MDOT Use Only
Checked _____
Loaded _____
Keyed _____

01 -

SM No. CBWO6211180031

PROPOSAL AND CONTRACT DOCUMENTS

FOR THE CONSTRUCTION OF

01
Renovation of the Existing District Six Shop and Minor Site Improvements, known as State Project Nos. BWO-6211-18(003) / 502889301 & LWO-6017-18(006) / 502889302 in Forrest County.

Project Completion: 09/29/2017

(STATE DELEGATED)

NOTICE

BIDDERS MUST PURCHASE A BID PROPOSAL FROM MDOT CONTRACT ADMINISTRATION DIVISION TO BID THIS PROJECT.

Electronic addendum updates will be posted on www.gomdot.com

SECTION 900

OF THE CURRENT 2004 STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION

JACKSON, MISSISSIPPI

BIDDER CHECK LIST
(FOR INFORMATION ONLY)

_____ First sheet of SECTION 905--PROPOSAL has been completed.

_____ Second sheet of SECTION 905--PROPOSAL has been completed and signed.

_____ All unit prices and item totals have been entered in accordance with Subsection 102.06 of the Mississippi Standard Specifications for Road and Bridge Construction.

_____ 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.

_____ Proposal bid sheet(s) of SECTION 905--PROPOSAL has been inserted into the proposal package.

_____ Equal Opportunity Clause Certification, when included in contract, has been completed.

_____ The Certification regarding Non-Collusion, Debarment and Suspension, etc. has been completed.

_____ 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.

_____ 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 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
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PROJECT: BWO-6211-18(003) / 502889301 - Forrest
LWO-6017-18(006) / 502889302 - Forrest

907-601-1	Structural Concrete
907-604-8	Manholes, Inlets And Catch Basins
907-607-3	Ornamental Iron Fence
907-618-13	Temporary Construction Signs
907-626-24	Thermoplastic Markings
907-626-25	Thermoplastic Traffic Markings
907-701-5	Hydraulic Cement, w/ Supplement
907-703-12	Aggregates, w/ Supplement
907-708-6	Non-Metal Drainage Structures
907-711-4	Synthetic Structural Fiber Reinforcement
907-713-6	Admixtures for Concrete
907-714-8	Miscellaneous Materials
907-720-2	Pavement Marking Materials
907-804-19	Concrete Bridges and Structures, w/ Supplement

Section 905 - Proposal, Proposal Bid Items, Combination Bid Proposal
State Board of Contractors Requirement
State Certification Regarding Non-Collusion, Debarment and Suspensions
Section 902 - Contract Form
Section 903 - Contract Bond Forms

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

06/01/2016 11:43 AM

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, July 26, 2016, and shortly thereafter publicly opened on the Sixth Floor for:

Renovation of the Existing District Six Shop and Minor Site Improvements, known as State Project Nos. BWO-6211-18(003) / 502889301 & LWO-6017-18(006) / 502889302 in Forrest 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. 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. 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. 1322 **CODE: (SP)**

DATE: 1/22/2007

SUBJECT: Non-Use of Precast Drainage Units

Bidders are hereby advised that the use of precast inlets and junction boxes will **NOT** be allowed on this project. Subsection 601.02.3 states that " the Contractor may request approval from the Engineer to furnish and install precast units in lieu of cast-in-place units". Should the Contractor make this request, the request will be denied.

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

Page	Subsection	Change
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 “ $\leq$ ”.

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 7th Street, SW
Washington, DC 20590
(202) 366-2212

or

http://ops.fhwa.dot.gov/freight/sw/brdgcalc/calc_page.htm

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. 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. 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 15th 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. 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. 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 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. 5044 **CODE: (SP)**

DATE: 05/13/2014

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 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 the day prior to the letting. Answers to questions will be posted by 6:00 p.m. on the day prior to the letting. 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. Bidders are advised that by signing the contract documents for this project, they agree that the on-line Questions and Answers submitted on this project shall be added to and made part of the official contract.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SECTION 904 - NOTICE TO BIDDERS NO. 5053 **CODE: (SP)**

DATE: 06/03/2014

SUBJECT: Contractor Correspondence

Bidders are advised that all correspondence concerning this project, other than correspondence related to the execution of the contract and sub-contracting, shall be sent to the Project Engineer. The Project Engineer will then forward any necessary correspondence to the appropriate Division. This includes general correspondence, submittals, shop drawings, requests for advancement of materials, etc.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SECTION 904 - NOTICE TO BIDDERS NO. 5104 **CODE: (SP)**

DATE: 06/17/2014

SUBJECT: Additional Governing Specifications for BWO/LWO Projects

Bidders are advised that if the language of the AIA Document A201 in Special Provision 907-242 is in conflict with the provisions in Section 100 of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction, the language in the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction shall control.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SECTION 904 - NOTICE TO BIDDERS NO. 5405 **CODE: (SP)**

DATE: 02/11/2015

SUBJECT: Traffic Control Devices

Bidders are advised of the following two changes regarding traffic control devices.

Flashing Arrow Panels

In Subsection 619.02.5 of the Standard Specifications, it states that flashing arrow panels shall meet the requirements of Section 6F.53 of the MUTCD. The new MUTCD has changed this reference to Section 6F.61. Flashing arrow panels on this project must meet the requirements of Section 6F.61 of the latest MUTCD.

Type III Barricade Rails

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/

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SECTION 904 - NOTICE TO BIDDERS NO. 5412 **CODE: (SP)**

DATE: 02/18/2015

SUBJECT: Weight Limits

Bidders are hereby advised that all trucks hauling materials to and from this project shall comply with the legal weight limits as established by law. MDOT will not compensate the Contractor for any portion of a load delivered to the project in excess of the legal limit for that truck.

Vehicles relying on harvest permits are limited to hauling only those materials set forth in Section 27-19-81(4) of the Mississippi Code, as amended.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SECTION 904 - NOTICE TO BIDDERS NO. 5824 **CODE: (SP)**

DATE: 09/10/2015

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, CMS-2h, LD-7, CQS-1h, ETAC-H, and NTSS-1HM 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.

Materials Used	Material Adjustment Made Based on Prices For
RC-70, 250, 800	MC-70
RS-1, 2	CRS-2
MC-30, 250	MC-70
MS-2h, CMS-2h	SS-1
LD-7, CQS-1h, ETAC-H, NTSS-1HM	CSS-1

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SECTION 904 - NOTICE TO BIDDERS NO. 5865 **CODE: (SP)**

DATE: 10/28/2015

SUBJECT: Non-Quality Control / Quality Assurance Concrete

Bidders are advised that the following concrete 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.

Section	Description
221	Paved Ditches
601	Minor Structures - manholes, inlets, catch basins, junction boxes, pipe headwalls, and pipe collars.
605	Edge Drain and Underdrain Outlet Pads
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. 5866 **CODE: (SP)**

DATE: 10/28/2015

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 weekly. 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. 6406 **CODE: (SP)**

DATE: **5/31/2016**

SUBJECT: **Contract Time**

PROJECT: **BWO-6211-18(003) / 502889301 &**
LWO-6017-18(006) / 502889302 – Forrest County

The calendar date for completion of work to be performed by the Contractor for this project shall be **September 29, 2017** 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 **August 8, 2016** and the effective date of the Notice to Proceed / Beginning of Contract Time will be **October 10, 2016**.

Should the Contractor request a Notice to Proceed earlier than **October 10, 2016** 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.

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. 907-102-11 **CODE: (SP)**

DATE: 11/04/2015

SUBJECT: Bidding Requirements and Conditions

907-102.06--Preparation of Proposal. Delete the first, fifth, sixth, and seventh paragraphs of Subsection 102.06 on pages 17 & 18, 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. 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.

A completed proposal package, with all forms completed, will constitute the official bid and shall be signed on the last sheet of Section 905 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.

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. 907-103-11 **CODE: (SP)**

DATE: 07/22/2015

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. 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. 907-104-6 **CODE: (SP)**

DATE: **11/20/2014**

SUBJECT: **Partnering Process**

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

907-104.01--Intent of Contract. At the end of Subsection 104.01 on Page 24, add the following:

907-104.01.1--Partnering Process.

COVENANT OF GOOD FAITH AND FAIR DEALING:

This contract imposes an obligation of good faith and fair dealing in its performance and enforcement.

The Contractor and the Department, with a positive commitment to honesty and integrity, agree to the following mutual duties:

A. Each will function within the laws and statutes applicable to their duties and responsibilities.

B. Each will assist in the other's performance.

C. Each will avoid hindering the other's performance.

D. Each will proceed to fulfill its obligations diligently.

E. Each will cooperate in the common endeavor of the contract.

The Mississippi Department of Transportation intends to encourage the foundation of a cohesive partnership with the contractor and its principal subcontractors and supplier. This partnership will be structured to draw on the strengths of each organization to identify and achieve reciprocal goals. The objectives are effective and efficient contract performance and completion within budget, on schedule, and in accordance with plans and specifications.

FORMAL PARTNERING:

This partnership will be bilateral in make-up, and participation will be required by both MDOT and the Contractor. Any cost associated with effectuating this partnering will be agreed to by both parties and will be shared equally.

To implement this partnering initiative prior to starting of work in accordance with the requirements of Subsection 108.02 Notice to Proceed and prior to the preconstruction conference, the contractor's management personnel and MDOT's District Engineer, will initiate a partnering development seminar/team building workshop. The Contractor working with the assistance of the District and the State Construction Engineer will make arrangements to determine attendees for the workshop, agenda of the workshop, duration, and location. Persons required to be in attendance will be the MDOT key project personnel, the contractor's on-site project manager and key project supervision personnel of both the prime and principal subcontractors and suppliers. The project design engineers, FHWA and key local government personnel will be also be invited to attend as necessary. The contractors and MDOT will also be required to have Regional/District and Corporate/State level managers on the project team.

Follow-up workshops may be held periodically throughout the duration of the contract as agreed by the contractor and Mississippi Department of Transportation.

The establishment of a partnership charter on a project will not change the legal relationship of the parties to the contract nor relieve either party from any of the terms of the contract.

INFORMAL PARTNERING:

If the Contractor and MDOT does not choose to have a Formal Partnering process or the contract does not require a Mandatory Formal Partnering process, an informal partnering meeting shall be conducted on at least a monthly basis. It will be mandatory that the Project Engineer and Project Superintendent attend the meeting. It is recommended that MDOT Inspectors, foremen, and other project managers attend the meeting.

The Project Engineer will be responsible for taking minute of the meeting. As soon as practical after the meeting, the Engineer will send a copy of the minutes of the meeting to the Contractor, District Construction Engineer, and State Construction Engineer. The Contractor will have 30 days to dispute the contents of the minutes or they will become an official record of the project.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-105-8 **CODE: (SP)**

DATE: 11/20/2014

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.

907-105.04--Coordination of Plans, Specifications, Interim Specifications, Special Provisions and Notice to Bidders. Delete the second full paragraph of Subsection 105.04 on page 35, and substitute the following.

In case of a conflict between plan quantities, advertisement quantities, and/or bid sheet quantities, the bid sheet quantities shall prevail.

907-105.05--Cooperation by Contractor. Delete Subsection 105.05 on page 35 and substitute the following.

907-105.05--Cooperation by Contractor. The Contractor shall give the work the attention necessary to expedite its progress, and shall cooperate with the Engineer, inspectors and other Contractors in every possible way.

907-105.05.1--Project Superintendent. The Contractor shall have a competent and experienced full time resident superintendent who is capable of reading and understanding the plans and specifications for the particular work being performed. The superintendent shall be on the project site at any time work is being performed by the Prime Contractor or any Subcontractors. The superintendent shall advise the Project Engineer of an intended absence from the work and designate a person to be in charge of the work during such absence. The superintendent shall receive instructions from the Engineer or authorized representative. Upon issuance of the Notice to Award, the Contractor or duly appointed agent authorized to bind the Contractor shall file with the Executive Director the name and address of the superintendent who will supervise the work with copies to the Construction Engineer, Contract Administration Engineer, District Engineer and Project Engineer. The Executive Director shall be immediately notified in writing with copies to those stated when a change is made in the Contractor's superintendent or superintendent's address. The superintendent shall have full authority to execute orders or directives of the Engineer without delay and to promptly supply materials, equipment, labor and incidentals as may be required. Such superintendence shall be furnished irrespective of the amount of work sublet.

907-105.05.2--Certified Erosion Control Person. On projects that require an erosion control plan, 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.

907-105.16--Acceptance. Delete Subsection 105.16 on pages 40 and 41, and substitute the following.

907-105.16--Acceptance.

907-105.16.1--Partial Acceptance of a Unit. When the Contractor has completed a unit of the work such as an interchange, a structure, a portion of the road or pavement or one project of a multi-project contract, the Contractor may request the Engineer to make a final inspection of that unit; or the Executive Director may order a final inspection of the unit if it is in the public's interest. If the Engineer finds upon inspection that the unit has been completed in compliance with the contract and it is a complete facility which can be made available to the public or made available for the prosecution of work under another contract, the Executive Director may conditionally accept the unit and conditionally relieve the Contractor of certain contractual responsibilities as defined in the release.

In the event items of work covered by such release are found to be defective or deficient as evidenced by unsatisfactory test reports of materials incorporated in the work or other engineering determination, the release shall terminate upon written notification to the Contractor. The Contractor shall make all corrections, restorations, constructions or reconstructions deemed necessary and shall resume all contractual responsibilities until all corrective measures have been made in accordance with the terms of the contract.

Partial acceptance does not constitute final acceptance of the work, or any part thereof, nor in any way void or alter any of the terms of the contract.

Relief from "certain contractual responsibilities" as indicated herein may, or may not, include:

(a) Further maintenance of the defined limits of the partially accepted work.
(b) Further public liability for the defined limits of the partially accepted work.
(c) Further liability for liquidated damages as applicable to the value of the partially accepted work when the quantities for the partially accepted work are separate quantities listed on the Summary of Quantities sheet of the plans, and the separate quantities and the total amounts thereof are listed on the Engineer's Estimate. Otherwise, no reduction in liquidated damages will be made because of such partial acceptance.

Unless specifically provided in the contract, the liability for liquidated damages shall not be reduced to less than that applicable under the contract for an amount of such work equal to at least fifty percent (50%) of the total amount of work under the contract.

907-105.16.2--Partial Maintenance Release of a Project. Upon written notice from the Contractor of presumptive completion of all the work and upon due notice from the Resident or Project Engineer, the Engineer will make an inspection.

If the inspection discloses any work as being unsatisfactory or incomplete, the Engineer will discuss in detail with the Contractor all discrepancies in the work. Upon correction of the work, another inspection will be made which shall constitute the final inspection provided the work has been satisfactorily completed.

However, if during the final inspection the Engineer determines that all work has been satisfactorily completed save that of growth and coverage of plant establishment on all or part of the work, the Engineer may recommend partial release of all work except items related to growth and coverage. Upon such recommendation, the Contractor will be given a partial release of maintenance and shall be released from further contractual liabilities for the completed work. The Contractor will retain responsibility for plant establishment and all maintenance and repairs appurtenant thereto until satisfactory growth and coverage is achieved.

907-105.16.3--Final Maintenance Release of a Project. Upon written notice from the Contractor of presumptive completion of all the work and upon due notice from the Resident or Project Engineer, the Engineer will make an inspection. If all work provided by the contract has been completed to the Engineer's satisfaction, the inspection will constitute the final inspection, and the Engineer will conditionally release the Contractor of maintenance.

As provided in the contract, in the event items of work are found to be deficient or defective as evidenced by unsatisfactory test reports of material incorporated into the work, the Contractor shall assume full responsibility for corrective measures, and shall reassume maintenance and public liability until such corrective measures are completed to the satisfaction of the Engineer.

907-105.16.4.--Final Acceptance of a Project. Upon evidence that the Contractor has fulfilled all obligations under the contract, the Executive Director will make final acceptance and notify the Contractor in writing. Final acceptance of the project will not be given until all obligations imposed under the contract, including but not limited to the final reporting of payrolls, final reporting of DBE payments, acceptable certifications and test reports of materials used, etc., have been fulfilled.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SUPPLEMENT TO SPECIAL PROVISION NO. 907-107-13

DATE: 11/17/2015

SUBJECT: Permits, Licenses and Taxes

After the second paragraph of Subsection 907-107.02 on page 1, add the following.

Prior to commencing work on any Project, the Contractor shall obtain a Material Purchase Certificate number (MPC#) from the Mississippi Department of Revenue, pursuant to Miss. Code Ann. § 27-65-21, and Miss. Admin. Code 35.IV.10.01. Upon receipt of the MPC#, the Contractor must immediately provide the MPC# to the Contract Administration Division of the Department. Failure to obtain and submit a MPC# prior to commencing work shall result in the withholding of payment to the Contractor until such time that a MPC# is obtained and submitted to the Department.

