using the maturity equipment.

Before Subsection 907-804.03.19 on page 9, add the following.



**907-804.03.17--Curing Concrete.** Delete Subsection 804.03.17 on pages 874 & 875, and substitute the following.

Curing is defined as all actions taken to ensure the moisture and temperature conditions of freshly placed concrete exist so the concrete may develop its potential properties. Curing shall take place from the time of placement until its potential properties have developed. The Contractor shall use the guidance in ACI 308R-01 to:

- a) cure the concrete in such a manner as to prevent premature moisture loss from the concrete,
- b) supply additional moisture to the concrete as required in order to ensure sufficient moisture within the concrete, and
- c) maintain a concrete temperature beneficial to the concrete.

Curing in accordance with the requirements in either Subsection 907-804.03.17.1 or Subsection 907-804.03.17.2 shall be completely established within 20 minutes after finishing, except as noted for bridge decks. Finishing is complete when the pan drag, burlap drag, or other is complete.

The length of time for curing shall be maintained in accordance with either of the following:

**1. Prescribed Length of Time:**

- a) Curing following the requirements of Subsection 804.03.17.1 shall continue uninterrupted for at least 14 days.
- b) Curing following the requirements of Subsection 804.03.17.2 shall continue uninterrupted for at least 10 days.

OR

**2. Length of Time Defined by Development of Compressive Strength:**

Curing following the application requirements of Subsection 907-804.03.17.1 or Subsection 907-804.03.17.2 shall continue uninterrupted for each day's production until the compressive strength of the concrete exceeds 75% of the 28-day compressive strength submitted as the Basis of Proportioning per Subsection 907-804.02.10.1. Therefore, if an area is being cured in accordance with Subsection 907-804.03.17.1, the curing by wet burlap shall continue until the concrete in that area has attained a minimum of 75% of the 28-day compressive strength submitted as the Basis of Proportioning per Subsection 907-804.02.10.1. Likewise, if an area is being cured in accordance with Subsection 907-804.03.17.2, the curing by liquid membrane shall continue until the concrete in that area has attained a minimum of 75% of the 28-day compressive strength submitted as the Basis of Proportioning per Subsection 907-804.02.10.1.

The compressive strength of the concrete may be determined by the use of maturity meter in accordance with Subsection 907-804.03.15.

**907-804.03.17.1--Water With Waterproof Cover.** All burlap shall be completely saturated and wet prior to placing it on the concrete. The burlap shall have been fully soaked in water for a minimum of 12 hours prior to placement on the concrete.

For bridge decks, the Contractor shall apply one (1) layer of saturated burlap within 20 minutes of the initial strike-off for bridges without a skew and 25 minutes of the initial strike-off for bridges with a skew. For all other concrete, the Contractor shall apply one (1) layer of saturated burlap within 20 minutes of completing finishing.

Following the first layer of burlap, the Contractor shall apply a second layer of saturated burlap within five (5) minutes of applying the first layer. The concrete surface shall not be allowed to dry after strike-off or at any time during the curing period.

The Contractor shall maintain the burlap in a fully wet condition using powered fogging equipment capable of producing a fog spray of atomized droplets of water until the concrete has gained sufficient strength to allow foot traffic without the foot traffic marring the surface of the concrete. Burlap shall not be maintained in the fully wet condition using equipment which does not produce a fog spray of atomized droplets of water or by use of manually pressurized sprayers. For bridge decks, once the concrete has gained sufficient strength to allow foot traffic which does not mar the surface of the concrete, soaker hoses shall be placed on the burlap. The soaker hoses shall then be supplied with running water continuously to maintain continuous saturation of all burlap and the entire concrete surface.

If there is a delay in the placement of the first layer of saturated burlap outside the time limit, the struck-off and finished concrete shall be kept wet by use of the powered fogging equipment used to keep the burlap wet.

White polyethylene sheets shall be placed on top of the wet burlap and, as applicable, soaker hoses covering the entire concrete surface as soon as practical and not more than 12 hours after the placement of the concrete. White polyethylene sheets of the widest practical width shall be used, overlapping adjacent sheets a minimum of six inches (6") and tightly sealed with an adhesive like pressure sensitive tape, mastic, glue, or other approved methods to form a complete waterproof cover of the entire concrete surface. White polyethylene sheets which overlap a minimum of two feet (2') may be held in place using means other than an adhesive. The white polyethylene sheets shall be secured so that wind will not displace them. The Contractor shall immediately repair the broken or damaged portions or replace sections that have lost their waterproof qualities.

If burlap and/or white polyethylene sheets are temporarily removed for any reason during the curing period, the Contractor shall keep the entire exposed area continuously wet. The saturated burlap and white polyethylene sheets shall be replaced, resuming the specified curing conditions, as soon as possible.

The Contractor shall inspect the concrete surface once every 8 hours for the entirety of the curing period, so that all areas remain wet for the entire curing period and all curing requirements are satisfied and document the inspection in accordance with Subsection 907-804.03.17.1.1.

At the end of the curing period, one coating of liquid membrane shall be applied following the requirements of Subsection 907-804.03.17.1.2. The purpose of the coating of liquid membrane is

to allow for slow drying of the concrete. The application of liquid membrane to any area shall be complete within 30 minutes of the beginning of removal of the white polyethylene sheets, soaker hoses, and burlap from this area.

**907-804.03.17.1.1--Documentation.** The Contractor shall provide the Engineer with a daily inspection report that includes:

- documentation that identifies any deficiencies found (including location of deficiency);
- documentation of corrective measures taken;
- a statement of certification that all areas are wet and all curing material is in place on the entire bridge deck;
- documentation showing the time and date of all inspections and the inspector's signature;
- documentation of any temporary removal of curing materials including location, date and time, length of time curing was removed, and means taken to ensure exposed area was kept continuously wet.

**907-804.03.17.1.2--Liquid Membrane.** At the end of the 14-day wet curing period the wet burlap and polyethylene sheets shall be removed and within 30 minutes, the Contractor shall apply white liquid membrane to the deck. The liquid membrane shall be thoroughly mixed within the time recommended by the liquid membrane producer but no more than an hour before use. If the use of liquid membrane results in a streaked or blotched appearance, the method shall be stopped and water curing applied until the cause of defective appearance is corrected.

The liquid membrane shall be applied when no free water remains on the surface but while the surface is still wet. The liquid membrane shall be applied according to the manufacturer's instructions with a minimum spreading rate per coat of one (1) gallon per 200 square feet of concrete surface. If the concrete is dry or becomes dry, the Contractor shall thoroughly wet it with water applied as a fog spray by means of approved equipment.

The application of liquid membrane shall be accomplished by the use of power applied spray equipment using nozzles and other equipment recommended by the liquid membrane producer. Manually pressurized or manual pump-up type sprayers shall not be used to apply the first application of liquid membrane.

As a visual guide, the color of concrete covered with the required amount of liquid membrane should be indistinguishable from a sheet of commercially available standard "letter" size white copier paper placed on top of it when viewed from a distance of about five feet (5') away horizontally if standing on the same grade as the concrete. The appearance of the concrete does not supersede applying the minimum spreading rate.

The coating shall be protected against marring for at least seven (7) days after the application of the curing compound. The coating on bridge decks shall receive extra attention and may require additional protection as required by the Engineer. All membrane marred or otherwise disturbed shall be given an additional coating. Manually pressurized or manual pump-up type sprayers may be used for giving marred areas the required additional application of liquid membrane. Should the surface coating be subjected repeatedly to injury, the Engineer may require that the water curing method be applied at once.

The 7-day period during which the liquid membrane is applied and protected shall not be reduced even if the period of wet curing is extended past the required 14 days.

**907-804.03.17.1.2.1--Liquid Membrane Documentation.** The Contractor shall make available to the Engineer an application rate verification method and any information necessary during application of the liquid membrane to verify that the rate of application meets the prescribed rate for the various surfaces of the concrete, including, but not limited to, the top surface of the bridge deck and exposed sides of the bridge deck after any forms are removed. The Contractor shall submit this application verification method to the Engineer in accordance with Subsection 907-804.02.12.1.1.