Delete the last sentence of the last paragraph of Subsection 907-107.02 on page 1, and substitute the following.

The Department will notify the Mississippi Department of Revenue of the names and addresses of any Contractors or Subcontractors.

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 or 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: **06/03/2014**

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.

After the last paragraph of Subsection 907-107.22.1 on page 2, add the following.

As soon as the ECP has been approved, a copy of the SWPPP (Narrative, ECP with updates) shall be available on the project at all times. The Contractor shall provide and install a weatherproof enclosure, such as a mailbox, on the project at a location that will be readily accessible to the Engineer or others who may want to review the project ECP. The cost of installing and maintaining this enclosure shall be included in the prices bid for the various erosion control pay items and no direct payment will be made for this work.

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. 907-108-38 **CODE: (SP)**

DATE: 04/18/2016

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. On working day projects, the Department will furnish the Contractor a progress schedule developed for the determination of contract time which may be used as the contract progress schedule, or the Contractor's own proposed progress schedule may be submitted for approval. If the Contractor elects to furnish a progress schedule for approval by the Engineer, it should be furnished promptly after award of the contract.

On completion date projects which include A + B projects, 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.

On projects using A + C bidding, 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 Contractor prepared progress schedules and approve schedules as it relates to compliance with the specifications and logic. The progress schedule must be approved by the Engineer prior to commencing work. The progress schedule shall be a computer generated bar-chart type schedule 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.

This progress schedule shall provide a bar for each major phase of construction such as, but not limited to, clearing and grubbing, grading, drainage structures, bridges, base, shoulders, paving, etc. with an estimated start working day and completion working day for each bar, all within the specified contract time.

A revised progress schedule may be required within ten days of the occurrence of any one of the following conditions:

- when a major change occurs in the work
- when a time extension is granted
- when the progress schedule becomes unrealistic

The Engineer's approval of the aforementioned Progress Schedules does not waive any contract requirements.

In the event the Contractor has not submitted an approvable progress schedule by the beginning of contract time, the progress schedule prepared by the Department shall be the approved progress schedule and used to assess contract time.

An approved progress schedule shall be in effect until the date on which a revised schedule is approved. The approved progress schedule will be the basis for contract time assessment.

When a Critical Path Method (CPM) schedule is required in the proposal, this schedule will be used in lieu of the bar graph progress schedule in evaluating work progress. In such case, the same time frame noted in this subsection for the original submittal along with the update requirements will apply.

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--Based on Working Day Completion.

907-108.06.1.1--General. Contract Time will be established on the basis of an allowable number of Working Days, as indicated in the contract. A working day is defined as a day the Contractor worked or could have worked in accordance with the conditions set forth in Subsection 907-108.06.1.2, Subparagraphs (a) and (b), except during the months of December, January, and February.

During the months of December, January, and February, time will be assessed in the miscellaneous phase regardless of whether or not the Contractor actually works. The value for the time on any particular day will be determined by dividing the number of anticipated working day shown in the following table by the number of days in the particular month. This number will be expressed to three decimal places (0.000)

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".

907-108.06.1.2--Contract Time. The following TABLE OF ANTICIPATED WORKING DAYS indicates an average/anticipated number of working days per month.

TABLE OF ANTICIPATED WORKING DAYS

Month	Working 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

NOTE: The above Table is for informational purposes only. The actual working day total as assessed by the Project Engineer on Form CSD-765 shall govern.

On projects other than A + C projects, available working 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. On A + C projects, available working days will start being assessed at the original Notice to Proceed/Beginning of Contract Time date shown in the contract documents, or the earlier Notice to Proceed/Beginning of Contract Time date if an early Notice to Proceed is allowed.

Available working 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 working 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 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, and

(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 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.

Time will not be charged during any required waiting period for placement of permanent pavement markings as set forth in Subsection 618.03 provided all other work is complete except growth and coverage of vegetative items as provided in Subsection 210.01.

Each month the Engineer will complete, and furnish to the Contractor, an "Assessment Report of Working Days" (CSD-765). This report shows the number of working days assessed during the estimate period and the cumulative working days assessed 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 working days assessed to-date on Form CSD-765 to the total allowable working 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.

907-108.06.1.3--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.

An extension of contract time may be granted for unforeseen utility delays, abnormal delays caused solely by the State or other governmental authorities, or unforeseeable disastrous phenomena of nature of the magnitude of earthquakes, hurricanes, named tropical storms, tornadoes, or flooded essential work areas which are deemed to unavoidably prevent prosecuting the work.

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 Working 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.

Any extension of contract time will be on a working day basis.

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.

If the contract time 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 907-108.07 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.

907-108.06.1.4--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.

907-108.06.2--Based on Specified Completion Date.

907-108.06.2.1--General. Contract Time will be established on the basis of a Specified Completion Date indicated in the Contract, or as determined by the Contractor in accordance with the contract documents. The span of time allowed for the completion of the work included in the contract will be known as "Contract Time".

For contracts in which a Specified Completion Date is indicated in the Contract, the span of Contract Time shall be between the date of the Beginning of Contract Time and the Specified Completion Date indicated in the Contract.

For contracts in which a Completion Date is determined by the Contractor (A + B Contracts), the span of Contract Time shall be between the date of the Beginning of Contract Time and the date representing the number of Calendar Days determined by the Contractor to complete the work.

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.

At any given date, the ratio of the accumulated monetary value of that part of the work actually accomplished to the total contract bid amount adjusted to reflect approved increases or decreases shall determine the "percent complete" of the work.

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 elapsed time shall be calculated as a direct ratio of the expired Calendar Days to the total Calendar Days provided for in 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.

907-108.06.2.2--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.

On all completion date contracts, an extension of contract time may be granted for unforeseen utility delays, abnormal delays caused solely by the State or other governmental authorities, or unforeseeable disastrous phenomena of nature of the magnitude of earthquakes, hurricanes, named

tropical storms, tornadoes, or flooded essential work areas which are deemed to unavoidably prevent prosecuting the work.

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.

Any extension of contract time will be based on a calendar day basis, excluding Saturdays, Sundays or legal holidays recognized by the Department in Subsection 108.04.1.

If the contract time 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 907-108.07 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.

907-108.06.2.3--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

Original Contract Amount		Daily Charge
From More Than	To and Including	Per Calendar Day
$ 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

SPECIAL PROVISION NO. 907-109-8 **CODE: (SP)**

DATE: 09/10/2015

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. 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%, which also includes tax and bond.

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, including mark-up, 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:

In the last sentence of subparagraph (b) in Subsection 109.04 on page 91, change "bond" to "bond(s)".

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

Equipment. For any machinery or special equipment, other than small tools, authorized by the Engineer, the Contractor will use the rates shown in 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, unless otherwise allowed by the Engineer. This book shall be used to determine equipment ownership and operating expense rates. These rates do not include allowances for operating labor, mobilization or demobilization costs, overhead or profit, and do not represent rental charges for those in the business of renting equipment. Operating labor and overhead cost will be allowed. Subject to advance approval of the Engineer, actual transportation cost for a distance of not more than 200 miles will be reimbursed for equipment not already on the project. The cost of transportation after completion of the force account work will be reimbursed except it cannot exceed the allowance for moving the equipment to the work.

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.

907-109.06.2--Advancement on Materials. Delete Subsection 109.06.2 on pages 94 & 95, and substitute the following.

907-109.06.2--Advancement on Materials. Partial payments may include advance payment for certain nonperishable or durable materials such as base aggregates, reinforcing steel, bridge piling, structural steel, prefabricated bridge components, traffic signal equipment, electrical equipment, fencing materials, and sign materials with approval of the Engineer. Advance payment may be requested for structural steel members provided fabrication has been completed and the members have been declared satisfactory for storage by a Department representative. The Contractor must make a written request to the Project Engineer for advanced payment and furnish written consent of the Surety. To qualify for advance payment, materials must be stored or stockpiled on or near the project or at other locations approved by the Engineer; or in the case of precast concrete members, treated timber, guard posts and other approved preprocessed durable and bulky materials, the materials may be stored at the commercial producer's yard provided it is located in Mississippi; or in the case of prestressed concrete members that may

require being produced at an out-of-state location, the prestress members shall be produced and may be stored at the commercial manufacturer's yard provided it is a PCI certified plant on the Department's List of Approved Prestress & Precast Plants and it is located within the continental United States; or in the case of structural steel members that may require fabrication at an out-of-state location, the fabricated members may be stored at the location of the commercial fabricator's yard provided it is located within the continental United States.

Advancements will not be allowed until the Project Engineer has received copies of material invoices and certified test reports or acceptable certificates of conformance, and in the case of materials stored at the commercial producer's/fabricator's yard, the material shall be positively identified for the specific project and a Certificate of Storage issued by the Department or a designated representative of the Department. Requests for advancements on fabricated structural steel members and prestress concrete members stored out-of-state will be denied when the Department does not have available a designated representative to issue a Certificate of Storage.

The Contractor shall make suitable arrangements to the satisfaction of the Engineer for storage and protection at approved sites or, in the case of materials stored at the commercial producer's yard located in Mississippi or, in the case of fabricated structural steel members stored at the commercial fabricator's yard or prestress concrete members stored at a commercial manufacturer's yard located within the continental United States, the Contractor shall make arrangements with the producer/fabricator for suitable storage and protection. If advanced payment is allowed and the materials are damaged, lost, destroyed or for any reason become unacceptable, the previous payments will be deducted from subsequent estimates until the materials are replaced or restored to an acceptable condition. In all cases, the Contractor shall save harmless the Commission in the event of loss or damage, regardless of cause.

An invoice or an accumulation of invoices for each eligible material must total $10,000 or more before consideration will be given for making advanced payment. When allowed, advance payment will be based on verified actual material cost plus transportation charges to the point of storage. Sales tax, local haul and handling costs shall not be included as material cost.

Advanced payment shall not exceed 100% of the invoice price or 75% of the total contract bid price for the pay item, whichever is less.

Advanced payment for a component of a pay item shall not exceed 95% of the invoice price or 75% of the total contract bid price for the pay item of which the material is a part, whichever is less.

Advanced payment will be made only on materials that will be incorporated permanently in the project.

No advanced payment will be made on minor material items, hardware, etc.

No advanced payment will be made for materials when it is anticipated that those materials will be incorporated into the project within 60 calendar days.

Advanced payment will be paid for those materials which are not readily available, and which can be easily identified and secured for a specific project and for which lengthy stockpiling periods would not be detrimental.

Where a storage area is used for more than one project, material for each project shall be segregated from material for other projects, identified, and secured. Adequate access for auditing shall be provided. All units shall be stored in a manner so that they are clearly visible for counting and/or inspection of the individual units.

Unless specifically provided for in the contract, advance payment will not be made on materials, except for fabricated structural steel members or prestress concrete members, stored or stockpiled outside of the State of Mississippi.

Materials for which an advanced payment has been allowed must be paid for by the Contractor within 60 days of the estimate on which the advanced payment was first allowed and proof of said payment must be verified by the supplier. If proof of payment is not furnished within the allowable 60 days, the advanced payment will be deducted on subsequent current estimates until such time proof of payment is furnished.

As the materials are incorporated into the work, proportionate reductions for advance payments shall be made from monthly estimates covering the work performed. Calculation of percentage of completion, or rate of progress, shall be based on completed work and no consideration will be given to stockpiled materials.

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."

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. 907-216-1 **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. 907-234-5 **CODE: (SP)**

DATE: 09/23/2010

SUBJECT: Siltation Barriers

Section 234, Silt Fence, of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows.

907-234.01--Description. Delete the first paragraph of Subsection 234.01 on page 177 and substitute the following:

This work consists of furnishing, constructing and maintaining a water permeable filter type fence, inlet siltation guard or turbidity barrier for the purpose of removing suspended soil particles from the water passing through it in accordance with the requirements shown on the plans, directed by the Engineer and these specifications. Fence, inlet siltation guards and turbidity barriers measured and paid as temporary shall be removed when no longer needed or permanent devices are installed.

Delete the first sentence of the second paragraph of Subsection 234.01 on page 177 and substitute the following:

It is understood that measurement and payment for silt fence, inlet siltation guards, and turbidity barriers will be made when a pay item is included in the proposal.

907-234.02--Materials. After the first paragraph of Subsection 234.02 on page 177, add the following:

Inlet siltation guards shall be listed on the Department's "Approved Sources of Materials".

Turbidity barriers shall be one of the following, or an approved equal.

1. SiltMax Turbidity Barrier by Dawg, Inc., 1-800-935-3294, www.dawginc.com
2. Turbidity Barrier by IWT Cargo-Guard, Inc., 1-609-971-8810, www.iwtcargoguard.com
3. Turbidity Curtain by Abasco, LLC, 1-281-214-0300, www.abasco.net

Chain link fence and hardware for super silt fence shall meet the requirements of Section 607, as applicable. Geotextile for super silt fence shall meet the requirements of Subsection 714.13 for a Type II Woven fabric.

907-234.03--Construction Requirements. After the last paragraph of Subsection 234.03.1 on page 178, add the following:

Super Silt Fence. Super silt fence shall be constructed in accordance with the plans and these specifications.

All posts shall be installed/driven so that at least 34 inches of the post will protrude above the ground. The chain link wire and geotextile shall be stretched taut and securely fastened to the posts as shown on the plans. The bottom edge of the fence and geotextile shall be buried at least eight inches below ground surface to prevent undermining. When splicing of the geotextile is necessary, the fabric shall be overlapped approximately 18 inches.

907-234.03.1.1--Placement of Inlet Siltation Guards and Turbidity Barriers. The inlet siltation guards and turbidity barriers shall be constructed at the locations shown on the erosion control plans. Inlet siltation guards and turbidity barriers shall be installed in accordance with the erosion control drawings in the plans. A copy of the manufacturer's instructions for placement of inlet siltation guards and turbidity barriers shall be provided to the Engineer prior to construction.

907-234.03.2--Maintenance and Removal. At the end of the first paragraph of Subsection 234.03.2 on page 178, add the following:

The Contractor shall maintain the inlet siltation guards. The geotextile shall be removed and replaced when deteriorated to such extent that it reduces the effectiveness of the guard. Replacement geotextile shall be the same type and manufacture as the original. Excessive accumulations against the guard shall be removed and disposed of at a location approved by the Engineer.

The Contractor shall maintain the turbidity barriers. Excessive accumulations against the turbidity barrier shall be removed and disposed of at a location approved by the Engineer.

Delete the second paragraph of Subsection 234.03.2 on page 178 and substitute the following:

Unless otherwise directed, all temporary silt fences, inlet guards and turbidity barriers shall be removed. Upon removal, the Contractor shall remove and dispose of any excess silt accumulations, shape the area to the line, grade, and cross section shown on the plans and vegetate all bare areas in accordance with the contract requirements. The temporary fence, inlet guard materials and turbidity barriers will remain the property of the Contractor and may be used at other locations provided the materials are acceptable to the Engineer.

After Subsection 234.03.2 on page 178, insert the following:

907-234.03.3--Resetting Inlet Siltation Guards and Turbidity Barriers. When inlet siltation guards and turbidity barriers are no longer needed at one location, they may be removed and reset at other needed locations. The Engineer may allow the resetting of siltation guards and turbidity barriers upon an inspection and determination that the siltation guards (frame and geotextile) and turbidity barriers are adequate for their intended purpose. When they have to be stored until needed at another location, payment for resetting will not be made until they are reset at their needed location.

907-234.04--Method of Measurement. Delete the sentence in Subsection 234.04 on page 178, add the following:

Silt fence and super silt fence will be measured by the linear foot.

Inlet siltation guard and resetting siltation guards will be measured per each. Turbidity barrier will be measured per linear foot.

907-234.05--Basis of Payment. Delete the sentence in Subsection 234.05 on page 178, add the following:

Silt fence and super silt fence, measured as prescribed above, will be paid for at the contract unit price per linear foot which shall be full compensation for completing the work.

Inlet siltation guard, resetting inlet siltation guards, and turbidity barrier, measured as prescribed above, will be paid for at the contract unit price per each or linear foot, which shall be full compensation for furnishing, constructing, and maintaining the work and for the removal and disposal of all items comprising the devices.

After the last pay item listed on page 178, add the following:

907-234-C:	Super Silt Fence	- per linear foot
907-234-D:	Inlet Siltation Guard	- per each
907-234-E:	Reset Inlet Siltation Guard	- per each
907-234-F:	Turbidity Barrier	- per linear foot

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. 907-242-37 **CODE: (SP)**

DATE: 04/05/2016

SUBJECT: Renovate District Shop

PROJECT: BWO-6211-18(003) / 502889301 &
LWO-6017-18(006) / 502889302 -- Forrest County

Section 907-242, Renovate District Shop, 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-- Renovate District Shop

The following specifications are to be used ONLY for the Renovation of the Existing District Six Shop. The Mississippi Standard Specifications for Road and Bridge Construction shall be used for all other items of work.