One method of verifying the rate of application is as follows:

1. Determine the volume of liquid membrane in the container. For a container with a uniform cross-sectional area, for example a 55-gallon drum, determine the area of the cross-section. Determine the height of the surface of the liquid membrane from the bottom of the container. This may be accomplished by inserting a sufficiently long, clean dip-stick parallel with the axis of the container into the liquid membrane until the inserted end of the dip-stick contacts the bottom of the container. On removing the dip-stick, measure the length from the end which was inserted to the point on the dip-stick where the liquid membrane ceases to coat the dip-stick. Multiply the area of the cross-section by the height of the level of liquid membrane, maintaining consistent units, to determine the volume.
2. Perform step 1 prior to beginning applying the liquid membrane to establish the initial volume.
3. During the period of application, perform step 1 each 100 square feet of bridge deck.
4. In order to meet the required application rate of one (1) gallon per 200 square feet, the amount in the container shall be at least 0.5 gallon less than the previous volume in the previous 100 square feet. Other changes in volume may apply depending on the manufacturer's recommended application rate.
5. Additional applications to an area shall be applied until the required rate is satisfied. Areas which are not visually satisfactory to the Engineer shall have additional liquid membrane applied as directed by the Engineer.

The amount of liquid membrane applied shall be determined each day using the application verification method. This information shall be submitted to the Engineer within 24 hours of applying the liquid membrane.

**907-804.03.17.2--Liquid Membrane Method.** Surfaces on which curing is to be by liquid membrane shall be given the required surface finish prior to the application of liquid membrane. Concrete surfaces cured by liquid membrane shall receive two applications of white liquid membrane. Neither application shall be made from a position supported by or in contact with the freshly placed concrete. Both applications shall be applied perpendicularly to the surface of the concrete.

When using liquid membrane, the liquid membrane shall be thoroughly mixed within the time recommended by the liquid membrane producer but no more than an hour before use. If the use of liquid membrane results in a streaked or blotched appearance, the method shall be stopped and water curing applied until the cause of defective appearance is corrected.

The application of liquid membrane shall be accomplished by the use of power applied spray equipment using nozzles and other equipment recommended by the liquid membrane producer. Manually pressurized or manual pump-up type sprayers shall not be used to apply the first two applications of liquid membrane.

The liquid membrane shall be applied when no free water remains on the surface but while the surface is still wet. The liquid membrane shall be applied according to the manufacturer's instructions with a minimum spreading rate per coat of one (1) gallon per 200 square feet of concrete surface. If the concrete is dry or becomes dry, the Contractor shall thoroughly wet it with water applied as a fog spray by means of approved equipment.

The first application of the liquid membrane shall be made as the work progresses. For bridge decks, the first application shall be completed in each area of the deck within 20 minutes of initial strike-off for bridges with no skew and within 25 minutes of initial strike-off for bridges with skew. For all other concrete, the first application of the liquid membrane shall be completed within 20 minutes of finishing.

The second application shall be applied within 30 minutes after the first application. The liquid membrane shall be uniformly applied to all exposed concrete surfaces.

As a visual guide, the color of concrete covered with the required amount of liquid membrane should be indistinguishable from a sheet of commercially available standard "letter" size white copier paper placed on top of it when viewed from a distance of about five feet (5') away horizontally if standing on the same grade as the concrete. The appearance of the concrete does not supersede applying the minimum spreading rate.

The Contractor shall make available to the Engineer an application rate verification in accordance with Subsection 907-804.03.17.1.2.1.

The coating shall be protected against marring for at least 10 days after the application of the curing compound. The coating on bridge decks shall receive extra attention and may require additional protection as required by the Engineer. All membrane marred or otherwise disturbed shall be given an additional coating. Manually pressurized or manual pump-up type sprayers may be used for giving marred areas the required additional application of liquid membrane. Should the surface coating be subjected repeatedly to injury, the Engineer may require that the water curing method be applied at once.

Delete Subsection 907-804.19.7 on page 9, and substitute the following.

**907-804.03.19.7--Finishing Bridge Decks.**

**907-804.03.19.7.1--General.** Delete the third paragraph of Subsection 804.03.19.7.1 on page 884, and substitute the following.

Except when indicated otherwise on the plans, the finish of the bridge deck shall be either a belt finish, a broom finish, or one of the following drag methods: pan, double pan, burlap, or pan and burlap. Manual finishing of the bridge deck shall be performed only in areas inaccessible by the

finishing equipment mounted to the strike-off screed, but shall not hinder the requirements for curing in accordance with Subsection 907-804.03.17.1. The surface texture specified and surface requirements shall be in accordance with the applicable requirements of Subsections 501.03.17 and 501.03.18 modified only as the Engineer deems necessary for bridge deck construction operations.

At no time shall water on the surface of the concrete from bleeding, fogging, curing, or other sources be worked into the concrete or used as an aid for finishing.

Regardless of the method of finishing selected, requirements for curing per Subsection 907-804.03.17 shall be completed within the specified time limits. If the requirements in Subsection 907-804.03.17 are not completed within the specific time limits, the Contractor shall cease operations, revise his operations up to and including acquiring new or additional equipment or additional personnel in order to satisfy the requirements in Subsection 907-804.03.17, and, on approval from the Engineer, resume operations

**907-804.03.19.7.2--Longitudinal Method.** Before the first paragraph of Subsection 804.03.19.7.2 on page 884, add the following.

The longitudinal method may be used for repairs to bridge decks or bridge widening projects. For bridge widening projects, the time for establishing curing in accordance with Subsections 907-804.03.17 shall be increased to within 30 minutes for bridges without skew and within 35 minutes for bridges with skew.

**907-804.03.19.7.3--Transverse Method.** Delete the first sentence of the second paragraph of Subsection 804.03.19.7.3 on page 885, and substitute the following.

The machine shall be so constructed and operated as to produce a bridge deck of uniform density with minimum manipulation of the fresh concrete and achieved in the shortest possible time.

Delete the fourth paragraph of Subsection 804.03.19.7.3 on page 885, and substitute the following.

At least one dry run shall be made the length of each pour with a "tell-tale" device attached to the screed carriage to assure the specified clearance to the reinforcing steel.

Delete the last sentence of the fifth paragraph of Subsection 804.03.19.7.3 on page 885, and substitute the following.

The screed shall be mechanically actuated to deliver the screeding action and for travel in a longitudinal direction at a uniform rate along the bridge deck.

Delete the last paragraph of Subsection 804.03.19.7.3 on page 886, and substitute the following.

Other finishing requirements shall be in accordance with the general requirements in Subsection 907-804.03.19.7.1 and as specified on the plans.

Regardless of the finish, the requirements for curing per Subsection 907-804.03.17 shall be completed within the specified time limits.

**907-804.03.19.7.4--Acceptance Procedure for Bridge Deck Smoothness.** Delete the third sentence of the first paragraph of Subsection 804.03.19.7.4 on page 886, and substitute the following.

The profilograph shall meet the requirements of Subsection 907-804.03.19.7.5.

After the fourth sentence of the first paragraph of Subsection 804.03.19.7.4 on page 886, add the following.

The wheel paths shall be designated as being located three feet (3') and nine feet (9') from centerline or longitudinal joint, respectively.

After the first sentence of the second paragraph of Subsection 804.03.19.7.4 on page 886, add the following.

Auxiliary lanes, tapers, shoulders and other areas that are not checked with the profilograph, shall meet a 1/8 inch in 10-foot straightedge check made transversely and longitudinally across the deck or slab.

After Subsection 907-804.03.19.7.4 on page 9, add the following.

Delete the title of Subsection 804.03.19.7.4.1.3 on page 888, and substitute the following.

**907-804.03.19.7.4.1.3--Final Surface Texture.**

Delete the first sentence of the second paragraph of Subsection 804.03.19.7.4.1.3 on page 889 and substitute the following.

The finished bridge decks and bridge end slabs shall be retested for riding quality using a Contractor furnished profilograph meeting the requirements of Subsection 907-804.03.19.7.5.

After Subsection 804.03.19.7.4.1.3 on page 889, add the following.

**907-804.03.19.7.5--Profilograph Requirements.** The smoothness of the bridge deck will be determined by using a California Profilograph to produce a profilogram (profile trace) at each designated location. The surface shall be tested and corrected to a smoothness index as described herein with the exception of those locations or specific projects that are excluded from a smoothness test with the profilograph.

The profilograph, furnished and operated by the Contractor under supervision of the Engineer, shall consist of a frame at least 25 feet in length supported upon multiple wheels having no common axle. The wheels shall be arranged in a staggered pattern so that no two wheels will simultaneously cross the same bump. A profile is to be recorded from the vertical movement of a sensing mechanism. This profile is in reference to the mean elevation of the contact points established by the support wheels. The sensing mechanism, located at the mid-frame, may

consist of a single bicycle-type wheel or a dual-wheel assembly consisting of either a bicycle-type (pneumatic tire) or solid rubber tire vertical sensing wheel and a separate bicycle-type (pneumatic tire) longitudinal sensing wheel. The wheel(s) shall be of such circumference(s) to produce a profilogram recorded on a scale of one (1) inch equal to 25 feet longitudinally and one (1) inch equal to one (1) inch (full scale) vertically. Motive power may be provided manually or by the use of a propulsion unit attached to the center assembly. In operation, the profilograph shall be moved longitudinally along the pavement at a speed no greater than 3 MPH so as to reduce bounce as much as possible. The testing equipment and procedure shall comply with the requirements of Department SOP.