SECTION 00 01 10 TABLE OF CONTENTS

PROJECT: DISTRICT SIX SHOP RENOVATION,
FORREST COUNTY, MISSISSIPPI

PROJECT NUMBER: BWO-6211-18(003) 502889
LWO-6017-18(006) 502889

DATE: 03-23-16

DESCRIPTION A: This Work shall consist of minor site work and all construction work necessary in renovating the Existing District Six Shop at Hattiesburg, Forrest County, Mississippi, in accordance with these Specifications and conforming with the Drawings.

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

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

END OF TABLE OF CONTENTS

DOCUMENT 00 01 15 LIST OF DRAWING SHEETS

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	SHEET NUMBER	DESCRIPTION
-----	1	TITLE SHEET
T102	2	INDEX OF DRAWINGS
T103	3	SUMMARY OF QUANTITIES
T104	4	ABBREVIATIONS AND SYMBOLS
T105	5	LIFE SAFETY PLAN
C100	6	EXISTING SITE AND DEMOLITION PLAN
C200	7	SITE PLAN
C300	8	GRADING AND DRAINAGE PLAN
C400	9	UTILITY PLAN
C500	10	SITE DETAILS
C501	11	SITE DETAILS
C502	12	SITE DETAILS
C503	13	SITE DETAILS
S100	14	STRUCTURAL GENERAL NOTES
S101	15	FOUNDATION FRAMING PLAN
S201	16	WALL AND CONCRETE SECTIONS
S202	17	CONCRETE DETAILS
AD101	18	DEMOLITION PLAN – PART A
AD102	19	DEMOLITION PLAN – PART B
AD103	20	DEMOLITION PHOTOS
AD104	21	DEMOLITION PHOTOS
AD105	22	DEMOLITION PHOTOS
AD106	23	DEMOLITION PHOTOS
A101	24	FLOOR PLAN
A102	25	CLERESTORY PLAN
A103	26	REFLECTED CEILING PLAN
A104	27	EQUIPMENT PLAN
A105	28	ROOF PLAN
A106	29	ROOF DETAILS
A107	30	ROOF DETAILS
A108	31	ROOF DETAILS
A201	32	BUILDING ELEVATIONS
A202	33	BUILDING ELEVATIONS
A301	34	BUILDING SECTION
A302	35	BUILDING SECTION
A303	36	BUILDING SECTION
A304	37	WALL SECTIONS
A305	38	WALL SECTIONS
A306	39	WALL SECTIONS
A401	40	PART FLR PLAN, KITCHEN, JAN, & RESTRM ELEVATIONS
A402	41	FLOOR FINISH PLAN
A501	42	DOOR AND WINDOW DETAILS
A601	43	DOOR OPENINGS AND FINISH SCHEDULES

A602	44	DOOR AND WINDOW SCHEDULES
A603	45	OPENING DETAILS
A604	46	OPENING DETAILS
A605	47	OPENING DETAILS
A606	48	OPENING DETAILS
A607	49	OPENING DETAILS
A608	50	OPENING DETAILS
A901Q	51	EXTERIOR VIEWS
A902	52	EXTERIOR VIEWS
I101	53	FLOOR FINISH PLAN
I401	54	INTERIOR ELEVATIONS
I402	55	MILLWORK SECTIONS
I601	56	INTERIOR FINISH SCHEDULE
P001	57	PLUMBING LEGEND AND ABBREVIATIONS
FP101	58	FLOOR PLAN – FIRE PROTECTION
FP102	59	FIRE PROTECTION DETAILS
PD101	60	PLUMBING DEMOLITION
P101	61	FLOOR PLAN – PLUMBING (SANITARY)
P102	62	FLOOR PLAN – PLUMBING (SUPPLY)
P501	63	PLUMBING DETAILS
P502	64	PLUMBING DETAILS AND FIXTURE SCHEDULE
P601	65	PLUMBING RISERS
M001	66	LEGENDS AND ABBREVIATIONS
MD101	67	HVAC DEMOLITION
M101	68	HVAC - RENOVATION
M201	69	HVAC PIPING - RENOVATION
M501	70	MECHANICAL DETAILS
M502	71	MECHANICAL DETAILS
M601	72	MECHANICAL SCHEDULES
M602	73	MECHANICAL SCHEDULES
M701	74	CONTROL SCHEMATICS
M702	75	CONTROL SCHEMATICS
E100	76	SITE PLAN AND DETAILS
E200	77	FLOOR PLAN – DEMOLITION
E201	78	FLOOR PLAN – LIGHTING
E202	79	FLOOR PLAN – POWER AND TELECOMMUNICATIONS
E203	80	FLOOR PLAN – SPECIAL SYSTEMS
E300	81	POWER RISER DETAILS
E301	82	CIRCUITRY DETAILS
E302	83	DETAILS
E303	84	LOW VOLTAGE CONTROL WIRING DIAGRAMS
E304	85	LOW VOLTAGE CONTROL WIRING DIAGRAMS
E400	86	PANEL SCHEDULES
E401	87	PANEL SCHEDULES
E402	88	POWER CONNECTIONS SCHEDULE AND DETAIL
E403	89	LIGHTING FIXTURE SCHEDULE AND DETAIL
E404	90	SYMBOLS

END OF DOCUMENT

SECTION 00 21 13 INSTRUCTIONS TO BIDDERS

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, Article 102.01 – 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.

B. MANDATORY attendance of the Pre-Bid Meeting is required to submit a Bid for this Project, refer to Section 00 25 13 Pre-Bid Meeting. Failure to visit the site on this day will in no way relieve the successful Bidder from furnishing any materials or performing any work required to complete Work in accordance with Drawings and Project Manual (Proposal) at no additional cost to the Owner.

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 Form, 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.msboc.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.msboc.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.msboc.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:	Neal Dougherty – Contract Administration	(601) 359-7700
2.	Additional Prints:	Nathan Bruce – MDOT Plans Print Shop	(601) 359-7459
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

END OF DOCUMENT

DOCUMENT 00 22 13 SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

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 108 – Prosecution and Progress (as amended).

B. A Construction Schedule as described in Section 01 32 00-Construction Progress Documentation of these Specifications will be required.

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:

1. Building related Items, Materials, or Systems:
   a. Masonry Items
   b. Cellulose Thermal Insulation
   c. Thin-Set Tiling
   d. Insulated Translucent Wall Panel System
   e. Insulated Metal Wall and Roof Panels
   f. Metal Building System
   g. Plumbing Items
   h. Heating, Ventilating and Air Conditioning Items
   i. Security and Surveillance Items
   j. Electrical Items

See Notice To Bidders for Specialty Items associated with the Site Improvements for this Project.

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

END OF DOCUMENT

DOCUMENT 00 25 13 PREBID MEETING

1.01 PREBID MEETING

A. Owner will conduct a Prebid meeting as indicated below:

1. Meeting Date: Wednesday, June 29, 2016.
2. Meeting Time: 10:00 a.m., local time.
3. Location: District Six Headquarters Auditorium located at 6356 Highway 49, North, Hattiesburg, Mississippi, telephone (601) 544-6511.

B. Attendance:

1. Prime Bidders: Attendance at Prebid meeting is MANDATORY.
2. Subcontractors: Attendance at Prebid meeting is recommended.
3. Notice: Bids will only be accepted from prime bidders represented on Prebid Meeting sign-in sheet.

C. Agenda: Prebid meeting agenda will include review of topics that may affect proper preparation and submittal of bids, including the following:

1. Procurement and Contracting Requirements:
   a. Advertisement for Bids.
   b. Instructions to Bidders.
   c. Bidder Qualifications.
   d. Bonding.
   e. Insurance.
   f. Bid Security.
   g. Bid Form and Attachments.
   h. Bid Submittal Requirements.
   i. Bid Submittal Checklist.
   j. Notice of Award.
2. Communication during Bidding Period:
   a. Obtaining documents.
   b. Access to Project Web site.
   c. Bidder's Requests for Information.
   d. Bidder's Substitution Request / Prior Approval Request.
   e. Addenda.
3. Contracting Requirements:
   a. Agreement.
   b. The General Conditions.
   c. Other Owner requirements.
4. Construction Documents:
   a. Scopes of Work.
   b. Temporary Facilities.
   c. Use of Site.
   d. Work Restrictions.
   e. Substitutions following award.
5. Schedule:
   a. Project Schedule.
   b. Contract Time.
   c. Liquidated Damages.
   d. Other Bidder Questions.

6. Site / facility visit or walkthrough.
7. Post-Meeting Addendum.

D. Minutes: MDOT will record and distribute meeting minutes to attendees issued as part of written Addendum Number One between day after meeting and week before Letting.

1. Sign-in Sheet: Minutes will include list of meeting attendees.

END OF DOCUMENT

DOCUMENT 00 72 00 GENERAL CONDITIONS

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.

END OF DOCUMENT

AIA® Document A201™ – 2007

General Conditions of the Contract for Construction

for the following PROJECT:
(Name and location or address)
DISTRICT SIX SHOP RENOVATION, FORREST COUNTY, MISSISSIPPI

BWO-6211-18(003) 502889 / 301000
LWO-6017-18(006) 502889 / 303000

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)

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.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

TABLE OF ARTICLES

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15 CLAIMS AND DISPUTES

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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 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 preformed 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.

§ 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.

§ 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.

§ 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.

§ 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 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 extention 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. This date shall be the Date of Completion. All Warranties and Extended Warranties shall use this date as the starting date of Warranty Period.

§ 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 D
$ 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

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

.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 GENERAL LIABILITY:

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…… $	1,000,000.00	Per Occurrence
Fire Damage Liability…… $	50,000.00	Per Fire
Medical Expense…… $	5,000.00	Per Person

.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 11.1.5.

§ 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.

§ 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 OFCOMPLETION

§ 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 laws of the State of Mississippi 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 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 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 affects 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 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)

DOCUMENT 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.

END OF DOCUMENT

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 Renovate District Six Shop at Hattiesburg, Forrest County, Mississippi.

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 and one copy to the Project Engineer and to the MDOT Architect CAD-720 form - REQUEST FOR PERMISSION TO SUBCONTRACT for each subcontractor before they are allowed to perform any Work.

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 others on site.

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 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 work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Driveways, Walkways and Entrances: Keep driveways, loading areas, 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.

C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

1.04 COORDINATION WITH OCCUPANTS

A. Full Owner Occupancy: Owner will occupy site and adjacent building(s) during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations.

1. Maintain access to existing walkways and other adjacent occupied or used facilities. Do not close or obstruct walkways, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.
2. Notify Owner not less than 72 hours in advance 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 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.

1.05 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.

1.06 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 (Not Used)

END OF SECTION

SECTION 01 21 00 ALLOWANCES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements governing allowances.

B. Types of allowances include the following:

1. Lump-sum allowances.

C. Related Requirements:

1. Section 41 22 00 Cranes and Hoists.

1.02 SELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, advise Project Engineer and Architect of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.

B. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.

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

1.03 ACTION SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Supplemental Agreements (Change Orders).

1.04 INFORMATIONAL SUBMITTALS

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

B. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.

C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.05 COORDINATION

A. Coordinate allowance items with other portions of the Work.

1.06 LUMP-SUMS

A. Allowance shall include cost to Contractor of specific products and materials selected by Architect under allowance including taxes**,** freight**,** and delivery to Project site.

B. Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials under allowance shall be included as part of the Allowance.

1.07 ADJUSTMENT OF ALLOWANCES

A. Allowance Adjustment: To adjust allowance amounts, prepare a Supplemental Agreement (Change Order) proposal based on the difference between actual materials plus labor amount and the allowance amount.

1. Include installation costs as part of the allowance, but as separate components.
2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.

B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, overhead, and profit.

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION

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

3.03 SCHEDULE OF ALLOWANCES

A. Allowance No. One: Lump-Sum Allowance for the sum of $138,500: Include one (1) complete 10-ton capacity and one (1) complete 5-tom capacity top running single girder crane as specified in Section 41 22 00 and as shown on Drawings.

1. This allowance includes material cost, receiving, handling, and installation, and Contractor overhead and profit.

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 45 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 it's 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 Architect and 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.

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 Six. The Work includes District Six Shop renovation, Forrest 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:
MDOT Project No. BWO-6211-18(003) 502889
District Six Shop Renovation
In Forrest 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 dairy 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, and Architect of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
   a. Contract Documents.
   b. Options.
   c. Related RFIs.
   d. Related 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 Architect 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 81/2 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 81/2 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 35 16 ALTERATION PROJECT PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Project coordination and assignment of the work of all Parties and the scheduling of all elements of alterations and renovation work by procedures and methods to expedite completion of the Work for each Part.

B. Work to be assigned, coordinated and scheduled includes, but is not limited to, the following:

1. Work of each Division and Section of the Specifications as shown on the Drawings and in the Specifications
2. Procedures and activities required under the provisions of this Section.

1.02 PROJECT COORDINATION

A. Definition: Project Coordination is the process utilized to guide all participants in the Project's construction and includes assigning, scheduling, expediting, reviewing, and modifying, as appropriate, the activities required to produce the total Work to the designated quality and within the assigned time.

B. Responsibility: Except otherwise provided by the Contract Documents, all Project Coordination shall be the entire responsibility of the Contractor. The Contractor shall set forth procedures and conditions for coordination of the Work and shall personally be responsible for the implementation of the required coordination which shall include the following:

1. Communications: Establish lines of authority and communication at the Job Site.
2. General Coordination: Closely coordinate all work of Project participants to effect quality construction and steady progress in all phases and aspects of the Work with a minimum of delays and interference.
3. Special Coordination Give additional careful attention to the work of the following:
    a. Mechanical / Electrical Subcontractors and be responsible for the following:
        1) Establishment of locations, clearances and precedence for all piping, conduit and ductwork (underground and above ceilings).
        2) Submittal of Schematic Drawings giving location and clearance information for Architect / Engineer review.
4. Supervision: Supervise the activities of every phase of the Work of the Project. Make frequent inspections of the Work to determine progress and quality; proceed immediately to remedy problems and to effect changes needed in the construction process and personnel.
5. Interpretation of Contract Documents:
    a. Consultation: Consult with MDOT Architect to obtain interpretations.
    b. Assistance: Assist in resolution of questions.
    c. Stop work not in accordance with the requirements of the Contract Documents.

6. Division One: Coordinate requirements of Division One and specifically as follows:
   a. Testing: Coordinate all required testing. Refer to Section 01 45 29.
   b. Temporary Facilities and Controls: Allocate, maintain and monitor all temporary facilities. Refer to Section 01 50 00.
   c. Cutting and Patching: Supervise and control all cutting and patching. Refer to Section 01 73 00 - Execution.
   d. Cleaning: Direct and execute a continuing cleaning program throughout the construction, requiring each trade to dispose of their own debris, except as otherwise provided in the Contract Documents. Refer to Section 01 74 00.
   e. Project Record Documents: Maintain up-to-date project record documents. Refer to Section 01 78 39.
7. Enforce all safety requirements.
8. Maintain quality control of all work.

1.03 QUALITY CONTROL

A. Assign all elements of the work to trades qualified to perform each type of work.

B. Patch, repair and refinish existing work using skilled mechanics that are capable of matching existing quality of workmanship. Quality of patched or extended work shall be not less than that specified for new work.

1.04 PROJECT MEETINGS

A. When required by Project Engineer / MDOT Architect or by individual Specification Sections, convene meetings to coordinate the Work and / or to review conditions at the Site and to outline procedures by which the Work will be performed. Refer to Section 01 31 00 – Project Management & Coordination.

B. Require attendance by all affected Parties.

1.05 CONSTRUCTION ACCESS

A. Access to construction area for construction materials and exit way for demolition debris shall be as directed by the Project Engineer.

1.06 PROTECTION OF WORK

A. Protect from damage, existing finishes, equipment, adjacent work scheduled to remain, and all new work.

   1. Protect existing and new work from temperature extremes. Maintain interior work above 60 degrees F.
   2. Provide heat and humidity control as needed to prevent damage to existing work and new work.
   3. Provide dust partitions as needed to prevent damage to existing work and new work.

1.07 CUTTING AND PATCHING

A. Scope: Provide the necessary cutting, fitting and patching required to complete all elements of the Work including, but not limited to, the following procedures:

1. To integrate with other work, to fit properly together.
2. To uncover work to provide for installation of ill-timed work.
3. To remove and replace defective and / or non-conforming work.
4. To remove installed material for testing.
5. To provide openings for penetration of mechanical and electrical work.

B. Preparation: Prior to commencing cutting and patching, examine existing conditions (including structure and elements subject to movement) and advise Project Engineer in writing of any condition that could be adversely affected by cutting and patching.

1. Submit written request in advance of cutting or alteration that affects:
   a. Structural integrity of any element of the Project.
   b. Integrity of weather-exposed or moisture-resistant element.
   c. Efficiency, maintenance, or safety of any operational element.
   d. Visual qualities of sight exposed elements.
   e. Work of User or separate contractor.
2. Include in the request:
   a. Identification of Project.
   b. Location and description of affected work.
   c. Necessity for cutting or alteration.
   d. Description of proposed work, and products to be used.
   e. Alternatives to cutting and patching.
   f. Effect on work of User or separate contractor.
   g. Written permission of affected separate contractor.
   h. Date and time work will be executed.

C. Procedures: Perform cutting and patching as required in Part 3-Execution of this Section.

1. Proceed only when permitted and after temporary supports and other devices are in place to ensure structural integrity and to protect other portions of the Project from damage.
2. Execute work by methods to avoid damage to other Work, and which will provide appropriate surfaces to receive patching and finishing.
3. Cut rigid materials using masonry saw or core drill. Pneumatic tools are not allowed without prior approval from the Project Engineer.
4. Restore work with new products in accordance with requirements of the Contract Documents.
5. Fit work air tight to pipes, sleeves, ducts, conduits and other penetrations through surfaces.
6. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material, to full thickness of the penetrated element.
7. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

1.08 WORK RESTRICTIONS

A. Project participants shall not perform any work on any Sunday or any Legal Holidays (as defined in Section 3-3-7, Mississippi Code of 1972, Annotated) except as required by emergency conditions and approved by the Project Engineer.

B. "No Smoking" shall be observed in the work areas.

PART 2 - PRODUCTS

2.01 SALVAGED MATERIALS

A. Coordinate with Project Engineer in identifying salvageable materials. The Owner has first right of refusal for all items.

B. Contractor shall take proper care in removing and placement where directed in designated area on Site.

C. Salvage sufficient quantities of cut or removed material to replace damaged work of existing construction, when material is not readily obtainable on current market.

1. Items not required for use in repair of existing work to remain shall be discarded if of no value to the Owner.
2. Do not incorporate salvaged or used material in new construction unless approved in writing by the Project Engineer

2.02 PRODUCTS FOR PATCHING, EXTENDING AND MATCHING

A. Provide products or types of construction same as in existing structure, as needed to patch, extend or match existing work to make work complete and consistent to standards of quality of connected and / or similar adjacent construction. Except otherwise indicated all products shall be new.

B. Where Contract Documents do not define products or standards of workmanship in existing construction, Contractor shall determine products by inspection and any necessary testing, and upgrade by use of the existing as a sample of comparison.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that demolition is complete and areas are ready for beginning of repairing, refinishing and new construction.

3.02 PREPARATION

A. Cut, move, or remove existing construction as necessary for access to alterations and renovations work; repair, replace, and restore where existing affected construction is to remain a part of final completed work.

3.03 ADJUSTMENTS

A. Where partitions are removed, patch floors, walls, and ceilings for installation of new materials.

B. Where removal of partition(s) results in adjacent spaces becoming one space, rework floor surfaces and ceilings to provide smooth planes without breaks, steps, or bulkheads.

C. Where extreme change of plane occurs, request instructions from MDOT Architect as to method of making transition.

D. Where new work adversely affects existing conditions beyond work limits defined, new work shall extend to facilitate proper joining and finishing of work.

3.04 DAMAGED SURFACES

A. Patch and replace any portion of an existing finished surface which as a result of this construction, is found to be damaged, lifted, discolored, or shows other imperfections, with matching material.

1. Provide adequate support of substrate prior to matching the finish.
2. Refinish patched portions of painted or coated surfaces in a manner to produce uniform color and texture over entire surface

B. Patch and replace any portion of an existing surface to be refinished as a finished surface that is found to be damaged, lifted, discolored or show imperfections that renders surface or substrate unsuitable for application of new finish material.

1. Refinish patched portion to match existing adjacent surface in order to produce a uniform color and texture.

C. Where new or existing wall is patched or damaged, the wall surface shall be patched and refinished from base to ceiling and end to end, or nearest natural break, and shall match new work in quality.

3.05 TRANSITION FROM EXISTING TO NEW WORK

A. When new work abuts or finishes flush with existing work, make a smooth and workmanlike transition. Patched work shall match existing adjacent work in texture and appearance.

B. When finished surfaces are cut in such a way that a smooth transition with new work is not possible, terminate existing surface in a neat manner along a straight line at a natural line of division.

3.06 CLEANING - PERIODIC AND FINAL

A. General Requirements:

1. Maintain the Project Space, including areas used for passage of Project personnel and materials, in a neat, clean and orderly condition at all times.
2. Do not allow the accumulation of scrap, debris, waste material, and other items not required for the Work.
3. Provide adequate storage for all items awaiting removal from Site, observing all requirements for fire prevention and protection of the environment.

B. Periodic Cleaning, as follows:

1. Daily and more often if necessary, inspect the Project Space and pick up all scrap, debris, and waste material; remove to designated storage.
2. At completion of work of each trade, clean area and make surfaces ready for work of successive trades.
3. One each week, more often if necessary, remove all stored waste material and legally dispose of off the Site.

C. Final Cleaning: Under provision of Section 01 74 19 – Construction Waste Management and Disposal.

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. Finished Floors: Level to within plus or minus 1/8 inch in 10 feet for hardwood and 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, MDOT Architect's and 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)
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
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)
BOCA	BOCA (Building Officials and Code Administrators International Inc.) (See ICC)
CDA	Copper Development 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	CSA International (Formerly: IAS - International Approval Services)
CSI	Construction Specifications Institute (The)
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)
ESD	ESD Association (Electrostatic Discharge Association)
EVO	Efficiency Valuation Organization
FM Approvals	FM Approvals LLC
FM Global	FM Global (Formerly: FMG - FM Global)
FSA	Fluid Sealing Association
GA	Gypsum Association
GANA	Glass Association of North America
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	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.

NCMA	National Concrete Masonry Association
NEBB	National Environmental Balancing Bureau
NECA	National Electrical Contractors Association
NEMA	National Electrical Manufacturers Association
NETA	InterNational Electrical Testing Association
NFPA	NFPA (National Fire Protection Association)
NFPA	NFPA International (See NFPA)
NFRC	National Fenestration Rating Council
NLGA	National Lumber Grades Authority
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)
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
SPFA	Spray Polyurethane Foam Alliance
SPIB	Southern Pine Inspection Bureau
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
UBC	Uniform Building Code (See ICC)
UL	Underwriters Laboratories Inc.
UNI	Uni-Bell PVC Pipe Association
USGBC	U.S. Green Building Council
WASTEC	Waste Equipment Technology Association
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)

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 fur 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

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 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.

CCR California Code of Regulations
Office of Administrative Law
California Title 24 Energy Code

SCAQMD South Coast Air Quality Management District

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, 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.

1. Locate facilities to limit site disturbance as specified in Section 01 10 00 "Summary."

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.

C. Powder Actuated Tools: The use of powder actuated tools shall be prohibited from use during all phases of the construction, unless explicitly approved in writing, prior to construction, by the Project Engineer.

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 municipal system as directed by authorities having jurisdiction.

C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.

D. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Completion, restore these facilities to condition existing before initial use.

E. 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.

1. Toilets: Use of Owner's existing toilet facilities may be permitted, if acceptable with the Project Engineer, and as long as facilities are cleaned and maintained in a condition acceptable to Owner. At Final Completion, restore these facilities to condition existing before initial use.

F. 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.

G. 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.

H. 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.

I. 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.

J. 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. 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.

C. Parking: Use designated areas of Owner's existing parking areas for construction personnel.

D. 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.

E. Project Signs: Unauthorized signs are not permitted.

F. Waste Disposal Facilities: Comply with requirements specified in Section 01 74 19 "Construction Waste Management and Disposal."

G. 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. Environmental Protection Procedures: Designate one person, the Construction Superintendent or other, to enforce strict discipline on activities related to generation of wastes, pollution of air/water/soil, generation of noise, and similar harmful or deleterious effects which might violate regulations or reasonably irritate persons at or in vicinity of Project Site.

D. 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.

E. 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.

F. 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.

G. 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 Final Completion. Perform control operations lawfully, using environmentally safe materials.

H. 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.

I. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

J. 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 Final 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 Final 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.
2. At Final 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 00 "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. 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. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

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

D. 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.

E. Adjacent Occupied Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

F. 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 prevent interruption to occupied areas.

G. 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.

H. 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.

I. 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. Disposing of nonhazardous demolition and construction waste.

B. Related Requirements:

1. Section 02 41 19 "Selective Demolition" for disposition of waste resulting from partial demolition of buildings, structures, and site improvements.

1.02 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

C. Disposal: Removal off-site of demolition and construction waste and deposit in landfill or incinerator acceptable to authorities having jurisdiction.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

1.03 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.

B. Waste Reduction Work Plan: List each type of waste and whether it will be disposed of in landfill or incinerator.

1. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
2. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.

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. 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.
3. Review plan procedures and locations established for salvage, recycling, and disposal.

C. 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. 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

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.

3.03 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 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 parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. 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: 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 01 91 13 GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. OPR and BoD documentation are included by reference for information only.

1.02 SUMMARY

A. Section includes general requirements that apply to implementation of commissioning without regard to specific systems, assemblies, or components.

1.03 DEFINITIONS

A. BoD: Basis of Design. A document that records concepts, calculations, decisions, and product selections used to meet the OPR and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.

B. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.

C. OPR: Owner's Project Requirements. A document that details the functional requirements of a project and the expectations of how it will be used and operated. These include Project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information.

D. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

1.04 COMMISSIONING TEAM

A. Members Appointed by Contractor(s): Individuals, each having the authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated action. The commissioning team shall consist of, but not be limited to, representatives of Contractor, including Project superintendent and subcontractors, installers, suppliers, and specialists deemed appropriate by the Project Engineer and MDOT Architect.

B. Members Appointed by Owner:

1. Representatives of the facility user and operation and maintenance personnel.
2. Architect and engineering design professionals.

1.05 OWNER'S RESPONSIBILITIES

A. Provide the OPR documentation to the Contractor for information and use.

B. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities.

C. Provide the BoD documentation, prepared by MDOT Architect and approved by Owner, to the Contractor for use in developing the commissioning plan, systems manual, and operation and maintenance training plan.

1.06 CONTRACTOR'S RESPONSIBILITIES

A. Contractor shall assign representatives with expertise and authority to act on its behalf and shall schedule them to participate in and perform commissioning process activities including, but not limited to, the following:

1. Provide commissioning plan.
2. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.
3. Attend commissioning team meetings held on a monthly basis.
4. Integrate and coordinate commissioning process activities with construction schedule.
5. Review and accept construction checklists provided by the MDOT Architect.
6. Complete paper or electronic (preferred) construction checklists as Work is completed and provide to the Project Engineer and MDOT Architect on a weekly basis.
7. Complete commissioning process test procedures.

1.07 PROJECT ENGINEER’S RESPONSIBILITIES

A. Organize and lead the commissioning team.

B. Convene commissioning team meetings.

C. Verify the execution of commissioning process activities.. Verification will include, but is not limited to, equipment submittals, construction checklists, training, operating and maintenance data, tests, and test reports to verify compliance with the OPR.

D. Witness systems, assemblies, equipment, and component startup.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 02 41 19 SELECTIVE STRUCTURE DEMOLITION

PART 1 - GENERAL

1.01 SUMMARY

A. Extent of demolition Work is indicated on Drawings. Demolition requires selective removal and subsequent offsite disposal. The building(s) will be vacated during the demolition and construction.

B. Types of Demolition Work include, but are not limited to the following items:

1. Portions of building structure indicated on Drawings and as required to accommodate new construction.
2. Removal of all or portions of interior or exterior partitions as indicated on Drawings.
3. Removal of exterior building or site items indicated on Drawings.
4. Removal of doors and frames indicated "remove".

1.02 DEFINITIONS

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

B. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.03 PREINSTALLATION MEETINGS

A. Pre-demolition Conference: Conduct conference at Project site.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For refrigerant recovery technician.

B. Pre-demolition Photographs or Video: Submit before Work begins.

C. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician.

1.05 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

1.06 FIELD CONDITIONS

A. Owner will occupy other buildings immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

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

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. Hazardous materials will be removed by Owner before start of the Work.
2. If suspected hazardous materials are encountered, do not disturb; immediately notify Project Engineer and MDOT Architect. Hazardous materials will be removed by Owner under a separate Contract.

E. Storage or sale of removed items or materials on-site is not permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

1.07 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.01 PEFORMANCE REQUIREMENTS

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

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

PART 3 - EXECUTION

3.01 EXAMINATION

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

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

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

D. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.

E. Survey of Existing Conditions: Record existing conditions by use of measured drawings and preconstruction photographs.

3.02 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services / Systems to Remain: Maintain services / systems indicated to remain and protect them against damage.

1. Comply with requirements for existing services/systems interruptions specified in Section 01 10 00 "Summary."

B. Existing Services / Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical / electrical systems serving areas to be selectively demolished.

1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
2. Arrange to shut off indicated utilities with utility companies.
3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services / systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated to be removed.
   a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
   b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
   c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
   d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
   e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
   f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
   g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.

C. Refrigerant: Remove refrigerant from mechanical equipment to be selectively demolished according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.03 PREPARATION

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Comply with requirements for access and protection specified in Section 01 50 00 "Temporary Facilities and Controls."

B. Temporary Facilities: Provide temporary barricades and other protection required to maintain site security, prevent injury to people and damage to adjacent buildings and facilities to remain.

C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

D. Coordination: Some items to be removed are integral to the structural stability of items that will remain. Coordinate removal of these items with installation of the new items that will perform the same function or provide temporary bracing and support as required to maintain the structural integrity of the structure.

3.04 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
4. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
5. Dispose of demolished items and materials promptly. Comply with requirements in Section 01 74 19 "Construction Waste Management and Disposal."

B. Reuse of Building Elements: Do not demolish building elements beyond what is indicated on Drawings without Project Engineer's / MDOT Architect's approval.

C. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

D. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.05 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them**.**

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
4. Comply with requirements specified in Section 01 74 19 "Construction Waste Management and Disposal."

B. Burning: Do not burn demolished materials.

3.06 CLEANING

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

END OF SECTION

SECTION 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 as follows:

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.

1. Align forms so that the actual surface does not vary from true surface more than l/8 inch.
2. The surface shall be clean, undamaged, and free of offsets and irregularities at joints.
3. 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.

1. Walls shall consist of at least two 2 by 4's.
2. Studs shall not be spaced more than l6 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 l0 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 100 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. Sump 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.

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 03 54 00 CAST UNDERLAYMENT

PART 1 - GENERAL

1.01 SUMMARY

A. A specially formulated, medium-bed self-leveling cementitious underlayment, to level and repair concrete floors up to one inch thickness prior to installation of finished flooring.

1.02 SUBMITTALS

A. Submit manufacturer's technical product data and installation instructions for materials required.

1.03 QUALITY ASSURANCE

A. Manufacturer: Company specializing in cementitious underlayment systems with 10 years minimum experience and have continuing in-house quality control system to assure highest standards of quality.

B. Applicator: Company with 3 years minimum experience, with a record of successful in-service performance, who is thoroughly familiar with manufacturer's installation requirements.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Prevent damage or contamination of materials by water, freezing, foreign matter or other causes.

B. Deliver and store materials on site at least 24 hours before work begins.

C. Provide heated and dry storage facilities on site.

1.05 PROJECT CONDITIONS

A. Maintain environmental conditions and protect work during and after installation to comply with manufacturer's printed recommendations.

B. Maintain temperatures at not less than 50 degrees F during installation and 7 days after completion unless higher installation standards are required by manufacturer's written instructions.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Drawings and specifications are based on products manufactured by Mapei Corporation, 1501 Wall Street, Garland, Texas 75401-4046 Tel. (800) 992-6273.

B. Equivalent products by the following manufacturers are acceptable:

1. Ardex Engineered Cements, Aliquippa, PA. Tel. (724) 203-5000.
2. Hacker Industries, Inc., Newport Beach, CA. Tel. (800) 642-3455.
3. Maxxon Corporation, Hamel, MN. Tel. (800) 356-7887.

C. Substitutions shall fully comply with specified requirements and with PM Division 01 Sections.

2.02 MATERIALS

A. Underlayment shall equal to UltraPlan® Easy, HCT™ (High-Hydrated Cement Technology)-based, quick-setting, self-leveling underlayment, as manufactured by Mapei Corporation.

2.03 MIXES

A. Site mix self-leveling underlayment with clean water in accordance with manufacturer's instructions.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor with applicator present shall examine areas and conditions under which this Work is to be installed and notify the Project Engineer / MDOT Architect 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 and are in compliance with manufacturer's instructions.