The Contractor may elect to use a computerized version of the profilograph in lieu of the standard profilograph. If the computerized version of the profilograph is used, it shall meet the requirements of Subsection 907-804.03.19.7.5.1.

**907-804.03.19.7.5.1--Computerized Profilograph.**

**907-804.03.19.7.5.1.1--General** The computerized profilograph, furnished and operated by the Contractor under the supervision of the Engineer, shall be equipped with an on-board computer capable of meeting the following conditions.

Vertical displacement shall be sampled every three (3) inches or less along the bridge deck. The profile data shall be bandpass filtered in the computer to remove all spatial wavelengths shorter than two (2) feet. This shall be accomplished by a third order, low pass Butterworth filter. The resulting band limited profile will then be computer analyzed according to the California Profilograph reduction process to produce the required inches per mile index. This shall be accomplished by fitting a linear regression line to the length of bridge. This corresponds to the perfect placement of the blanking band bar by a human trace reducer. Scallops above and below the blanking band are then detected and totaled according to the California protocol. Bump/Dip analysis shall take place according to the California Profilograph reduction process.

The computerized profilograph shall be capable of producing a plot of the profile and a printout which will give the following data: Stations every twenty five (25) feet, bump/dip height and bump/dip length of specification (3/10 of an inch and 25 feet respectively), the blanking band width, date of measurement, total profile index in inches per mile for the measurement, total length of the measurement, and the raw inches for each segment.

**907-804.03.19.7.5.1.2--Mechanical Requirements.** The profilograph shall consist of a frame twenty five (25) feet long supported at each end by multiple wheels. The frame shall be constructed to be easily dismantled for transporting. The profilograph shall be constructed from aluminum, stainless steel and chromed parts. The end support wheels shall be arranged in a staggered pattern such that no two wheels cross a transverse joint at the same time. The relative smoothness shall be measured by the vertical movement of an eight (8) inch or larger diameter sensing wheel at the midpoint of the 25-foot frame. The horizontal distance shall be measured by a twenty (20) inch or larger diameter pneumatic wheel. This profile shall be the mean elevation referenced to the twelve points of contact with the pavement established by the support wheels. Recorded graphical trace of the profile shall be on a scale of one inch equals one inch (full scale) vertical motion of the sensing wheel and one inch equals 25 feet horizontal motion of the profilograph.



**907-804.03.19.7.5.1.3--Computer Requirements.** The computer shall have the ability to produce output on sight for verification. The computerized output shall indicate the profile index for each specified section of bridge deck. Variable low and high pass third-order Butterworth filtering options shall be available. The printout shall be capable of showing station marks automatically on the output. Blanking band positioning for each specified section of the bridge deck shall be placed according to the least squares fit line of the collected data. Variable bump and dip tests shall be available to show “must correct” locations on the printout. The computer must have the ability to display on screen “must correct” conditions and alert the user with an audible warning when a “must correct” location has been located. The computer must have the ability to store profile data for later reanalysis. The measurement program must be menu driven and PC compatible. User selected options, identification, calibration factors, and time and date stamps shall be printed at the top of each printed report for verification. The control software must be upgradeable. A power source shall be included for each profilograph and be capable of supplying all power needs for a full days testing.

**907-804.03.20--Opening Bridges.**

**907-804.03.20.2--Construction Traffic.** Delete the paragraph in Subsection 804.03.20.2 on page 889, and substitute the following:

Unless otherwise specified, the concrete bridge decks shall be closed to construction traffic for the time required for curing in Subsection 907-804.03.17 and until the required compressive strength for the concrete is obtained.

**MISSISSIPPI DEPARTMENT OF TRANSPORTATION**

**SPECIAL PROVISION NO. 907-804-13**

**CODE: (IS)**

**DATE: 11/09/2010**

**SUBJECT: Concrete Bridges And Structures**

Section 804, Concrete Bridges And Structures, of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows:

**907-804.02-- Materials.**

**907-804.02.1--General.** Delete the third and fourth sentences of the first paragraph of Subsection 804.02.1 on page 846, and substitute the following:

For projects with 1000 cubic yards and more, quality control and acceptance shall be achieved through statistical evaluation of test results. For projects of more than 200 but less than 1000 cubic yards, quality control and acceptance shall be achieved by individual test results.

Add the following materials to the list of materials in Subsection 804.02.1 on page 847.

- Blended Cement..... 907-701.01 and 907-701.04
- Ground Granulated Blast Furnace Slag (GGBFS)..... 907-714.06
- Silica Fume ..... 907-714.07.2

**907-804.02.8--Laboratory Accreditation.** In Table 1 of Subsection 804.02.8 on page 849, substitute AASHTO: R 39 - Making and Curing Concrete Test Specimens in the Laboratory for AASHTO: T 126 - Making and Curing Concrete Test Specimens in the Laboratory.

**907-804.02.9--Testing Personnel.** Delete Table 2 in this subsection and replace it with the following.

**Table 2**

<b>Concrete Technician's Tasks</b>	<b>Test Method Required</b>	<b>Certification Required**</b>
Sampling or Testing of Plastic Concrete	AASHTO Designation:T 23, T 119, T 121, T 141, T 152, T 196, and ASTM Designation: C 1064	MDOT Class I certification
Compressive Strength Testing of Concrete Cylinders	AASHTO Designation: T 22 and T 231	MDOT Concrete Strength Testing Technician certification
Sampling of Aggregates	AASHTO Designation: T 2	Work under the supervision of an MDOT Class II certified technician

Testing of Aggregates	AASHTO Designation: T 19, T 27, T 84, T 85, T 248, and T 255	MDOT Class II certification
Proportioning of Concrete Mixtures*	AASHTO Designation: M 157 and R 39	MDOT Class III
Interpretation and Application of Maturity Meter Readings	AASHTO Designation: T 325 and ASTM Designation: C 1074	MDOT Class III or Two hours maturity method training

- \* Technicians making concrete test specimens for meeting the requirements of Subsection 804.02.10.1.2 shall be MDOT Class I certified and under the direct supervision of an MDOT Class III certified technician.
- \*\* MDOT Class I certification encompasses the same test procedures and specifications as ACI Concrete Field Testing Technician Grade I. MDOT Class II certification encompasses the same test procedures and specifications as ACI Aggregate Testing Technician - Level 1. MDOT Concrete Strength Testing Technician encompasses the same test procedures and specifications as ACI Concrete Strength Testing certification.

For specifics about the requirements for each level of certification, please refer to the latest edition of the Department’s *Concrete Field Manual*. Technicians holding current MDOT Class I, MDOT Class II and/or MDOT Class III certifications shall be acceptable until those certifications expire. Upon a current certification expiration, recertification with the certifications listed in Table 2 shall be required. Technicians currently performing either specific gravity testing of aggregates or compressive strength tests shall be required to either:

- have the required MDOT certification listed in Table 2, or
- have a current MDOT Class III certification or work under the direct supervision of current MDOT Class III technician, and have demonstrated the specific gravity and/or compressive strength test during the inspection of laboratory equipment by the Materials Division, Concrete Section.

**907-804.02.10--Portland Cement Concrete Mix Design.** Delete the first sentence of the first paragraph of Subsection 804.02.10 on page 850 and substitute the following:

At least 30 days prior to production of concrete, the Contractor shall submit to the Engineer proposed concrete mixture designs complying with the Department’s *Concrete Field Manual*.

Delete the Notes under Table 3 of Subsection 804.02.10 on pages 850 & 851, and substitute the following:

- \* Maximum size aggregate shall conform to the concrete mix design for the specified aggregate.
- \*\* The replacement limits of Portland cement by weight by other cementitious materials (such as fly ash, GGBFS, metakaolin, silica fume, or others) shall be in accordance with the values in Subsection 907-701.02. Other hydraulic cements may be used in accordance with the specifications listed in Section 701.

\*\*\* The slump may be increased up to eight (8) inches with :

- an approved water-reducing admixture,
- an approved water-reducing/set-retarding admixture, or
- a combination of an approved water-reducing admixture and an approved set-retarding admixture, in accordance with 907-713.02. Minus slump requirements shall meet those set forth in Table 3 of AASHTO Designation: M157.

\*\*\*\* Entrained air is not required except for concrete exposed to seawater. For concrete exposed to seawater, the total air content shall be 3.0 % to 6.0%. For concrete not exposed to seawater, the total air content shall not exceed 6.0%.

\*\*\*\*\* Class DS Concrete for drilled shafts shall have an 8±1-inch slump.

Delete the last paragraph of Subsection 804.02.10 on page 851 and substitute the following:

At least one water-reducing admixture shall be used in all classes of concrete in accordance with the manufacturer's recommended dosage range. Any combinations of admixtures shall be approved by the Engineer before their use.

**907-804.02.10.1.1--Proportioning on the Basis of Previous Field Experience of Trial Mixtures.** Delete the first sentence of the first paragraph of Subsection 804.02.10.1.1 on page 851, and substitute the following:

Where a concrete production facility has a record, based on at least 10 consecutive strength tests from at least 10 different batches within the past 12 months from a mixture not previously used on Department projects, the standard deviation shall be calculated.

**907-804.02.10.3--Field Verification of Concrete Mix Design.** Delete the first sentence of the third paragraph of Subsection 804.02.10.3 on page 853 and substitute the following:

For all Classes of concrete, the mixture shall be verified to yield within 2.0% of the correct volume when all the mix water is added to the batch.

For all Classes of concrete other than DS, F, and FX, the mixture shall produce a slump within a minus 1½-inch tolerance of the maximum permitted for mixtures with a maximum permitted slump of three inches (3") or less or within a minus 2½-inch tolerance of the maximum permitted for mixtures with a maximum permitted slump of greater than three inches (3"), and producing a total air content within a minus 1½ percent tolerance of the maximum allowable air content in Table 3.

For Class DS, the slump shall be within the requirements in Note \*\*\*\*\* below Table 3. For Class DS exposed to seawater, the total air content shall be within a minus 1½ percent tolerance of the maximum allowable air content in Note \*\*\*\* below Table 3. For Class DS not exposed to seawater the total air content shall be within the requirements in Note \*\*\*\*\* below Table 3.

For Classes F and FX, the slump shall be within a minus 1½-inch tolerance of the maximum permitted for mixtures with a maximum permitted slump of three inches (3") or less or within a minus 2½-inch tolerance of the maximum permitted for mixtures with a maximum permitted

slump of greater than three inches (3"). For Classes F and FX exposed to seawater, the total air content shall be within a minus 1½ percent tolerance of the maximum allowable air content in Note \*\*\*\* below Table 3. For Classes F and FX not exposed to seawater the total air content shall be within the requirements in Note \*\*\*\* below Table 3.

Delete the third sentence of the third paragraph of Subsection 804.02.10.3 on page 853, and substitute the following:

If the requirements of yield, slump, or total air content are not met within three (3) production days after the first placement, subsequent field verification testing shall not be permitted on department projects, and the mix design shall not be used until the requirements listed above are met

**907-804.02.10.4--Adjustments of Mixture Proportions.** Delete the paragraph in Subsection 804.02.10.4 on page 854, and substitute the following:

The mixture may be adjusted by the Class III Certified Technician representing the Contractor in accordance with the allowable revisions listed in the Department's Concrete Field Manual, paragraph 5.7. Written notification shall be submitted to the Engineer a minimum of seven (7) days prior to any source or brand of material change, aggregate size change, allowable material type change, or decrease in any cementitious material content. Any adjustments of the concrete mixture design shall necessitate repeat of field verification procedure as described in Subsection 804.02.10.3 and approval by the Engineer.

**907-804.02.11--Concrete Batch Plants.** Delete the first three paragraphs of Subsection 804.02.11 on page 854, and substitute the following:

The concrete batch plant shall meet the requirements of the National Ready Mixed Concrete Association *Quality Control Manual, Section 3, Plant Certification Checklist* as outlined in the latest edition of the Department's *Concrete Field Manual*. The Contractor shall submit a copy of the approved checklist along with proof of calibration of batching equipment, i.e., scales, water meter, and admixture dispenser, to the Engineer 30 days prior to the production of concrete.

For projects with 1000 cubic yards and more, the concrete batch plant shall meet the requirements for an automatic system capable of recording batch weights. It shall also have automatic moisture compensation for the fine aggregate. For projects of more than 200 but less than 1000 cubic yards the plant can be equipped for manual batching with a fine aggregate moisture meter visible to the plant operator.

The concrete batch plant shall have available adequate facilities to cool concrete during hot weather.

Mixer trucks to be used on the project are to be listed in the checklist and shall meet the requirements of the checklist.

**907-804.02.12--Contractor's Quality Control.** Delete the fourth paragraph of Subsection 804.02.12 on page 854 & 855, and substitute the following:

The Contractor's Quality Control program shall encompass the requirements of AASHTO Designation: M 157 into concrete production and control, equipment requirements, testing, and batch ticket information. The requirement of AASHTO Designation: M 157, Section 11.7 shall be followed except, on arrival to the job site, a maximum of 1½ gallons per cubic yard is allowed to be added. Water shall not be added at a later time. If the maximum permitted slump is exceeded after the addition of water at the job site, the concrete shall be rejected.

**907-804.02.12.3--Documentation.** After the second sentence of the second paragraph of Subsection 804.02.12.3 on page 856, add the following:

Batch tickets and gradation data shall be documented in accordance with Department requirements. Batch tickets shall contain all the information in AASHTO Designation: M157, Section 16 including the additional information in Subsection 16.2 with the following exception: the information listed in paragraphs 16.2.7 and 16.2.8 is not required. Batch tickets shall also contain the concrete producer's permanent unique mix number assigned to the concrete mix design.

**907-804.02.12.5--Non-Conforming Materials.** In Table 4 of Subsection 804.02.12.5 on page 857, delete “/ FM” from the requirements on line B.3.a.

In Table 4 of Subsection 804.02.12.5 on page 857, replace “One set ( two cylinders ) for 0-100 yd<sup>3</sup> inclusive” with “A minimum of one set (two cylinders) for each 100 yd<sup>3</sup>,”

**907-804.02.13--Quality Assurance Sampling and Testing.** Delete subparagraph c) in Subsection 804.02.13 on page 858 and substitute the following:

- c) For concrete, the Contractor's QC and Department's QA testing of concrete compressive strengths compare when using the data comparison computer program with an alpha value of 0.01 for projects with 1000 cubic yards and more; or, strength comparisons are within 990 psi for projects of more than 200 but less than 1000 cubic yards.

In Table 5 of Subsection 804.02.13 on page 858, delete “and FM” from the requirements on line A.3.

Delete Subsection 907-804.02.13.1 beginning on page 859 and substitute the following:

**907-804.02.13.1--Basis of Acceptance.**

**907-804.02.13.1.1--Sampling.** Sampling of concrete mixture shall be performed in accordance with the latest edition of the Department's *Concrete Field Manual*.

**907-804.02.13.1.2--Slump.** Slump of plastic concrete shall meet the requirements of Table 3: MASTER PROPORTION TABLE FOR STRUCTURAL CONCRETE DESIGN. A check test shall be made on another portion of the sample before rejection of any load.

**907-804.02.13.1.3--Air.** Total air content of concrete shall be within the specified range for the class of concrete listed in Table 3: MASTER PROPORTION TABLE FOR STRUCTURAL CONCRETE DESIGN. A check test shall be made on another portion of the sample before rejection of any load.

**907-804.02.13.1.4--Yield.** If the yield of the concrete mix design is more than plus or minus 3% of the designed volume, the mix shall be adjusted by a Class III Certified Technician representing the Contractor to yield the correct volume plus or minus three percent ( $\pm 3\%$ ). If batching of the proportions of the mix design varies outside the batching tolerance range of the originally approved proportions by more than the tolerances allowed in Subsection 804.02.12.1, the new proportions shall be field verified per Subsection 804.02.10.3.

**907-804.02.13.1.5--Temperature.** Cold weather concreting shall follow the requirements of Subsection 907-804.03.16.1. Hot weather concreting shall follow the requirements of Subsection 804.03.16.2 with a maximum temperature of 95°F for Class DS concrete or for concrete mixes containing cementitious materials meeting the requirements of Subsection 907-701.02.2 as a replacement of Portland cement. For other concrete mixes, the maximum concrete temperature shall be 90°F. Concrete with a temperature more than the maximum allowable temperature shall be rejected and not used in Department work.

**907-804.02.13.1.6--Compressive Strength.** Laboratory cured concrete compressive strength tests shall conform to the specified strength ( $f'_c$ ) listed in the specifications. Concrete represented by compressive strength test below the specified strength ( $f'_c$ ) may be removed and replaced by the Contractor. If the Contractor elects not to remove the material, it will be evaluated by the Department as to the adequacy for the use intended. All concrete evaluated as unsatisfactory for the intended use shall be removed and replaced by the Contractor at no additional cost to the Department. For concrete allowed to remain in place, reduction in payment will be as follows:

**Projects with 1000 Cubic Yards and More.** When the evaluation indicates that the work may remain in place, a statistical analysis will be made of the QC and QA concrete test results. If this statistical analysis indicates at least 93% of the material would be expected to have a compressive strength equal to or greater than the specified strength ( $f'_c$ ) and 99.87% of the material would be expected to have a compressive strength at least one standard deviation above the allowable design stress ( $f_c$ ), the work will be accepted. If the statistical analysis indicates that either of the two criteria are not met, the Engineer will provide for an adjustment in pay as follows for the material represented by the test result.