3.02 PREPARATION

A. Prepare substrate in accordance with manufacturer's printed instructions.

3.03 APPLICATION

A. Apply underlayment in strict accordance with manufacturer's printed instructions.

3.04 PROTECTION

A. Protect from foot traffic for a minimum of 3 hours after installation.

B. Protect from general traffic, dirt and dust from other trades until final flooring surface has been completely laid.

END OF SECTION

SECTION 04 20 00 UNIT MASONRY

PART 1-GENERAL

1.01 SUMMARY

A. Section Includes:

1. Concrete Block.
2. Architectural Masonry Units
3. Clay Facing Brick.
4. Common Brick.
5. Mortar and Grout.
6. Reinforcement and Anchorage.
7. Flashings.
8. Lintels.
9. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 09 05 15 - Color Design.

1.03 REFERENCE STANDARDS

A. ACI 530/530.1/ERTA - Building Code Requirements and Specification for Masonry Structures and Related Commentaries; American Concrete Institute International; 2011.

B. ASTM A82/A82M - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement; 2007.

C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

D. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement; 2015.

E. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2009a.

F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

G. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2015.

H. ASTM C62 - Standard Specification for Building Brick (Solid Masonry Units Made From Clay or Shale); 2013.

I. ASTM C67 - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile; 2014.

J. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units; 2014.

K. ASTM C91/C91M - Standard Specification for Masonry Cement; 2012.

L. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units; 2011.

M. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2011.

N. ASTM C150/C150M - Standard Specification for Portland Cement; 2012.

O. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2006 (Reapproved 2011).

P. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made From Clay or Shale); 2014.

Q. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2014a.

R. ASTM C387/C387M - Standard Specification for Packaged, Dry, Combined Materials for Concrete and High Strength Mortar; 2011b.

S. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2011.

T. ASTM C476 - Standard Specification for Grout for Masonry; 2010.

U. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc.; current edition.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all relevant installers.

1.05 SUBMITTALS

A. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, masonry accessories, and flashings and integral water repellant admixture.

B. Samples: Submit four samples of facing brick and AMU units to illustrate color, texture, and extremes of color range.

1. Provide full sample of end dams as required by other sections.

C. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

1.06 QUALITY ASSURANCE

A. Comply with provisions of ACI 530/530.1/ERTA, except where exceeded by requirements of the contract documents.

B. Fire Rated Assemblies: Conform to plans and applicable code for hourly fire rating requirements for fire rated masonry construction.

1.07 MOCK-UP

A. Construct a masonry wall as a mock-up panel sized 8 feet long by 6 feet high; include mortar, accessories, structural backup, and flashings (with lap joint, corner, and end dam) in mock-up.

B. Locate where directed.

C. Mock-up may not remain as part of the Work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

PART 2-PRODUCTS

2.01 CONCRETE MASONRY UNITS

A. Concrete Block: Comply with referenced standards and as follows:

1. Size: Standard units with nominal face dimensions of 16 x 8 inches and nominal depths as indicated on the drawings for specific locations.
   a. Nominal depths if not indicated on the drawings shall included but not necessarily limited to 4, 6, 8, or 12-inches.
2. Load-Bearing Units: ASTM C90, lightweight.
   a. Hollow block, as indicated.
3. Non-Loadbearing Units: ASTM C129.
   a. Hollow block.

2.02 ARCHITECTURAL MASONRY UNITS

A. Types: See drawings for location.

1. Solid Units: ASTM C 90.
   a. Type 1 - 4 x 8 x 24 inches nominal.
   b. Type 2 - 4 x 12 x 24 inches nominal.
   c. Product: Refer to 09 05 00

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.

1. Cast Stone Products shall not be accepted as substitution for Architectural Masonry Units specified.

2.03 BRICK UNITS

A. Facing Brick: ASTM C216, Type FBS, Grade SW.

1. Color and texture: Refer to 09 05 00.
2. Nominal size: As indicated on drawings.
3. Special shapes: Molded units as required by conditions indicated, unless standard units can be sawn to produce equivalent effect.

B. Building (Common) Brick: ASTM C62, Grade SW; solid units.

1. Nominal size: Corners of soldiers and as indicated on the drawings.

2.04 MORTAR AND GROUT MATERIALS

A. Masonry Cement: ASTM C91/C91M, Type N.

1. Colored Mortar: Premixed cement as required to match Architect's color sample.

B. Portland Cement: ASTM C150/C150M, Type I; color as required to produce approved color sample.

C. Hydrated Lime: ASTM C207, Type S.

D. Mortar Aggregate: ASTM C144.

E. Grout Aggregate: ASTM C404.

F. Water: Clean and potable.

G. Moisture-Resistant Admixture: Water repellent compound designed to reduce capillarity.

H. Integral Water Repellent Admixture for Mortar and Grout: Polymeric liquid admixture added to mortar and grout at the time of manufacture.

1. Use in all exterior brick and architectural masonry units mortar.
2. Use only water repellent admixture for mortar and grout from the same manufacturer as water repellent admixture in masonry units.
3. Meet or exceed performance specified for water repellent admixture used in masonry units.
4. Manufacturers:
   a. Grace Construction Products, a unit of W. R. Grace & Com.; Product: Dryblock Mortar Additive.
   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

I. Packaged Dry Material for Mortar for Unit Masonry: Premixed Portland cement, hydrated lime, and sand; complying with ASTM C387/C387M and capable of producing mortar of the specified strength in accordance with ASTM C270 with the addition of water only.

1. Type: Type N.
2. Color: Mineral pigments added as required to produce approved color sample.
3. Products:
   a. Ash Grove Packaging.
   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.

2.05 REINFORCEMENT AND ANCHORAGE

A. As a "Standard of Quality". the products for reinforcement and anchorage are based on the products of Hohmann & Barnard, unless noted otherwise.

B. Manufacturers of Joint Reinforcement and Anchors:

1. The following manufacturers are acceptable after compliance with the requirements of this section:
2. Hohmann & Barnard, Inc (including Dur-O-Wal brand): www.h-b.com.
3. WIRE-BOND: www.wirebond.com.
4. 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.

C. Reinforcing Steel: ASTM A615/A615M, Grade 40 - 40,000 psi, deformed billet bars; uncoated.

D. Single Wythe Joint Reinforcement: Truss or ladder type; ASTM A1064/A1064M steel wire, mill galvanized to ASTM A641/A641M, Class 3; 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage on each exposure.

1. Hohmann & Barnard; Product: 120 Ladder-Mesh (truss)
2. When masonry joint reinforcement is lap spliced for longitudinal continuity, wires shall be lapped side by side to avoid a double thickness of wire in the mortar joint. Minimum lap length of side rods should be 6-3/4 inches for 9 gauge side rods and 8-1/2 inches for 3/16 inch side rods.

E. Multiple Wythe Joint Reinforcement: Truss type; fabricated with moisture drip; ASTM A1064/A1064M steel wire, hot dip galvanized after fabrication to ASTM A153/153M, Class B; 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage on each exposure.

1. Masonry cavity walls multiple wythe joint reinforcement shall include two-piece wall ties: Hohmann & Barnard; Product: 270 Ladder Lox-All Adjustable Eye-Wire and 170 Truss Lox-All Adjustable Eye-Wire as specified below.
2. When masonry joint reinforcement is lap spliced for longitudinal continuity, wires shall be lapped side by side to avoid a double thickness of wire in the mortar joint. Minimum lap length of side rods should be 6-3/4 inches for 9 gauge side rods and 8-1/2 inches for 3/16 inch side rods.

F. Strap Anchors: Bent steel shapes configured as required for specific situations, 1-1/4 in width, 0.105 in thick, lengths as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage from masonry face, corrugated for embedment in masonry joint, hot dip galvanized to ASTM A 153/A 153M, Class B.

1. Hohmann & Barnard strap anchors suitable for the connection to the building's structure.
   a. #345 Notched Column Anchor (Corrugated), with pairs at 32 inches o.c. vertical with slot tight to the front face of column flange on one side and the other tie tight to the back side of column flange; or, alternate using one at 16 inches o.c vertically with alternating sides but maintaining tightness to front and back of column flange (welding not required).

G. Flexible Anchors: 2-piece anchors that permit differential movement between masonry and building frame, sized to provide not more than 1 inch and not less than 1/2 inch of mortar coverage from masonry face.

1. Masonry to Concrete with dovetail ties:
   a. Hohmann & Barnard; Product: #305 Dovetail Slot.
   b. Hohmann & Barnard; Product: #315 Dovetail Brick Tie.
2. Masonry to Concrete with flexible ties:
   a. Hohmann & Barnard; 345-BT Flexible Tie.
3. Steel frame: Crimped wire anchors for welding to frame, 0.25 inch thick, with trapezoidal wire ties 0.1875 inch thick, hot dip galvanized to ASTM A 153/A 153M, Class B.

H. Two-Piece Wall Ties: Formed steel wire, 0.1875 inch thick, adjustable, eye and pintle type, hot dip galvanized to ASTM A 153/A 153M, Class B, sized to provide not more than 1 inch and not less than 1/2 inch of mortar coverage from masonry face and to allow vertical adjustment of up to 1-1/4 in.

1. Hohmann & Barnard; Product: 170 Truss Lox-All Adjustable Eye-Wire for masonry cavity walls when the back-up wythe is not reinforced vertically and 270 Ladder Lox-all Adjustable Eye-Wire when the back-up wythe is reinforced vertically.

I. Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural backup, hot dip galvanized to ASTM A 153/A 153M, Class B.

1. Anchor plates: Not less than 0.075 inch thick, designed for fastening to structural backup through sheathing by two fasteners; provide design with legs that penetrate sheathing and insulation to provide positive anchorage.
   a. Legs shall be sized to accommodate 5/8", 3/4", 1-1/2", 2", 2-1/2", and 3" combined thicknesses of insulation and/or sheathing.
2. Wire ties: Manufacturer's standard shape, 0.1875 inch thick.
3. Vertical adjustment: Not less than 3-1/2 inches.
4. Products:
   a. Hohmann & Barnard: X-Seal Tape, X-Seal Anchor with VBT - Vee-Byna Ties.

2.06 FLASHINGS

A. Rubberized Asphalt Flashing: Self-adhering composite material comprising rubberized asphalt adhesive compound bonded to cross-laminated polyethylene film, minimum 0.040 inch total thickness. Provide Textroflash manufactured by Hohmann & Barnhard, Inc.

1. Flashing Accessories: Priming; prep with Textroflash Primer and Textroflash Mastic for concrete, masonry and some exterior gypsum substrates.
2. Termination Bar; T2-FTS as manufactured by Hohmann & Barnard, Inc. with factory installed foam strip and 3/8 inch flange for caulking.
   a. Caulk the top of all flashing termination bars with manufacturers recommended sealant.

B. Corners and End Dams: Soldered Stainless Steel End Dam, at all inside corners, outside corners and end dams; ASTM A 240, ASTM A 666, 480, ASTM A167, as manufactured by Hohmann & Barnard, Inc.

1. Type 26 gauge 304 stainless steel.

2. Soldered to ensure seal at joints.
3. Location: All end dams and inside and outside corners under rubberized asphalt flashing (Textroflash).
4. Spacing not to exceed 30' OC; intermediate end dams back-to-back.

C. Galvanized Steel Flashing: ASTM A653/A653M, with G90/Z275 coating, 24 gage, 0.0239 inch base metal thickness.

2.07 ACCESSORIES

A. Preformed Control Joints: PVC material for single-wythe concrete masonry walls.

1. Manufacturers:
   a. Hohmann & Barnard, Inc (including Dur-O-Wal brand); RS Series: www.h-b.com.
   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.

B. Joint Filler: Closed cell polyethylene; oversized 50 percent to joint width; self expanding; 1/4 to 6 (as required) inch wide x by maximum lengths available.

1. Manufacturers:
   a. Hohmann & Barnard, Inc (including Dur -O-Wal brand); Standard Backer Rod: www.h-b.com.
   b. WIRE-BOND: www.wirebond.com.
   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.

C. Control Joint Sealant:

1. Sealant - All sealant, unless otherwise specifically approved by the Architect, shall be one-part or two-part urethane terapolymer meeting Federal Specification TT-S-00230C, Type II. Color shall be as selected from the manufacturer's standard colors or custom color selected by the Architect for vertical joint surfaces.
   a. Dymeric 240FC; Tremco Inc., polyurethane terpolymer sealant
   b. Dymonic 100; Tremco Inc., polyurethane terpolymer sealant.
   c. Sonneborn NP1 or NP2.
   d. See Section 07 9200.
2. Primer - Where required, as recommended by the Sealant Manufacturer. Always prime surfaces unless directed otherwise by Architect.

D. Expansion Joints at Exterior Masonry Walls:

1. Construction Specialties; Wall to Wall ColorJoint System, VF-100 (1") or greater as required to match expansion joint width.
2. Color to be selected from manufacturers standard colors to match brick and/or Architectural Masonry Units.

E. Cavity Mortar Control: Semi-rigid polyethylene or polyester mesh panels, sized to thickness of wall cavity, and designed to prevent mortar droppings from clogging weeps and cavity vents and allow proper cavity drainage.

1. Mortar Diverter: Semi-rigid mesh designed for installation at flashing locations.
   a. Manufacturers:
      1) Mortar Net Solutions; Mortar Net with Insect Barrier: www.mortarnet.com.
      2) 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.

F. Weeps: Cotton rope.

1. Weeps shall be installed vertically and spaced horizontally in a bed course at all conditions where a membrane flashing appears and as indicated on the drawings, not necessarily limited to the following locations: base of masonry walls, door and window heads, window sills.

G. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

2.08 MORTAR AND GROUT MIXES

A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.

1. Unless indicated otherwise on the structural drawings the following shall apply to the project;
2. Masonry below grade and in contact with earth: Type S.
3. Exterior, loadbearing masonry: Type N.
4. Exterior, non-loadbearing masonry: Type N.
5. Interior, loadbearing masonry: Type N.
6. Interior, non-loadbearing masonry: Type N.

B. Grout: ASTM C476; consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches.

C. Admixtures: Add to mixture at manufacturer's recommended rate and in accordance with manufacturer's instructions; mix uniformly.

D. Mixing: Use mechanical batch mixer and comply with referenced standards.

PART 3-EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry.

B. Verify that related items provided under other sections are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 PREPARATION

A. Direct and coordinate placement of metal anchors supplied for installation under other sections.

B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

C. Brick and mortar shall be covered from rain and weather and stored off ground on pallets.

D. Sand shall be clean and stored in debris free area.

E. Package tag shall be on each pallet.

3.03 COLD AND HOT WEATHER REQUIREMENTS

A. Cold Weather Construction: The following construction requirements shall apply to work in progress and shall be based on ambient temperature.

1. Temperatures between 40 degrees F and 32 degrees F:
   a. Water and aggregates used in mortar and grout shall not be heated above 140 degrees F.
   b. Mortar sand or mixing water shall be heated to produce mortar temperatures between 40 degrees F and 120 degrees F at the time of mixing.
   c. Heat water and aggregates for grout materials when their temperature is below 32 degrees F.
   d. Protection Requirements.
      1) Completely cover newly constructed masonry with a weather-resistive membrane for 24 hrs after construction.
2. Temperatures between 32 degrees F and 25 degrees F:
   a. The requirements for temperatures between 40 degrees F and 32 degrees F (as specified above) shall be met; and the following construction requirements:
      1) Maintain mortar temperature above freezing until used in masonry.
      2) Aggregates and mixing water for grout shall be heated to temperatures between 70 degrees F and 120 degrees F at the time of mixing. Grout temperature shall be maintained above 70 degrees F at the time of grout placement.
   b. Protection Requirements.
      1) Completely cover newly constructed masonry with a weather-resistive membrane for 24 hrs after construction.
3. Temperatures between 25 degrees F and 20 degrees F:
   a. The requirements for temperatures between 40 degrees F and 32 degrees F and the requirements for temperatures between 32 degrees F and 25 degrees F (as specified above) shall be met; and the following construction requirements:
      1) Masonry surfaces under construction shall be heated to 40 degrees F.
      2) Wind Breaks or enclosures shall be provided when wind velocity exceeds 15 miles per hour (mph).
      3) Prior to grouting, masonry shall be heated to a minimum of 40 degrees F.
   b. Protection Requirements.
      1) Completely cover newly constructed masonry with a weather-resistive membrane for 24 hrs after construction.
      2) Extend the time period to 48 hrs. for grouted masonry, unless the only cement in the grout is Type III portland cement.

4. Temperatures at or below 20 degrees F:
   a. Masonry units shall not be laid when the temperature is 20 degrees F or below.

B. Hot Weather Construction: The following construction requirements shall apply to work in progress and shall be based on ambient temperature.