Total Pay on Material in Question = Unit Price - (Unit Price x % Reduction)

$$\% \text{ Reduction} = \frac{(f'_c - X)}{f'_c - (f_c + s)} \times 100$$

where:

$f'_c$  = Specified 28-day compressive strength, psi

- $X$  = Individual compressive strength below  $f'_c$ , psi
- $s$  = standard deviation, psi\*
- $f_c$  = allowable design stress, psi

\* Standard deviation used in the above reduction of pay formula shall be calculated from the applicable preceding compressive strengths test results plus the individual compressive strength below  $f'_c$ . If below  $f'_c$  strengths occur during the project's first ten compressive strength tests, the standard deviation shall be calculated from the first ten compressive strength tests results.

**Projects of More Than 200 but Less Than 1000 Cubic Yards.** When the evaluation indicates that the work may remain in place, a percent reduction in pay will be assessed based on a comparison of the deficient 28-day test result to the specified strength. The Engineer will provide for an adjustment in pay as follows for the material represented by the test result.

Total Pay on Material in Question = Unit Price - (Unit Price x % Reduction)

$$\% \text{ Reduction} = \frac{(f'_c - X)}{f'_c} \times 100$$

where:

- $f'_c$  = Specified 28-day compressive strength, psi
- $X$  = Individual compressive strength below  $f'_c$ , psi

**907-804.03--Construction Requirements.**

**907-804.03.6--Handling and Placing Concrete.**

**907-804.03.6.2--Consolidation.** After the last sentence of Subsection 804.03.6.2 on page 864, add the following:

If the Department determines that there is an excessive number of projections, swells, ridges, depressions, waves, voids, holes, honeycombs or other defects in the completed structure, removal of the entire structure may be required as set out in Subsection 105.12.

**907-804.03.15--Removal of Falsework, Forms, and Housing.** Delete the first sentence of the second paragraph of Subsection 804.03.15 on page 871, and substitute the following:

Concrete in the last pour of a continuous superstructure shall have attained a compressive strength of 2,400 psi, as determined by cylinder tests or maturity meter probe, prior to striking any falsework.

Delete the first sentence of the third paragraph of Subsection 804.03.15 on page 871, and substitute the following:



At the Contractor's option and with the approval of the Engineer, the time for removal of forms may be determined by cylinder tests, in accordance with the requirements listed in Table 6, in which case the Contractor shall furnish facilities for testing the cylinders.

Delete the fourth and fifth paragraphs of Subsection 804.03.15 on pages 871 & 872, and substitute the following:

The cylinders shall be cured under conditions which are not more favorable than those existing for the portions of the structure which they represent.

Delete the table in Subsection 804.03.15 on page 872, and substitute the following:

**Table 6**  
**Minimum Compressive Strength Requirements for Form Removal**

**Forms:**

Columns .....	1000 psi
Side of Beams .....	1000 psi
Walls not under pressure .....	1000 psi
Floor Slabs, overhead .....	2000 psi
Floor Slabs, between beams .....	2000 psi
Slab Spans .....	2400 psi
Other Parts .....	1000 psi

**Centering:**

Under Beams .....	2400 psi
Under Bent Caps .....	2000 psi

**Limitation for Placing Beams on:**

Pile Bents, pile under beam .....	2000 psi
Frame Bents, two or more columns .....	2200 psi
Frame Bents, single column .....	2400 psi

In lieu of using concrete strength cylinders to determine when falsework, forms, and housings can be removed, an approved maturity meter may be used to determine concrete strengths by inserting probes into concrete placed in a structure. The minimum number of maturity meter probes required for each structural component shall be in accordance with Table 7. Falsework, forms, and housings may be removed when maturity meter readings indicate that the required concrete strength is achieved. Procedures for using the maturity meter and developing the strength/maturity relationship shall follow the requirements of AASHTO Designation: T 325 and ASTM Designation: C 1074 specifications. Technicians using the maturity meter or calculating strength/maturity graphs shall be required to have at least two hours of training prior to using the maturity equipment.

**Table 7  
Requirements for use of Maturity Meter Probes**

<b>Structure Component</b>	<b>Quantity of Concrete</b>	<b>No. of Probes</b>
Slabs, beams, walls, & miscellaneous items	0 - 30 yd <sup>3</sup>	2
	> 30 to 60 yd <sup>3</sup>	3
	> 60 to 90 yd <sup>3</sup>	4
	> 90 yd <sup>3</sup>	5
Footings, Columns & Caps	0 - 13 yd <sup>3</sup>	2
	> 13 yd <sup>3</sup>	3
Pavement, Pavement Overlays	1200 yd <sup>2</sup>	2
Pavement Repairs	Per repair or 900 yd <sup>2</sup> Whichever is smaller	2

**907-804.03.16--Cold or Hot Weather Concreting.**

**907-804.03.16.1--Cold Weather Concreting.** After the third paragraph of Subsection 804.03.16.1 on page 873, add the following:

In lieu of the protection and curing of concrete in cold weather, at the option of the Contractor with the approval of the Engineer, when concrete is placed during cold weather and there is a probability of ambient temperatures lower than 40°F, an approved maturity meter may be used to determine concrete strengths by inserting probes into concrete placed in a structure. The minimum number of maturity meter probes required for each structural component shall be in accordance with Table 7. An approved insulating blanketing material shall be used to protect the work when ambient temperatures are less than 40°F and shall remain in place until the required concrete strength in Table 6 is achieved. Procedures for using the maturity meter and developing the strength/maturity relationship shall follow the requirements of AASHTO Designation: T 325 and ASTM Designation: C 1074 specifications. Technicians using the maturity meter or calculating strength/maturity graphs shall be required to have at least two hours of training prior to using the maturity equipment.

Rename the Table in Subsection 804.03.16.1 on page 874 from “Table 6” to “Table 8”.

**907-804.03.19--Finishing Concrete Surfaces.**

**907-804.03.19.7--Finishing Bridge Floors.**

**907-804.03.19.7.4--Acceptance Procedure for Bridge Deck Smoothness.** After the first sentence of the second paragraph of Subsection 804.03.19.7.4 on page 886, add the following:

Auxiliary lanes, tapers, shoulders and other areas that are not checked with the profilograph, shall meet a 1/8 inch in 10-foot straightedge check made transversely and longitudinally across the deck or slab.

**907-804.05--Basis of Payment.** Add the "907" prefix to the pay items listed on page 898.

# SECTION 905 - PROPOSAL

Date \_\_\_\_\_

Mississippi Transportation Commission  
Jackson, Mississippi

Sirs: The following proposal is made on behalf of \_\_\_\_\_  
\_\_\_\_\_ of \_\_\_\_\_

for constructing the following designated project(s) within the time(s) hereinafter specified.

The plans are composed of drawings and blue prints on file in the offices of the Mississippi Department of Transportation, Jackson, Mississippi.

The Specifications are the current Standard Specifications of the Mississippi Department of Transportation approved by the Federal Highway Administration, except where superseded or amended by the plans, Special Provisions and Notice(s) to Bidders attached hereto and made a part thereof.

I (We) certify that I (we) possess a copy of said Standard and any Supplemental Specifications.

Evidence of my (our) authority to submit the Proposal is hereby furnished. The proposal is made without collusion on the part of any person, firm or corporation. I (We) certify that I (we) have carefully examined the Plans, the Specifications, including the Special Provisions and Notice(s) to Bidders, herein, and have personally examined the site of the work. On the basis of the Specifications, Special Provisions, Notice(s) to Bidders, and Plans, I (we) propose to furnish all necessary machinery, tools, apparatus and other means of construction and do all the work and furnish all the materials in the manner specified. I (We) understand that the quantities mentioned herein are approximate only and are subject to either increase or decrease, and hereby propose to perform any increased or decreased quantities of work at the unit prices bid, in accordance with the above.

Attached hereto is a certified check, cashier's check or Proposal Guaranty Bond in the amount as required in the Advertisement (or, by law).

**INSTRUCTION TO BIDDERS:** Alternate and Optional Items on Bid Schedule.

1. Two or more items entered opposite a single unit quantity WITHOUT DEFINITE DESIGNATION AS "ALTERNATE ITEMS" are considered as "OPTIONAL ITEMS". Bidders may or may not indicate on bids the Optional Item proposed to be furnished or performed WITHOUT PREJUDICE IN REGARD TO IRREGULARITY OF BIDS.
2. Items classified on the bid schedule as "ALTERNATE ITEMS" and/or "ALTERNATE TYPES OF CONSTRUCTION" must be preselected and indicated on bids. However, "Alternate Types of Construction" may include Optional Items to be treated as set out in Paragraph 1, above.
3. Optional items not preselected and indicated on the bid schedule MUST be designated in accordance with Subsection 102.06 prior to or at the time of execution of the contract.
4. Optional and Alternate items designated must be used throughout the project.

I (We) further propose to perform all "force account or extra work" that may be required of me (us) on the basis provided in the Specifications and to give such work my (our) personal attention in order to see that it is economically performed.

**SECTION 905 -- PROPOSAL (CONTINUED)**

I (We) further propose to execute the attached contract agreement (Section 902) as soon as the work is awarded to me (us), and to begin and complete the work within the time limit(s) provided for in the Specifications and Advertisement. I (We) also propose to execute the attached contract bond (Section 903) in an amount not less than one hundred (100) percent of the total of my (our) part, but also to guarantee the excellence of both workmanship and materials until the work is finally accepted.

I (We) enclose a certified check, cashier's check or bid bond for **five percent (5%) of total bid** and hereby agree that in case of my (our) failure to execute the contract and furnish bond within Ten (10) days after notice of award, the amount of this check (bid bond) will be forfeited to the State of Mississippi as liquidated damages arising out of my (our) failure to execute the contract as proposed. It is understood that in case I am (we are) not awarded the work, the check will be returned as provided in the Specifications.

Respectfully Submitted,

DATE \_\_\_\_\_

\_\_\_\_\_  
Contractor

BY \_\_\_\_\_  
Signature

TITLE \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY, STATE, ZIP \_\_\_\_\_

PHONE \_\_\_\_\_

FAX \_\_\_\_\_

E-MAIL \_\_\_\_\_

(To be filled in if a corporation)

Our corporation is chartered under the Laws of the State of \_\_\_\_\_ and the names, titles and business addresses of the executives are as follows:

_____ President	_____ Address
_____ Secretary	_____ Address
_____ Treasurer	_____ Address

The following is my (our) itemized proposal.

Construction necessary to build Headquarters Building, Equipment Shed, and Storage Bins at Dekalb, known as State Project Nos. BWO-5123-35(001), BWO-5214-35(001), BWO-5067-35(003), BWO-5221-35(001), and LWO-5035-35(002) / 502587301, 302, 303, 304, & 305 in Kemper County.

Line No.	Item Code	Adj Code	Quantity	Units	Description [Fixed Unit Price]
<b>Roadway Items</b>					
0010	202-B064		48	Linear Feet	Removal of Pipe, 8" And Above
0020	203-A003	(E)	1,500	Cubic Yard	Unclassified Excavation, FM, AH
0030	203-EX034	(E)	830	Cubic Yard	Borrow Excavation, AH, LVM, Class B17
0040	209-A004		3,150	Square Yard	Geotextile Stabilization, Type V, Non-Woven
0050	213-C001		1	Ton	Superphosphate
0060	220-A001		1	Acre	Insect Pest Control [\$30.00]
0070	221-A001	(S)	2	Cubic Yard	Portland Cement Concrete Paved Ditch
0080	223-A001		2	Acre	Mowing [\$50.00]
0090	224-A001		260	Square Yard	Soil Reinforcing Mat
0100	234-A001		1,500	Linear Feet	Temporary Silt Fence
0110	603-CA002	(S)	64	Linear Feet	18" Reinforced Concrete Pipe, Class III
0120	603-CB001	(S)	4	Each	18" Reinforced Concrete End Section
0130	607-B041		73	Linear Feet	72" Type I Chain Link Fence, Class I, With Top Guard
0140	607-D002		73	Linear Feet	Barbed Wire Fence, 3 Strands, Galvanized Steel
0150	607-G112		4	Each	Gate, 13' x 6' Chain Link, With Top Guard
0160	607-P1009		6	Each	Line Post, 9' x 2" Galvanized Steel
0170	607-P2021		1	Each	Brace Post, 9' 6" x 2 1/2" Galvanized Steel
0180	607-P3008		4	Each	Gate Post, 9' x 3 1/2" Galvanized Steel
0190	608-B001	(S)	140	Square Yard	Concrete Sidewalk, With Reinforcement
0200	609-B001	(S)	213	Linear Feet	Concrete Curb, Header
0210	620-A001		1	Lump Sum	Mobilization
0220	630-A001		17	Square Feet	Standard Roadside Signs, Sheet Aluminum, 0.080" Thickness
0230	630-C003		28	Linear Feet	Steel U-Section Posts, 3.0 lb/ft
0240	907-216-A001		1,400	Square Yard	Solid Sodding
0250	907-225-A001		2	Acre	Grassing
0260	907-225-B001		6	Ton	Agricultural Limestone
0270	907-225-C001		4	Ton	Mulch, Vegetative Mulch
0280	907-226-A001		2	Acre	Temporary Grassing
0290	907-237-A003		500	Linear Feet	Wattles, 20"
0300	907-239-PP002		1	Each	Stabilized Construction Entrance, Per Plans
0310	907-242-PP001		1	Lump Sum	Water and Sewer Improvements, Per Plans
0320	907-246-B002		50	Each	Rockbags

Line No.	Item Code	Adj Code	Quantity	Units	Description [Fixed Unit Price]
0330	907-290-A001		1	Each	Flagpole
0340	907-601-B003	(S)	15	Cubic Yard	Class "B" Structural Concrete, Minor Structures
0350	907-626-G004		492	Linear Feet	Thermoplastic Detail Stripe, White
0360	907-626-H001		108	Square Feet	Thermoplastic Legend, Blue-ADA
0370	907-626-H002		2	Each	Thermoplastic Legend, Blue-ADA Handicap Symbol
0380	907-626-H004		100	Linear Feet	Thermoplastic Legend, White
0390	907-630-PP001		2	Each	Handicap Parking Sign with Post
0400	907-699-A002		1	Lump Sum	Roadway Construction Stakes
<b>ALTERNATE GROUP AA NUMBER 1</b>					
0410	907-304-F002	(GT)	804	Ton	Size 610 Crushed Stone Base
<b>ALTERNATE GROUP AA NUMBER 2</b>					
0420	907-304-F003	(GT)	804	Ton	3/4" and Down Crushed Stone Base
<b>ALTERNATE GROUP AA NUMBER 3</b>					
0430	907-304-F004	(GT)	804	Ton	Size 825B Crushed Stone Base
<b>ALTERNATE GROUP BB NUMBER 1</b>					
0440	907-403-A011	(BA1)	383	Ton	Hot Mix Asphalt, ST, 12.5-mm mixture
<b>ALTERNATE GROUP BB NUMBER 2</b>					
0450	907-403-M003	(BA1)	383	Ton	Warm Mix Asphalt, ST, 12.5-mm mixture
<b>ALTERNATE GROUP CC NUMBER 1</b>					
0460	907-403-A015	(BA1)	307	Ton	Hot Mix Asphalt, ST, 9.5-mm mixture
<b>ALTERNATE GROUP CC NUMBER 2</b>					
0470	907-403-M001	(BA1)	307	Ton	Warm Mix Asphalt, ST, 9.5-mm mixture
<b>Building Items</b>					
0480	907-242-A004		1	Lump Sum	Removal and Relocation of Metal Buildings (Existing Equipment Shed)
0490	907-242-A006		1	Lump Sum	Construction of (Bulk Storage Bins)
0500	907-242-A006		1	Lump Sum	Construction of (Equipment Shed W/Enclosed Bay)
0510	907-242-A006		1	Lump Sum	Construction of (Maintenance Area Headquarters)

**CONDITIONS FOR COMBINATION BID**

If a bidder elects to submit a combined bid for two or more of the contracts listed for this month's letting, the bidder must complete and execute these sheets of the proposal in each of the individual proposals to constitute a combination bid. In addition to this requirement, each individual contract shall be completed, executed and submitted in the usual specified manner.

Failure to execute this Combination Bid Proposal in each of the contracts combined will be just cause for each proposal to be received and evaluated as a separate bid.

\*\*\*\*\*

**COMBINATION BID PROPOSAL**

I. This proposal is tendered as one part of a Combination Bid Proposal utilizing option \_\_\_\* of Subsection 102.11 on the following contracts:

\* Option to be shown as either (a), (b), or (c).