1. Temperatures exceed 100 degrees F or exceed 90 degrees with a wind velocity greater than 8 mph.
   a. The temperature of mortar and grout shall be maintained below 120 degrees F.
   b. Mixers, mortar transport containers and mortar boards shall be flushed with cool water before they come into contact with mortar ingredients or mortar.
   c. Mortar consistency shall be maintained by re-tempering with cool water.
   d. Use mortar within 2 hours of mixing.
2. When ambient temperature exceeds 115 degrees or 105 degrees with a wind velocity greater than 8 mph, the requirements for temperatures exceeding 100 degrees F or exceeding 90 degrees with a wind velocity greater than 8 mph (as specified above) shall be implemented; and materials and mixing equipment shall be shaded from direct sunlight.

3.04 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Concrete Masonry Units:

1. Bond: Running.
2. Coursing: One unit and one mortar joint to equal 8 inches.
3. Mortar Joints: Concave.

D. Brick Units:

1. Bond: Running.
2. Coursing: Three units and three mortar joints to equal 8 inches.
3. Mortar Joints: Concave.

3.05 PLACING AND BONDING

A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

B. Lay hollow masonry units with face shell bedding on head and bed joints.

C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.

D. Remove excess mortar and mortar smears as work progresses.

E. Remove excess mortar with water repellent admixture promptly. Do not use acids, sandblasting or high pressure cleaning methods.

F. Interlock intersections and external corners.

G. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

H. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

I. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

J. Brick Sills: Provide minimum 15 degree slope (3/4 inch).

K. Architectural Masonry Units

1. Align units level, plumb, and true with uniform, carefully tooled 3/8" wide joints on the ground face side of the wall. No Rake Joints.
2. All exterior mortar shall include W.R. Grace, DRY-BLOCK water-repellent additive added to each batch in the appropriate dosage rates for the mortar type per manufacturer's instructions.
3. Carefully following manufacturer’s instructions, use Burnished Custom Masonry Cleaner by PROSOCO (dilute 1 part to 3 parts clean water). Available from manufacturer. Do not power wash

3.06 WEEPS/CAVITY VENTS

A. Install weeps in veneer and cavity walls at 24 inches on center horizontally above through-wall flashing, above shelf angles and lintels, at bottom of walls, and at door / window heads and window sills.

B. Cotton rope weeps shall be installed continuous in cavity with looped rope at each weep location through masonry.

C. Weeps shall always be installed above grade or sidewalks at least one course. Contractor shall coordinate the installation of weeps so that weeps are not installed below adjacent sidewalks or grade.

D. Architectural Masonry Units; install weeps at 48-inches (at typical 24 in. AMU units) on center horizontally except as follows:

1. Verify weep locations with Architect in the field where AMU units may vary in size and at window head and sill locations.

E. Install cavity vents in veneer and cavity walls at 24 inches on center horizontally below shelf angles and lintels.

3.07 CAVITY MORTAR CONTROL

A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.

B. For cavity walls, build inner wythe ahead of outer wythe to accommodate accessories.

C. Install cavity mortar diverter at base of cavity and at other flashing locations as recommended by manufacturer to prevent mortar droppings from blocking weep/cavity vents.

3.08 REINFORCEMENT AND ANCHORAGE - GENERAL

A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches on center.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.

C. Place continuous joint reinforcement in first and second joint below top of walls.

D. Lap joint reinforcement ends minimum 6-3/4 (for 9 gauge side rods) and 8-1/2 (for 3/16) inches.

E. Provide brick shelf angles maximum every 30 ft. of height.

3.09 REINFORCEMENT AND ANCHORAGE - SINGLE WYTHE MASONRY

A. Install horizontal joint reinforcement 16 inches on center.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.

3.10 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER

A. Install horizontal joint reinforcement 16 inches on center.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.

C. Place continuous joint reinforcement in first and second joint below top of walls.

D. Lap joint reinforcement ends minimum 6 inches.

E. Masonry Back-Up: Embed anchors to bond veneer at maximum 16 inches on center vertically and 32 inches on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.

F. Stud Back-Up: Secure veneer anchors to stud framed back-up and embed into masonry veneer at maximum 16 inches on center vertically and 32 inches on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.

1. Anchors and ties shall be securely attached to the steel studs through the sheathing, not to the sheathing alone.

3.11 REINFORCEMENT AND ANCHORAGES - CAVITY WALL MASONRY

A. Install horizontal joint reinforcement 16 inches on center.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of openings.

C. Place continuous joint reinforcement in first and second joint below top of walls.

D. Lap joint reinforcement ends minimum 6 inches.

3.12 MASONRY FLASHINGS

A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.

1. Provide end dam and corner flashings @ door and window heads, sills, masonry transitions, masonry corners and other locations indicated. Lap end dams with flashings.
   a. All masonry flashings are to be supported in the cavity wall, whether or not indicated in the drawings. The Contractor shall provide treated wood blocking the full depth of the masonry cavity under flashing for proper support with a positive slope to the exterior and to prevent sag and entrapment of water in the wall.
   b. Provide 26 gauge stainless steel pre-formed inside and outside corners and end dams under flashing.
   c. Provide intermediate end dams, back to back, in long flashing runs at spacing not to exceed 30' OC or to masonry control joints (typical @ 30' OC). Do not span masonry control joints with end dams.
2. Extend flashings full width at such interruptions and at least 6 inches into adjacent masonry or turn up at least 8 inches to form watertight pan at non-masonry construction.
3. Extend flashings at window head and sills 8 inches past jambs and provide termination bar at top of flashing at the window head.
4. Remove or cover protrusions or sharp edges that could puncture flashings.
5. Seal lapped ends and penetrations of flashing before covering with mortar.

B. Extend metal flashings through exterior face of masonry and turn down to form drip. Install joint sealer below drip edge to prevent moisture migration under flashing.

C. Extend specified flashings to within 1/4 inch of exterior face of masonry.

D. Lap end joints of flashings at least 6 inches and seal watertight with flashing sealant/adhesive.

E. Caulk the top of all masonry flashing termination bars with manufacturers recommended sealant.

F. Flashing at sloped grades shall be stair-stepped and sealed.

G. Provide water stops at all construction joints at or below grade.

3.13 LINTELS

A. Install loose steel lintels over openings.

B. Install reinforced unit masonry lintels over openings where steel or precast concrete lintels are not scheduled.

1. Unless otherwise indicated on the Structural Drawings the following are minimum requirements;
2. 8-inch CMU Walls:
   a. Openings to 48 inches: Place two, No. 5 reinforcing bars 1 inch from bottom web.
   b. Openings from 48 inches to 108 inches: Place two, No. 6 reinforcing bars 1 inch from bottom web.

3. 12-inch CMU Walls:
   a. Openings to 48 inches: Place two, No. 6 reinforcing bars 1 inch from bottom web.
   b. Openings from 48 inches to 108 inches: Place two, No. 7 reinforcing bars 1 inch from bottom web.
4. Openings over 108 inches: See structural.
5. Do not splice reinforcing bars.
6. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.
7. Place and consolidate grout fill without displacing reinforcing.
8. Allow masonry lintels to attain specified strength before removing temporary supports.
9. Paint any exposed steel surfaces to match color of masonry.

3.14 GROUTED COMPONENTS

A. Lap splices minimum 24 bar diameters.

B. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.

C. Place and consolidate grout fill without displacing reinforcing.

D. At bearing locations, fill masonry cores with grout for a minimum 12 inches either side of opening.

E. Perform all grouting by means of high-lift technique.

1. Do not use high-lift grouting where size of cavities mandates use of fine grout.
2. Verify that horizontal and vertical reinforcement is in proper position and adequately secured before beginning pours.
3. Hollow Masonry: Limit lifts to maximum 4 feet height.
4. Place grout for spanning elements in single, continuous pours.

F. Unless otherwise indicated, provide grouted masonry cores and reinforcing at the following locations:

1. 8 inches or 12 inches concrete block wall intersections.
   a. Fill five (5) adjacent cells with grout and 1#5 in ea. cell.
2. 8 inches or 12 inches concrete block corners.
   a. Fill three (3) adjacent cells with grout and 1#5 in ea. cell.
3. 8 inches or 12 inches concrete block wall at interior and exterior door openings; in addition to typical wall reinforcing.
   a. Fill two (2) cells ea. side of door opening with grout and 1#5 in ea. cell.
4. 8 inches or 12 inches concrete block window openings.
   a. Fill two (2) cells ea. side of window opening with grout and 1#5 in ea. cell; in addition to typical wall reinforcing.
5. Control joints in interior or exterior walls.
   a. Fill one (1) cell ea. side of control joint with grout and 1#5 in ea. cell.

3.15 CONTROL AND EXPANSION JOINTS

A. Do not continue horizontal joint reinforcement through control or expansion joints.

B. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

C. Install control joints typically within 10' of a corner and within 30' maximum spacing unless indicated on the drawings.

D. Prior to performance of caulking, a sample of caulking color and application must be provided for acceptance by the Architect. Work shall proceed only after Architect's approval of test application.

E. Comply with sealant manufacturer's printed instructions except where more stringent requirements are specified herein.

F. Install backings are to comply with, but are not limited to, the following requirements:

1. Install joint fillers of type indicated to provide support of caulking during application and at position required to produce the cross-sectional shapes and depths of installed caulking relative to joint widths which allow optimum caulking movement capability.
2. Do not leave gaps between ends of joint-fillers.
3. Do not stretch, twist, puncture or tear joint fillers.
4. Install bond breaker tape between sealants and joint fillers, compression seals or back of joints where required to prevent third-side adhesion of sealant to back of joint.
    a. Install joint fillers of type indicated to provide support of caulking during application and at position required to produce the cross-sectional shapes and depths of installed caulking relative to joint widths which allow optimum caulking movement capability.
    b. Do not leave gaps between ends of joint-fillers.
    c. Do not stretch, twist, puncture or tear joint fillers.
    d. Remove absorbent joint-fillers which have become wet prior to sealant application and replace with dry material.
    e. Install bond breaker tape between sealants and joint fillers, compression seals or back of joints where required to prevent third-side adhesion of sealant to back of joint.
5. Install caulking by proven techniques that result in caulking directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration and providing uniform, cross-sectional shapes and depths relative to joint widths which allow optimum sealant movement capability.
6. Tooling of Nonsag Caulking - Immediately after caulking application and prior to time skinning or curing begins, tool caulking to form smooth, uniform beads of configuration indicated, to eliminate air pockets and to ensure contact and adhesion of sealant with sides of joint. Remove excess material from surfaces adjacent to joint. Do not use tooling agents which discolor caulking or adjacent surfaces or are not approved by manufacturer. Concave joint configuration as required by the Drawings and approval of the Architect.
7. Employ only proven installation techniques which shall ensure that caulking shall be deposited in uniform, continuous ribbons without gaps or air pockets.
8. Fill sealant rabbet to a slightly concave surface, slightly below adjoining surfaces. Where horizontal joints are between a horizontal surfaces and a vertical surface, fill joint to form a slight cove, so that joint shall not trap moisture and dirt.
9. For normal joints sealed with sealants and not subject to traffic, fill joints to a depth equal to 50% of joint width, but not more than 1/2" deep or less than 1/4" deep.
10. Where necessary, use masking tape to avoid overflow onto adjoining surfaces or migration into the voids of rough textured surfaces.

11. Remove excess and spillage of compounds promptly as the work progresses. Clean the adjoining surfaces to eliminate evidence of spillage.
12. Cure caulking compounds in compliance with manufacturer's recommendations and warranty to obtain high early bond strength, internal cohesive strength and surface durability.

3.16 BUILT-IN WORK

A. As work progresses, install built-in metal door frames and other items to be built into the work and furnished under other sections.

B. Install built-in items plumb, level, and true to line.

C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.

1. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.

3.17 TOLERANCES

A. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.

B. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.

C. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

D. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.

E. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch.

3.18 CUTTING AND FITTING

A. Cut and fit for chases, pipes, and conduit. Coordinate with other sections of work to provide correct size, shape, and location.

B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.19 REPAIRING

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 or replacement.

1. Protect the base of the wall from mud splashes and mortar droppings.

3.20 CLEANING

A. Remove excess mortar and mortar droppings.

B. Replace defective mortar. Match adjacent work.

C. Pre-wet brick surface liberally to keep cleaning solution from being soaked into brick.

D. Clean soiled surfaces with cleaning solution per manufacturer's instructions.

E. Allow to remain on wall usually 3-5 minutes.

F. Spray wash off wall and thoroughly rinse.

G. Use non-metallic tools in cleaning operations.

3.21 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

B. Protect the top of concrete masonry walls from moisture and water penetration.

3.22 PARTITION IDENTIFICATION

A. Fire rated barriers/partitions not necessarily limited to the follow; smoke stop partitions, horizontal exit partitions, exit/shaft enclosures and fire walls, shall be effectively and permanently identified with signs or stenciling in a manner acceptable to the authority having jurisdiction.

1. Be located in accessible concealed floor, floor-ceiling or attic spaces;
2. Be located within 15 feet of the end of each wall and at intervals not exceeding 30 feet measured horizontally along the wall or partition; and
3. Include lettering not less than 3 inches in height with a minimum 3/ 8 inch stroke in a contrasting color incorporating the wording as follows;
   a. "FIRE AND/OR SMOKE BARRIER-PROTECT ALL OPENINGS"
4. Such identification shall be in the concealed spaces and place so that insulation, electrical fixture housings and/or other such components do not obscure the lettering.

END OF SECTION

SECTION 05 31 00 STEEL DECKING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Roof deck.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

1. Include dimensions of components, profile and finish.

B. Shop Drawings:

1. Include layout and types of deck panels, anchorage details including weld or screw pattern, cut deck openings, special jointing, accessories, location of support members and attachments to other construction.

1.03 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Product certificates.

C. Evaluation reports.

D. Field quality-control reports.

1.04 QUALITY ASSURANCE

A. Codes and Standards: Comply with applicable provisions of the following specifications:

1. American Iron and Steel Institute (AISI).
2. American Welding Society (ANSI/AWS D1.3 Structural Welding Code/Sheet Steel).
3. Steel Deck Institute (SDI).

B. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

C. Deck bundles placed on the building frame shall be placed near a main supporting beam at a column or wall. In not case, are the bundles to be placed on unattached supporting members.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

2.02 ROOF DECK

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. Consolidated Systems, Inc., Columbia, SC. Tel. (800) 554-5421
2. Epic Metals Corporation, Rankin, PA. Tel. (877) 696-3742.
3. Nucor Corp.; Vulcraft Group, Charlotte, NC. Tel. (843) 662-0381.
4. Roof Deck, Inc., Hightstown, NJ. Tel. (609) 448-6666.
5. Valley Joist; Subsidiary of EBSCO Industries, Inc., Fort Payne, AL. Tel. (800) 633-2258.
6. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation, Wheeling, WV. Tel. (877) 333-0900.

B. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:

1. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33, G90 (Z275) zinc coating.
2. Deck Profile: Type IR, intermediate rib.
3. Profile Depth: 1-1/2 inches
4. Design Uncoated-Steel Thickness: 0.0295 inch, 22 gage

2.03 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.

G. Galvanizing Repair Paint: ASTM A 780

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

3.02 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.

B. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

C. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

D. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

E. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

F. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

G. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.03 PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

END OF SECTION

SECTION 05 40 00 COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Provide all labor, materials and equipment necessary to complete the furnishing and installation of all cold-formed metal framing as shown, detailed and otherwise required, including lightgage framing and exterior non-load bearing wall framing.

B. Related Sections: Steel studs for interior non-structural walls are specified in Section. 09 29 00.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of cold-formed steel framing product and accessory.

B. Shop Drawings:

1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
3. Drawings shall bear a certification stating that the system is designed to meet all governing codes and the loading requirements stated in paragraph 1.04. The Drawings shall be prepared and stamped by a registered professional engineer licensed in the State of Mississippi.

1.03 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Welding certificates.

C. Product test reports.

D. Research reports.

1.04 QUALITY ASSURANCE

A. Product Tests: Mill certificates or data from a qualified independent testing agency.

B. Systems designed and manufactured by Clark Dietrich products establish a minimum of quality required. Framing system shall meet or exceed all the requirements of the International Building Code, 2012 edition, and shall be designed to withstand wind loading in compliance with data indicated on Sheet S100. Structural design of the system shall be the responsibility of the manufacturer.

1. The out-of-plane deflection for brick veneer walls shall not exceed the lightgage framing members span length divided by 360 (L/360).

C. Welding Qualifications: Quality procedures and personnel according to AWS D1.1, “Structural Welding Code - Steel,” and AWS D1.3, “Structural Welding Code - Sheet Steel.”

D. AISC Specifications: Comply with AISI’s Specification for the Design of Cold-Formed Steel Structural Members” for calculating structural characteristics of cold formed metal framing. Comply with CCFSS Technical Bulletin: AISI Specification Provisions for Screw Connections.