<u>Project No.</u>	<u>County</u>	<u>Project No.</u>	<u>County</u>
1. _____	_____	6. _____	_____
2. _____	_____	7. _____	_____
3. _____	_____	8. _____	_____
4. _____	_____	9. _____	_____
5. _____	_____	10. _____	_____

A. If option (a) has been selected, then go to II, and sign Combination Bid Proposal.

B. If option (b) has been selected, then complete the following, go to II, and sign Combination Bid Proposal.

SECTION 905 - COMBINATION BID PROPOSAL (Continued)

Project Number	Pay Item Number	Unit	Unit Price Reduction	Total Item Reduction	Total Contract Reduction
1. _____	_____ _____	_____ _____	_____ _____	_____ _____	
2. _____	_____ _____	_____ _____	_____ _____	_____ _____	
3. _____	_____ _____	_____ _____	_____ _____	_____ _____	
4. _____	_____ _____	_____ _____	_____ _____	_____ _____	
5. _____	_____ _____	_____ _____	_____ _____	_____ _____	
6. _____	_____ _____	_____ _____	_____ _____	_____ _____	
7. _____	_____ _____	_____ _____	_____ _____	_____ _____	
8. _____	_____ _____	_____ _____	_____ _____	_____ _____	



SECTION 905 - COMBINATION BID PROPOSAL (Continued)

Project Number	Pay Item Number	Unit	Unit Price Reduction	Total Item Reduction	Total Contract Reduction
9. _____	_____ _____	_____ _____	_____ _____	_____ _____	
10. _____	_____ _____	_____ _____	_____ _____	_____ _____	

C. If option (c) has been selected, then initial and complete one of the following, go to II. and sign Combination Bid Proposal.

\_\_\_\_\_ I (We) desire to be awarded work not to exceed a total monetary value of \$ \_\_\_\_\_.

\_\_\_\_\_ I (We) desire to be awarded work not to exceed \_\_\_\_\_ number of contracts.

II. It is understood that the Mississippi Transportation Commission not only reserves the right to reject any and all proposals, but also the right to award contracts upon the basis of lowest separate bids or combination bids most advantageous to the State.

It is further understood and agreed that the Combination Bid Proposal is for comparison of bids only and that each contract shall operate in every respect as a separate contract in accordance with its proposal and contract documents.

I (We), the undersigned, agree to complete each contract on or before its specified completion date.

SIGNED \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

TO: EXECUTIVE DIRECTOR, MISSISSIPPI DEPARTMENT OF TRANSPORTATION  
JACKSON, MISSISSIPPI

**CERTIFICATE**

If awarded this contract, I (we) contemplate that portions of the contract will be sublet. I (we) certify that those subcontracts which are equal to or in excess of fifty thousand dollars (\$50,000.00) will be in accordance with regulations promulgated and adopted by the Mississippi State Board of Contractors on January 13, 1999.

I (we) agree that this notification of intent DOES NOT constitute APPROVAL of the subcontracts.

NOTE: Insert name and address of subcontractors. (Subcontracts equal to or in excess of fifty thousand dollars (\$50,000.00) ONLY.)

_____	_____
(Individual or Firm)	(Address)
_____	_____
(Individual or Firm)	(Address)
_____	_____
(Individual or Firm)	(Address)
_____	_____
(Individual or Firm)	(Address)

NOTE: Failure to complete the above DOES NOT preclude subsequent subcontracts. Subsequent subcontracts, if any, equal to or in excess of fifty thousand dollars (\$50,000.00) will be in accordance with regulations promulgated and adopted by the Mississippi State Board of Contractors on January 13, 1999.

Contractor \_\_\_\_\_

By \_\_\_\_\_

Title \_\_\_\_\_

**CERTIFICATE MUST BE EXECUTED**

**MISSISSIPPI DEPARTMENT OF TRANSPORTATION**

CERTIFICATION  
(Execute in duplicate)

I, \_\_\_\_\_,  
(Name of person signing certification)

individually, and in my capacity as \_\_\_\_\_ of  
(Title)

\_\_\_\_\_ do hereby certify under  
(Name of Firm, Partnership, or Corporation)

penalty of perjury under the laws of the United States and the State of Mississippi that  
\_\_\_\_\_, Bidder  
(Name of Firm, Partnership, or Corporation)

on Project No. **BWO-5123-35(001), BWO-5214-35(001), BWO-5067-35(003), BWO-5221-35(001), and LWO-5035-35(002) / 502587301, 302, 303, 304, & 305**,

in Kemper County(ies), Mississippi, has not either directly or indirectly entered into any agreement, participated in any collusion; or otherwise taken any action in restraint of free competitive bidding in connection with this contract; nor have any of its corporate officers or principal owners.

Except as noted hereafter, it is further certified that said legal entity and its corporate officers, principal owners, managers, auditors and others in a position of administering federal funds are not currently under suspension, debarment, voluntary exclusion or determination of ineligibility; nor have a debarment pending; nor been suspended, debarred, voluntarily excluded or determined ineligible within the past three years by the Mississippi Transportation Commission, the State of Mississippi, any other State or a federal agency; nor been indicted, convicted or had a civil judgment rendered by a court of competent jurisdiction in any matter involving fraud or official misconduct within the past three years.

Initial here " \_\_\_\_\_ " if exceptions are attached and made a part thereof. Any exceptions shall address to whom it applies, initiating agency and dates of such action.

Note: Exceptions will not necessarily result in denial of award but will be considered in determining bidder responsibility. Providing false information may result in criminal prosecution or administrative sanctions.

All of the foregoing and attachments (when indicated) is true and correct.

Executed on \_\_\_\_\_ Signature

(5/29/2008S)

**MISSISSIPPI DEPARTMENT OF TRANSPORTATION**

CERTIFICATION  
(Execute in duplicate)

I, \_\_\_\_\_,  
(Name of person signing certification)

individually, and in my capacity as \_\_\_\_\_ of  
(Title)

\_\_\_\_\_ do hereby certify under  
(Name of Firm, Partnership, or Corporation)

penalty of perjury under the laws of the United States and the State of Mississippi that  
\_\_\_\_\_, Bidder  
(Name of Firm, Partnership, or Corporation)

on Project No. **BWO-5123-35(001), BWO-5214-35(001), BWO-5067-35(003), BWO-5221-35(001), and LWO-5035-35(002) / 502587301, 302, 303, 304, & 305**,

in Kemper County(ies), Mississippi, has not either directly or indirectly entered into any agreement, participated in any collusion; or otherwise taken any action in restraint of free competitive bidding in connection with this contract; nor have any of its corporate officers or principal owners.

Except as noted hereafter, it is further certified that said legal entity and its corporate officers, principal owners, managers, auditors and others in a position of administering federal funds are not currently under suspension, debarment, voluntary exclusion or determination of ineligibility; nor have a debarment pending; nor been suspended, debarred, voluntarily excluded or determined ineligible within the past three years by the Mississippi Transportation Commission, the State of Mississippi, any other State or a federal agency; nor been indicted, convicted or had a civil judgment rendered by a court of competent jurisdiction in any matter involving fraud or official misconduct within the past three years.

Initial here " \_\_\_\_\_ " if exceptions are attached and made a part thereof. Any exceptions shall address to whom it applies, initiating agency and dates of such action.

Note: Exceptions will not necessarily result in denial of award but will be considered in determining bidder responsibility. Providing false information may result in criminal prosecution or administrative sanctions.

All of the foregoing and attachments (when indicated) is true and correct.

Executed on \_\_\_\_\_ Signature

(5/29/2008S)

SECTION 902

CONTRACT FOR BWO-5123-35(001), BWO-5214-35(001), BWO-5067-35(003), BWO-5221-35(001), and LWO-5035-35(002) / 502587301, 302, 303, 304, & 305

LOCATED IN THE COUNTY(IES) OF Kemper

STATE OF MISSISSIPPI,

COUNTY OF HINDS

This contract entered into by and between the Mississippi Transportation Commission on one hand, and the undersigned contractor, on the other witnesseth;

That, in consideration of the payment by the Mississippi Transportation Commission of the prices set out in the proposal hereto attached, to the undersigned contractor, such payment to be made in the manner and at the time of times specified in the specifications and the special provisions, if any, the undersigned contractor hereby agrees to accept the prices stated in the proposal in full compensation for the furnishing of all materials and equipment and the executing of all the work contemplated in this contract.

It is understood and agreed that the advertising according to law, the Advertisement, the instructions to bidders, the proposal for the contract, the specifications, the revisions of the specifications, the special provisions, and also the plans for the work herein contemplated, said plans showing more particularly the details of the work to be done, shall be held to be, and are hereby made a part of this contract by specific reference thereto and with like effect as if each and all of said instruments had been set out fully herein in words and figures.