E. Installer qualifications: An experienced installer who has successfully completed cold-formed metal framing similar in material, design and extent to the indicated for this project.

1.05 DELIVERY, STORAGE AND HANDLING

A. Protect cold formed metal framing from corrosion, deformation or other damage during deliver, storage and handling.

B. Store cold-formed metal framing protected with a weatherproof covering and ventilate to avoid condensation.

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. AllSteel & Gypsum Products, Inc., Ft. Lauderdale, FL. Tel. (954) 587-1900.
2. ClarkDietrich Building Systems, West Chester, OH. Tel. (800) 543-7140.
3. MarinoWARE, South Plainfield, NJ. Tel. (800) 627-4661.
4. Nuconsteel; a Nucor Company, Denton, TX. Tel. (940) 891-3090.
5. Southeastern Stud & Components, Inc., Montgomery, AL. Tel. (877) 473-7883.
6. Steel Construction Systems, Orlando, FL. Tel. (800) 548-8499.
7. Steel Structural Systems, Louisville, KY. Tel. (877) 369-4252.

2.02 PERFORMANCE REQUIREMENTS

A. AISI Specifications and Standards: Unless more stringent requirements are indicated, comply with AISI S100 and AISI S200.

B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.03 MATERIALS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:

1. Grade: As required by structural performance.
2. Coating:
   a. Interior Walls: G60 or A60 galvanized.
   b. Exterior walls: G90 galvanized.

C. Steel Sheet for Vertical Deflection Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:

1. Grade: As required by structural performance.
2. Coating: G90 galvanized.

D. All stud and framing members shall be of the type and size as shown on the Drawings.

1. All runner and end tracks, bridging and non-load bearing studs shall be of the type and size required.
2. 11, 12, 14 and 16 gage track and bridging shall be formed from steel that corresponds to the requirements of the following Standards with a minimum yield of 33,000 psi: Galvanized Material - ASTM A446-72, grade A.
3. All 16 gage steel studs and accessories shall be formed from steel that corresponds to the requirements of the following Standards with a minimum yield of 33,000 psi: Galvanized Material - ASTM A446-72, grade A.

2.04 FABRICATION

A. Framing Components: Framing components may be prefabricated into panels prior to erection. Prefabricated panels shall be square with components attached by welding to prevent racking. Handling and lifting of panels shall be done in a manner as to not cause distortion in any member.

1. Framing components shall be cut squarely for attachment to perpendicular members, or as required for an angular fit against abutting members. Members shall be held positively in place until properly fastened.

B. Axial Loaded Bearing Studs: Install in a manner which will assure that stud ends are positioned against the inside track web prior to stud and track attachment.

2.05 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.

B. Anchor Bolts: ASTM F 1554, Grade 36 or Grade 55, threaded carbon-steel hex-headed bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C

C. Expansion Anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E 488 conducted by a qualified testing agency.

D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.

E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.

1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

2.06 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20 or MIL-P-21035B.

B. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107/C 1107M, with fluid consistency and 30-minute working time.

C. Shims: Load bearing, high-density multimonomer plastic, and nonleaching; or of cold-formed steel of same grade and coating as framing members supported by shims.

D. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

PART 3 - EXECUTION

3.01 PREPARATION

A. Install load bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch to ensure a uniform bearing surface on supporting concrete or masonry construction.

B. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.02 INSTALLATION, GENERAL

A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed steel framing according to AISI S200 and to manufacturer's written instructions unless more stringent requirements are indicated.

C. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.

D. Install framing members in one-piece lengths.

E. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

F. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

G. Install insulation, specified in Section 07 21 28 "Cellulose Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

H. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

I. Install all studs at 16 inches on center maximum spacing.

J. Erection Tolerances: Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.03 ERECTING FOR WINDLOAD MEMBERS

A. Tracks shall be securely anchored to the supporting structure in a manner which will transfer imposed load.

B. Studs shall be plumbed, aligned and securely attached to each side of the flange or web of the top and bottom tracks.

C. At track butt joints, abutting pieces of track shall be securely anchored to common structural element, or they shall be butt welded or spliced together.

D. Splices in wind loaded only studs shall be avoided if possible. When necessary, splice sections shall be of same or heavier size, a minimum of l8" long and attached in a manner to maintain original strength.

E. Jack studs shall be installed below window sills, above window and door headers, at free standing stair rails, and elsewhere to furnish structural support and shall be securely attached to supporting members.

F. Wall stud bridging shall be installed in accordance with manufacturer’s recommendations.

G. Provisions for structure vertical movement shall be provided where required using the vertical slide clip or other means in accordance with manufacturer’s recommendations.

H. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.04 ERECTING FOR AXIAL LOAD BEARING MEMBERS

A. Tracks shall be securely anchored to the supporting structure to properly transfer imposed loads.

B. Complete, uniform and level bearing support shall be provided for the bottom track at each bearing stud location. If not provided, install full size shims below bottom track at stud locations as needed or set bottom track in high strength grout.

C. At intersection or abutting track joints, abutting pieces of track shall be securely anchored to a common structural element, or they shall be spliced together.

D. Splices in axial loaded studs are not permitted.

E. Framed wall openings shall include a properly designed header and multiple (or heavier) studs at each edge of the opening, to compensate for those removed.

F. Diagonal bracing shall be installed at locations required to be "shear walls" for frame stability and to resist wind lateral loads. Bracing shall be securely anchored for uplift and horizontal shear. Additional stud(s) shall be positioned to resist the vertical component.

G. Bridging for wall framing shall be installed in accordance with manufacturer's recommendations.

H. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.05 FIELD QUALITY CONTROL

A. Testing: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor, Project Engineer and Architect.

D. Remove and replace work where test results indicate that it does not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.06 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 05 50 00 METAL FABRICATIONS

PART 1-GENERAL

1.01 SECTION INCLUDES

A. Shop fabricated steel items.

B. Fabricated Work Tables.

1.02 RELATED REQUIREMENTS

A. Section 09 05 15 - Color Design.

B. Section 09 90 00 - Painting and Coating Painting for all ferrous metal exposed to view and not covered by masonry or concrete.

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

B. ASTM A48/A48M - Standard Specification for Gray Iron Castings; 2003 (Reapproved 2012).

C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2013.

E. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

F. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2013.

G. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength; 2014.

H. ASTM A325M - Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength (Metric); 2014.

I. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2014.

J. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; American Welding Society; 2012.

K. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society; 2011 w/Errata.

L. SSPC-Paint 15 - Steel Joist Shop Primer; Society for Protective Coatings; 1999 (Ed. 2004).

M. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); Society for Protective Coatings; 2002 (Ed. 2004).

N. SSPC-SP 2 - Hand Tool Cleaning; Society for Protective Coatings; 1982 (Ed. 2004).

1.04 SUBMITTALS

A. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

B. Welders' Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.

PART 2-PRODUCTS

2.01 MATERIALS - STEEL

A. Steel Sections: ASTM A36/A36M.

B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.

C. Plates: ASTM A283.

D. Pipe: ASTM A53/A53M, Grade B Schedule 40, hot-dip galvanized finish.

E. Bolts, Nuts, and Washers: ASTM A325 (ASTM A325M), Type 1, galvanized to ASTM A153/A153M where connecting galvanized components.

F. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

G. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

H. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Continuously seal joined members by intermittent welds and plastic filler.

D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

E. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 PIPE RAILINGS

A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of ASTM E985 and applicable local code.

B. Allow for expansion and contraction of members and building movement without damage to connections or members.

C. Dimensions: See drawings for configurations and heights.

1. Top Rails and Wall Rails: 1-1/2 inches diameter, round.
2. Intermediate Rails: 1-1/2 inches diameter, round.
3. Posts: 1-1/2 inches diameter, round.
4. End and Intermediate Posts: Same material and size as top rails.
    a. Horizontal Spacing: As indicated on drawings.
    b. Mounting: Welded to top surface of stringer.

D. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.

1. For anchorage to concrete, provide inserts to be cast into concrete, for welding anchors.
2. For anchorage to masonry, provide brackets to be embedded in masonry, for bolting anchors.

E. Provide welding fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.

2.04 BOLLARD COVERS

A. 1/4 inch dome top bollard cover to fit 8 inch bollards. Color: Yellow.

B. Equivalent products by the following manufacturers are acceptable:

1. Ideal Shield; www.idealshield.com <http://www.idealshield.com>.
2. Reliance-Foundry; www.reliance-foundry.com.
3. Uline; www.uline.com.
4. Global Industrial; www.globalindustrial.com <http://www.globalindustrial.com>.

C. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of metal decking, joists, and masonry; galvanized finish.

2.05 STEEL FABRICATED WORK TABLES

A. Shop fabricated steel work tables as indicated on the drawings.

2.06 LOOSE LINTELS, LEDGE ANGLES, SHELF ANGLES, CHANNELS AND PLATES

A. Lintels: As detailed; galvanized finish.

B. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of metal decking, joists, and masonry; galvanized finish.

2.07 DOWNSPOUT BOOTS

A. Downspout Boots: Smooth interior without boxed corners or choke points; include integral lug slots, integral cleanout, cleanout cover, and tamper proof fasteners.

1. Configuration: Angular.
2. Material: Cast iron; ASTM A48/A48M.
3. Products:
   a. Equal to Neenah Foundry, a division of Neenah Enterprises, Inc; Model #4929-A17: www.nfco.com.

2.08 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.

2.09 FINISHES - STEEL

A. Prime paint steel items.

1. Exceptions: Galvanize items to be embedded in concrete and items to be imbedded in masonry.

B. Prepare surfaces to be primed in accordance with SSPC-SP2.

C. Prime Painting: One coat.

D. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements.

E. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

2.10 FABRICATION TOLERANCES

A. Squareness: 1/8 inch maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch.

C. Maximum Misalignment of Adjacent Members: 1/16 inch.

D. Maximum Bow: 1/8 inch in 48 inches.

E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3-EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Field weld components as indicated on drawings.

D. Perform field welding in accordance with AWS D1.1/D1.1M.

E. Obtain approval prior to site cutting or making adjustments not scheduled.

F. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

SECTION 06 10 00 ROUGH CARPENTRY

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Framing with dimension lumber.
2. Wood blocking and nailers.
3. Wood furring and grounds.
4. Wood sleepers.
5. Utility shelving.
6. Plywood panels.

B. Related Sections:

1. Section 03 10 00 - Concrete Forming and Accessories.
2. Section 06 16 00 – Sheathing.
3. Section 06 40 00 - Architectural Woodwork.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1.03 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For the following, from ICC-ES:

1. Preservative-treated wood.
2. Fire-retardant-treated wood.
3. Power-driven fasteners.

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 DELIVERY, STORAGE AND PROTECTION

A. Keep materials dry during delivery and storage. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber and plywood, and provide air circulation within stacks. 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.

1.06 PROJECT CONDITIONS

A. Installer must 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. 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: 15 percent for 2-inch nominal thickness or less, 19 percent for more than 2-inch nominal thickness unless otherwise indicated.

2.02 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.

4. Wood framing members that are less than 18 inches above the ground in crawl spaces or unexcavated areas.
5. Wood floor plates that are installed over concrete slabs-on-grade.

2.03 FIRE-RETARDANT-TREATED MATERIALS

A. 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.
3. Design Value Adjustment Factors: Treated lumber shall be tested according ASTM D 5664, and design value adjustment factors shall be calculated according to ASTM D 6841 For enclosed roof framing, framing in attic spaces, and where high temperature fire-retardant treatment is indicated, provide material with adjustment factors of not less than 0.85 modulus of elasticity and 0.75 for extreme fiber in bending for Project's climatological zone.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.

C. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.

D. Application: Treat items indicated on Drawings, and the following:

1. Framing for raised platforms.
2. Concealed blocking.
3. Roof framing and blocking.
4. Wood cants, nailers, curbs, equipment support bases, blocking, and similar members in connection with roofing.
5. Plywood backing panels.

2.04 DIMENSION LUMBER FRAMING

A. Non-Load-Bearing Interior Partitions: Standard, Stud, or No. 3 grade of any species.

B. Other Framing: Construction or No. 2 grade and any of the following species:

1. Hem-fir (north); NLGA.
2. Southern pine; SPIB.
3. Douglas fir-larch; WCLIB or WWPA.
4. Mixed southern pine; SPIB.
5. Spruce-pine-fir; NLGA.
6. Douglas fir-south; WWPA.
7. Hem-fir; WCLIB or WWPA.

8. Douglas fir-larch (north); NLGA.
9. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.

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. Rooftop equipment bases and support curbs.
4. Cants.
5. Furring.
6. Grounds.
7. Utility shelving.

B. For items of dimension lumber size, provide Standard, Stud, or No. 3 grade lumber of any species.

C. For utility shelving, provide lumber with 15 percent maximum moisture content of eastern white pine, Idaho white, lodgepole, ponderosa, or sugar pine; Standard or No. 3 Common grade; NeLMA, NLGA, WCLIB, or WWPA.

D. For concealed boards, provide lumber with 15 percent maximum moisture content and any of the following species and grades:

1. Mixed southern pine, No. 2 grade; SPIB.
2. Eastern softwoods, No. 3 Common grade; NELMA.
3. Northern species, No. 3 Common grade; NLGA.
4. Western woods, Standard or No. 3 Common grade; WCLIB or WWPA.

2.06 PLYWOOD PANELS

A. Equipment Backing Panels: DOC PS 1, Exterior, AC fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

B. Exposed Interior Plywood: Where plywood will be exposed to view, provide 5/8 inch minimum thickness Interior Type plywood B-C Plugged Grade, unless otherwise specified or shown on Drawings. Unless specifically stated otherwise, exposed plywood shall be painted or stained from standard colors as selected by Project Engineer / MDOT Architect.

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 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. Screws for Fastening to Metal Framing: ASTM C 1002 length as recommended by screw manufacturer for material being fastened.

2.08 MISCELLANEOUS MATERIALS

A. Flexible Flashing: Self-adhesive butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit.

B. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant treated plywood backing panels with classification marking of testing agency exposed to view.

D. Install exposed interior plywood panels by fasting to studs. Caulk joints prior to finishing.

E. Cut, join, and tightly fit framing around other Work. 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 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," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.

3.02 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.

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 stained finish.
3. Countertops.
4. Shelving.
5. Hardware.
6. Accessory materials.
7. 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.

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 Stained Finish: Comply with AWI quality standards for selection of species, grade and cut.

D. Plastic Laminate: Comply with NEMA LD3; type, thickness, color, pattern and finish as indicated for each application.

E. 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.

F. 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.

G. 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: 3 inch diameter grommets equal to Doug Mockett item No.MM5A.
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.

F. Grommets: Provide at openings in countertops at knee spaces.

G. Keyboard: Install per manufacturer’s instructions at knee spaces.

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 28 CELLULOSE THERMAL INSULATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Building insulation for interior and exterior walls.

1. Pneumatically sprayed damp into open wall cavities.
2. ECOCELL batts over Rooms 109 -111 at sloped roof inside Shop Area; friction-fit between joists and held in place with strapping or mesh.

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, 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©.
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/cm2; 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 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 26 14 SURFACE APPLIED VAPOR REDUCTION SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Provide all labor, materials, tools and equipment as necessary to perform installation of a surface applied moisture mitigation system (vapor retarder) on new and/or existing concrete slabs as shown on Drawings and as specified in this Section.
2. Repairs and preparation of concrete floors.

B. Related Sections:

1. Section 03 30 00 Cast-in-Place Concrete.
2. Section 09 65 00 Resilient Flooring.
3. Section 09 90 00 Painting and Coating

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM F 1869- Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 1998.
2. ASTM E 1907 – Standard Practices for Determining Moisture-Related Acceptability of Concrete Floors to Receive Moisture-Sensitive Finishes; 1997.
3. ASTM E 96 - Standard Test Methods for Water Vapor Transmission of Materials; 1995.
4. ASTM D 4541 B - Pull-Off Strength of Coatings; 1995, Modified.

1.03 ACTION SUBMITTALS

A. General: Submit manufacturer's certification that proposed materials, details and systems as indicated and specified fully comply with manufacturer's details and specifications. If any portion of Contract Documents do not conform to manufacturer's standard recommendations, submit notification of portions of design that are at variance with manufacturer's specifications.

B. Product Data:

1. Submit manufacturer's literature, installation instructions and MSDS (Material Safety Data Sheet) for each product.
2. Test Data: Submit independent testing laboratory data for product, evidencing:
   a. Up to 95 percent reduction of water vapor transmission (tested as per ASTM E 96-95).
   b. Product is insensitive to alkaline environment up to pH 14 (tested as per ASTM D 1308).

1.04 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Company specializing in manufacturing products specified in this Section with minimum 5 years documented experience.

B. Installer's Qualifications: Acceptable to manufacturer with documented experience on at least 3 projects of similar nature in past 5 years and/or training provided by the product manufacturer.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver and store in a dry, well ventilated area at minimum 50 deg F (10 deg C) and maximum 90 deg F (32 deg C).