It is further agreed that for the same consideration the undersigned contractor shall be responsible for all loss or damage arising out of the nature of the work aforesaid; or from the action of the elements and unforeseen obstructions or difficulties which may be encountered in the prosecution of the same and for all risks of every description connected with the work, exceptions being those specifically set out in the contract; and for faithfully completing the whole work in good and workmanlike manner according to the approved Plans, Specifications, Special Provisions, Notice(s) to Bidders and requirements of the Mississippi Department of Transportation.

It is further agreed that the work shall be done under the direct supervision and to the complete satisfaction of the Executive Director of the Mississippi Department of Transportation, or his authorized representatives, and when Federal Funds are involved subject to inspection at all times and approval by the Federal Highway Administration, or its agents as the case may be, or the agents of any other Agency whose funds are involved in accordance with those Acts of the Legislature of the State of Mississippi approved by the Governor and such rules and regulations issued pursuant thereto by the Mississippi Transportation Commission and the authorized Federal Agencies.

The Contractor agrees that all labor as outlined in the Special Provisions may be secured from list furnished by

It is agreed and understood that each and every provision of law and clause required by law to be inserted in this contract shall be deemed to be inserted herein and this contract shall be read and enforced as though it were included herein, and, if through mere mistake or otherwise any such provision is not inserted, then upon the application of either party hereto, the contract shall forthwith be physically amended to make such insertion.

The Contractor agrees that he has read each and every clause of this Contract, and fully understands the meaning of same and that he will comply with all the terms, covenants and agreements therein set forth.

Witness our signatures this the \_\_\_\_\_ day of \_\_\_\_\_, \_\_\_\_\_.

\_\_\_\_\_  
Contractor (s)

By \_\_\_\_\_

MISSISSIPPI TRANSPORTATION COMMISSION

Title \_\_\_\_\_

By \_\_\_\_\_

Signed and sealed in the presence of:  
(names and addresses of witnesses)

Executive Director

\_\_\_\_\_  
Secretary to the Commission

Award authorized by the Mississippi Transportation Commission in session on the \_\_\_\_ day of \_\_\_\_\_, \_\_\_\_\_, Minute Book No. \_\_\_\_\_, Page No. \_\_\_\_\_.

**S E C T I O N 9 0 3**  
**PERFORMANCE AND PAYMENT BOND**

CONTRACT BOND FOR: **BWO-5123-35(001), BWO-5214-35(001), BWO-5067-35(003),**  
**BWO-5221-35(001), and LWO-5035-35(002) / 502587301, 302, 303, 304, & 305**

LOCATED IN THE COUNTY(IES) OF: **Kemper**

STATE OF MISSISSIPPI,

COUNTY OF HINDS

Know all men by these presents: that we, \_\_\_\_\_  
( Contractor )

\_\_\_\_\_ Principal, a \_\_\_\_\_

residing at \_\_\_\_\_ in the State of \_\_\_\_\_

and \_\_\_\_\_  
( Surety )

residing at \_\_\_\_\_ in the State of \_\_\_\_\_,

authorized to do business in the State of Mississippi, under the laws thereof, as surety, are held and firmly bound unto the State of Mississippi in the sum of \_\_\_\_\_

\_\_\_\_\_ Dollars, lawful money of the United States of America, to be paid to it for which payment well and truly to be made, we bind ourselves, our heirs, administrators, successors, or assigns jointly and severally by these presents.

Signed and sealed this the \_\_\_\_ day of \_\_\_\_\_ A.D. \_\_\_\_\_.

The conditions of this bond are such, that whereas the said \_\_\_\_\_

principal, has (have) entered into a contract with the Mississippi Transportation Commission, bearing the date of \_\_\_\_\_ day of \_\_\_\_\_ A.D. \_\_\_\_\_ hereto annexed, for the construction of certain projects(s) in the State of Mississippi as mentioned in said contract in accordance with the Contract Documents therefor, on file in the offices of the Mississippi Department of Transportation, Jackson, Mississippi.

Now therefore, if the above bounden \_\_\_\_\_

\_\_\_\_\_ in all things shall stand to and abide by and well and truly observe, do keep and perform all and singular the terms, covenants, conditions, guarantees and agreements in said contract, contained on his (their) part to be observed, done, kept and performed and each of them, at the time and in the manner and form and furnish all of the material and equipment specified in said contract in strict accordance with the terms of said contract which said plans, specifications and special provisions are included in and form a part of said contract and shall maintain the said work contemplated until its final completion and acceptance as specified in Subsection 109.11 of the approved specifications, and save harmless said Mississippi Transportation Commission from any loss or damage arising out of or occasioned by the negligence, wrongful or criminal act, overcharge, fraud,

**SECTION 903 - CONTINUED**

or any other loss or damage whatsoever, on the part of said principal (s), his (their) agents, servants, or employees in the performance of said work or in any manner connected therewith, and shall be liable and responsible in a civil action instituted by the State at the instance of the Mississippi Transportation Commission or any officer of the State authorized in such cases, for double any amount in money or property, the State may lose or be overcharged or otherwise defrauded of, by reason of wrongful or criminal act, if any, of the Contractor(s), his (their) agents or employees, and shall promptly pay the said agents, servants and employees and all persons furnishing labor, material, equipment or supplies therefor, including premiums incurred, for Surety Bonds, Liability Insurance, and Workmen's Compensation Insurance; with the additional obligation that such Contractor shall promptly make payment of all taxes, licenses, assessments, contributions, damages, any liquidated damages which may arise prior to any termination of said principal's contract, any liquidated damages which may arise after termination of the said principal's contract due to default on the part of said principal, penalties and interest thereon, when and as the same may be due this state, or any county, municipality, board, department, commission or political subdivision: in the course of the performance of said work and in accordance with Sections 31-5-51 et seq. Mississippi Code of 1972, and other State statutes applicable thereto, and shall carry out to the letter and to the satisfaction of the Executive Director of the Mississippi Department of Transportation, all, each and every one of the stipulations, obligations, conditions, covenants and agreements and terms of said contract in accordance with the terms thereof and all of the expense and cost and attorney's fee that may be incurred in the enforcement of the performance of said contract, or in the enforcement of the conditions and obligations of this bond, then this obligation shall be null and void, otherwise to be and remain in full force and virtue.

Witness our signatures and seals this the \_\_\_\_\_ day of \_\_\_\_\_ A.D. \_\_\_\_\_.

_____	_____
(Contractors) Principal	Surety
By _____	By _____
	(Signature) Attorney in Fact
	Address _____
	_____
Title _____	_____
(Contractor's Seal)	(Printed) MS Agent
	(Signature) MS Agent
	Address _____
	_____
	_____
	(Surety Seal)
	_____
	Mississippi Insurance ID Number



# BID BOND

KNOW ALL MEN BY THESE PRESENTS, that we \_\_\_\_\_  
Contractor

\_\_\_\_\_  
Address

\_\_\_\_\_  
City, State ZIP

as Principal, hereinafter called the Principal, and \_\_\_\_\_  
Surety

a corporation duly organized under the laws of the state of \_\_\_\_\_

as Surety, hereinafter called the Surety, are held and firmly bound unto State of Mississippi, Jackson, Mississippi

As Obligee, hereinafter called Obligee, in the sum of **Five Per Cent (5%) of Amount Bid**  
Dollars (\$ \_\_\_\_\_)

for the payment of which sum will and truly to be made, the said Principal and said Surety, bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has submitted a bid for **Construction necessary to build Headquarters Building, Equipment Shed, and Storage Bins at Dekalb, known as State Project Nos. BWO-5123-35(001), BWO-5214-35(001), BWO-5067-35(003), BWO-5221-35(001), and LWO-5035-35(002) / 502587301, 302, 303, 304, & 305 in Kemper County.**

NOW THEREFORE, the condition of this obligation is such that if the aforesaid Principal shall be awarded the contract, the said Principal will, within the time required, enter into a formal contract and give a good and sufficient bond to secure the performance of the terms and conditions of the contract, then this obligation to be void; otherwise the Principal and Surety will pay unto the Obligee the difference in money between the amount of the bid of the said Principal and the amount for which the Obligee legally contracts with another party to perform the work if the latter amount be in excess of the former, but in no event shall liability hereunder exceed the penal sum hereof.

Signed and sealed this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_

\_\_\_\_\_  
(Principal) (Seal)

\_\_\_\_\_  
(Witness)

By: \_\_\_\_\_  
(Name) (Title)

\_\_\_\_\_  
(Surety) (Seal)

\_\_\_\_\_  
(Witness)

By: \_\_\_\_\_  
(Attorney-in-Fact)

\_\_\_\_\_  
MS Agent

\_\_\_\_\_  
Mississippi Insurance ID Number