B. Deliver materials in manufacturer's unopened containers fully identified with brand, type, grade, class and all other qualifying information. Provide Material Safety Data Sheets for each product.

1.06 SYSTEM REQUIREMENTS

A. Coordinate floor sealing installation with other trades.

B. Provide materials and accessories in timely manner so as not to delay Work.

1.07 PROJECT CONDITIONS

A. Maintain surfaces to be sealed and surrounding air temperature at not less than 50 deg F (10 deg C).

B. Exercise caution when temperatures exceed 90 deg F (32 deg C).

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Approved Manufacturers: AQUAFIN, Inc. 505 Blue Ball Rd., #160, Elkton, MD, Phone (800) 394-1410 or (410) 392-2300; Fax (410) 392-2324; e-mail info@aquafin.net.

B. Equivalent products by the following manufacturers are acceptable:

1. Koester American Corp., Virginia Beach, VA. Tel. (757) 425-1206.
2. Vexcon Chemicals, Inc., Philadelphia, PA. Tel. (215) 332-7709.

C. Substitutions shall fully comply with specified requirements, Section 01 25 00-Substitution Procedures and Section 01 60 00-Product Requirements.

2.02 MATERIALS

A. Moisture Vapor Emission Reduction Control System (concrete floor sealer): One-part system consisting of a two-component, moisture tolerant, high density, low odor, chemically enhanced epoxy based product which must reduce vapor emissions (MVER) to 3 lbs/24 hrs*1000 SF or less and be compatible with floor finishes and adhesives approved by the manufacturer. Characteristics:

1.	Moisture Product:	VAPORTIGHT COAT®-SG2
2.	Components A and B:	Precise blend of white and yellowish liquid
3.	Compressive Strength:	>11,000 psi (>80 Mpa) (ASTM D-695)
4.	Flexural Strength:	> 4,000 psi (>27 Mpa) (ASTM D-790)
5.	Bond/Adhesive	> 100 psi (>0.7 Mpa) at 5 day old concrete >500 psi (>3.5 Mpa) at 28 days on moist or dry concrete (ASTM D-4541)
6.	Permeance:	< perm (<5.7E-08 grams/Pa*s*m^2) (ASTM E-96)
7.	Alkaline Resistance:	Up to pH 14 (ASTM D-1308)
8.	Vapor Reduction:	Up to 95 percent (ASTM E-96)
9.	Cured for Installation of Flooring	12 hrs at 73 deg F (23 deg C)
10.	pH on Cured Surface:	7

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine all construction substrates and conditions under which concrete floor sealer material is to be installed. Do not proceed with the concrete floor sealer installation until unsatisfactory conditions are corrected.

B. Anhydrous Calcium Chloride Testing as per ASTM F-1869:

1. Before installation of concrete floor sealer: use tests carried out by Architect/Engineer during study phase, and confirm by testing through installer or independent laboratory prior to installation of concrete floor sealer.
2. After installation of concrete floor sealer: not required by manufacturer of specified concrete floor sealer, unless specified during bid stage.

3.02 PREPARATION

A. Protect adjacent surfaces not designated to receive concrete floor sealer.

B. Substrate Preparation:

1. Remove existing floor coverings, coatings and adhesives down to bare concrete, curing compounds, efflorescence, dust, grease, laitance, etc. with steel shot blasting, abrasive (sand) blasting or grinding using a diamond cup blade. Acid etching is not recommended.
2. Assure that all slabs have surface profile ICRI CSP 3 - 5 (ICRI, Des Plaines, IL, Guideline No. 03732.) for mechanical bond (i.e. medium grit sandpaper). Smooth surfaces are not acceptable, they must be shot blasted.
3. Repair defective areas such as honeycombs, cracks or other defects with a suitable repairing or manufacturer recommended mortar.
4. Treat saw cut and expansion joints as per manufacturer's application guideline.

5. Install cementitious underlayment, leveling mortars, flash patching, on top of surface applied vapor barrier (concrete floor sealer).
6. Carefully rinse all the surfaces to be treated with clean water, leave no standing water.

3.03 INSTALLATION

A. Mix concrete floor sealer material in proportions recommended by manufacturer.

B. Apply concrete floor sealer material in quantities as per manufacturer's specifications and recommendations:

1. Apply in one coat at specified rate for moisture vapor emission rate (MVER) up to 25 lbs/24 hrs*1000 SF (<5.0 g/hr/m^2).
2. Apply using roller or squeegee to the still moist substrate, and carefully scrub it into the pores with a long handled scrub brush. Follow with a roller to achieve a uniform coverage.

C. Immediately broadcast clean, dry, fresh water washed and dried #20 silica sand (0.5 to 1.0 mm) to “rejection” (full broadcast) or at a rate of up to 30 lb/100 SF (1.5 kg/m^2) into the fresh concrete floor sealer where a 2nd coat or subsequent top coating such as epoxy, epoxy terrazzo, cement-based topping, underlayment, polyurea, polyurethane, etc., follows.

D. Where specified install leveling course as per manufacturer’s specifications and recommendations.

E. Note: Water based adhesives under VCT, sheet vinyl, linoleum, rubber backed carpet or other non-breathable flooring systems require a cementitious underlayment on top of the concrete floor sealer for their curing process. Consult adhesive manufacturer for recommended minimum thickness of cementitious underlayment.

3.04 CLEANING

A. Remove left over materials and any foreign material resulting from the work from the site.

B. Clean adjacent surfaces and materials.

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" for embedded flashings.
2. Division 06 Section "Sheathing" for wall sheathings, wall sheathing joint-and-penetration treatments.
3. Division 07 Section "Self-Adhering Sheet Flashing."
4. Division 07 Section "Sheet Metal Flashing and Trim" for sheet metal flashings.
5. 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 building envelope shall be designed and constructed with a continuous air barrier to control air leakage into, or out of the conditioned space. An air barrier shall also be provided for interior partitions between conditioned space and space designed to maintain temperature or humidity levels which differ from those in the conditioned space by more than 50 percent of the difference between the conditioned space and design ambient conditions.

C. 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 0.02 L/s. x sq. m. @ 75 Pa), when tested in accordance with ASTM E2178.

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. 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. C1193 Guide for Use of Joint Sealants
2. D412 Standard Test Methods for Rubber Properties in Tension
3. D570 Test Method for Water Absorption of Plastics
4. D1004 Test Method for Initial Tear Resistance of Plastic Film and Sheeting
5. D1876 Test Method for Peel Resistance of Adhesives
6. D1938 Test Method for Tear Propagation Resistance of Plastic Film and Sheeting
7. D1970 Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
8. D4258 Practice for Surface Cleaning Concrete for Coating
9. D4263 Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
10. ASTM D4541 Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
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. E1186 Practice for Air Leakage Site Detection in Building Envelopes and Air Retarder Systems
14. E2178 Standard Test Method for Air Permeance of Building Materials
15. E2357 Standard Test Method for Determining Air Leakage of Air Barrier Assemblies
16. NPFA 285 Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components

1.05 PREINSTALLATION MEETINGS

A. Pre-installation 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 1.11.

1.08 QUALITY ASSURANCE

A. Manufacturer Qualifications: Air barrier systems shall be manufactured by a firm with a minimum of 10 years experience in the production and sales of waterproofing and air barriers.

B. 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.
      2) Grace Construction Products; Perm-A-Barrier VPL. (Basis-of-Design)
      3) Henry Company.
      4) Tremco Incorporated, an RPM company.

2. Physical and Performance Properties:
   a. Membrane Air Permeance: ASTM E2178: Not to exceed 0.004 cfm/sq. ft. under a pressure differential of 0.3 in. water (1.57 psf) (equal to 0.02 L/s. x sq. m. @ 75 Pa)
   b. Assembly Air Permeance: Provide a continuous air barrier assembly that has an air leakage not to exceed 0.04 cfm/sq. ft. of surface area under a pressure differential of 0.3 in. water (1.57 psf) (equal to 0.2 when tested in accordance with ASTM E2357
   c. Water Vapor Permeance: ASTM E96, Method B: Greater then 10 perms.
   d. Pull Adhesion: ASTM D4541: minimum 20 psi or substrate failure to glass faced wall board, minimum 100 psi to concrete/CMU.
   e. Low temperature flexibility: ASTM D1970: Pass at minus 20 degrees Fahrenheit (at minus 29 degrees Celsius).
   f. Water resistance of in-place membrane: ASTM E331: Pass. No water penetration after 90 minutes @ 299 Pa (6.24 psf) tested over OSB and gypsum sheathing.
   g. Nail sealability: ASTM D1970: Pass UV Exposure Limit: Equal to or greater than 180 calendar days.
   h. Fire Resistance: Evaluated to NFPA 285 as part of various wall assemblies with and without foam plastic insulation.

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 Through Wall 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. VOC Content: Not to exceed 10 g/l.
   3. Application Temperature: 25 degrees F and above.
   4. Freezing point (as packaged): 21 degrees F.
   5. 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/m2sPa (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 minus 4 degrees Celsius (25 degrees Fahrenheit): ASTM D1876: 880 N/m (5.0 lbs./in.) of width.

6. Low Temperature Flexibility ASTM D1970: Unaffected to minus 43 degrees Celsius (minus 45 degrees Fahrenheit)
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: Equal to Perm-A-Barrier Wall Flashing manufactured by Grace Construction Products.

E. Joint Reinforcing Strip: Air barrier manufacturer's approved tape.

F. Transition Membrane: 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/m2sPa (0.05 perms) maximum
2. Air Permeance: 75 Pa (0.3 in. water) pressure difference; 0.0006 L/s. sq. m (0.00012 cfm/ sq. ft.) maximum
3. Puncture Resistance: ASTM E154; 178 N (40 lbs.) minimum
4. Lap Adhesion: minus 4 degrees Celsius (25 degrees Fahrenheit): ASTM D1876: 880 N/m (5.0 lbs./in.) of width
5. Low Temperature Flexibility: ASTM D1970; Unaffected to minus 43 degrees Celsius (minus 45 degrees Fahrenheit)
6. Tensile Strength: ASTM D412, Die C Modified; Minimum 2.7 MPa (400 psi)
7. Elongation, Ultimate Failure of Rubberized Asphalt: ASTM D412, Die C: min. 200 percent
8. Product: Perm-A-Barrier Detail Membrane manufactured by Grace Construction Products.

G. Transition Aluminum Membrane: 0.9 mm (35 mils) of self-adhesive rubberized asphalt integrally bonded to 0.1 mm (5 mil) of aluminum 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 Absorption: ASTM D570: max. 0.1 percent by weight
2. Puncture Resistance: ASTM E154: 356 N (80 lbs.) min.
3. Lap Adhesion: Minus 4 degrees Celsius (25 degrees Fahrenheit), ASTM D1876 Modified: 880 N/m (5.0 lbs./in.) of width
4. Low Temperature Flexibility: ASTM D1970 Modified: Unaffected to minus 26 degrees Celsius (minus15 degrees Fahrenheit)
5. Tensile Strength: ASTM D412, Die C Modified; Minimum 4.1 MPa (600 Psi)
6. Elongation, Ultimate Failure of Rubberized Asphalt: ASTM D412, Die C: min. 200 percent
7. Product: Perm-A-Barrier Aluminum Flashing manufactured by Grace Construction Products.

H. Substrate Patching Membrane: Manufacturer's standard trowel-grade substrate filler.

I. Liquid Membrane for Details and Terminations and Substrate Patching: Bituthene Liquid Membrane manufactured by Grace Construction Products; a two-part, elastomeric, trowel grade material designed for use with fluid-applied membranes, self-adhered membranes and tapes. 10 g/L maximum VOC content.

J. Joint Sealant for Details, Final Terminations and Sheathing Joint Treatment: Grace S100 Sealant manufactured by Grace Construction Products: a one-part, neutral curing, ultra low modulus material designed for use with fluid-applied membranes, self-adhered membrane and tapes. 98 g/L maximum VOC content.

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-milwet film thickness, 45-mil dry film thickness.

D. Do not cover air barrier until it has been inspected by Project Engineer/ MDOT Architect.

E. 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.

G. Fill gaps in perimeter frame surfaces of windows, storefronts, and doors, and miscellaneous penetrations of air barrier membrane with foam sealant.

H. Repair punctures, voids, and deficient lapped seams in strips and transition membrane. Slit and flatten fish-mouths and blisters. Patch with transition membrane extending 6 inches beyond repaired areas in strip direction.

3.06 FIELD QUALITY CONTROL

A. Testing Agency: Owner may engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Inspection: Air barrier materials and installation are subject to inspection for compliance with requirements.

C. Tests: Testing to be performed will be determined by Owner's testing agency from among the following tests:

1. Qualitative Testing: Air barrier assemblies will be tested for evidence of air leakage according to ASTM E1186.

D. Remove and replace deficient air barrier components and retest as specified above.

3.07 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 62 00 SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Flashing and sheet metal work as indicated on the Drawings and provisions of this Specification. The types of work include the following:
   a. Metal flashing and counter flashing.

B. Related Sections: Section 09 05 15 – Color Design. (For color selection.)

1.02 ACTION SUBMITTALS

A. Product Data: Manufacturer's product data, technical specifications, installation instructions and general recommendations for each specified sheet material and fabricated product for Project Engineer / MDOT Architect's approval.

B. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.
2. Distinguish between shop- and field-assembled work.
3. Include identification of finish for each item.
4. Include pattern of seams and details of termination points, expansion joints and expansion-joint covers, direction of expansion, and connections to adjoining work.

C. Samples: Submit 2 samples, eight inch square, of specified sheet materials to be exposed as finished surfaces. Submit 2 twelve inches long, completely finished units of specified factory-fabricated products exposed as finished work. Submit 2 color charts of manufacturer's complete line of standard colors available.

1.03 INFORMATIONAL SUBMITTALS

A. Qualification Data: Submit 2 copies for firms and persons that demonstrate capabilities and experience. Include a list with five (5) completed Project names and addresses, and name and addresses of Architects and Owners.

B. Product certificates.

C. Product test reports.

D. Sample warranty.

1.04 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.05 QUALITY ASSURANCE

A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

1.06 WARRANTY

A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. Recycled Content of Steel-Sheet Flashing and Trim: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.02 FLASHING AND SHEET METAL MATERIALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet according to ASTM A 653/A 653M, G90 coating designation or aluminum-zinc alloy-coated steel sheet according to ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40; prepainted by coil-coating process to comply with ASTM A 755/A 755M.

1. Thickness: 24 gage.
2. Exposed Coil-Coated Finish:
   a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
3. Color: As selected by Architect from manufacturer's full range.
   a. Equal to Petersen Aluminum Corp., Tel. (800) 722-2523.
   b. Use galvanized finish where concealed from view only.

2.03 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
   a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
2. Fasteners for Zinc-Coated (Galvanized) or Aluminum-Zinc Alloy-Coated Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

C. Solder:

1. For Zinc-Coated (Galvanized) Steel: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead or Grade Sn60, 60 percent tin and 40 percent lead with maximum lead content of 0.2 percent.

D. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

E. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane, polysulfide and / or silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

H. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.

I. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.04 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.

1. Obtain field measurements for accurate fit before shop fabrication.

2. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
3. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

C. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.

D. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

E. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.

F. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.

G. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
3. Space cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
5. Torch cutting of sheet metal flashing and trim is not permitted.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

1. Coat concealed side of sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

D. Fasteners: Use fastener sizes that penetrate [wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws. Substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction. Prepare joints and apply sealants to comply with requirements in Section 07 92 00 - Joint Sealants.

G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets with solder to width of 1-1/2 inches; however, reduce pre-tinning where pre-tinned surface would show in completed Work.

1. Do not solder metallic-coated steel sheet.
2. Do not use torches for soldering.
3. Heat surfaces to receive solder, and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

3.02 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings.

3.03 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder.

C. Clean off excess sealants.

D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

E. Protection: Installer shall advise Contractor of required procedures for surveillance and protection of flashings, sheet metal work, and accessories during construction, to ensure that work will be without damage or deterioration, other than natural weathering, at time of substantial completion.

F. Flashings and sheet metal with cuts, abrasions, or imperfections will not be acceptable and is to be replaced.

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:

1. Section 07 27 26 – Fluid-Applied Membrane Air Barriers.
2. Section 07 62 00 – Sheet Metal flashing and Trim.

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.

1. Warranty period begins at the Date of Completion as determined by MDOT.

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-ADHEVISE 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.

1. Termination Bar: Type T2-FTS equal to Hohmann & Barnard, Inc. with factory installed foam strip and 3/8 inch flange for caulking.
2. Caulk the top of flashing termination bars with manufacturer's recommended sealant.

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 Substantial 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 Substantial 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 29 – Prefinished 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.
3. Galvanizing (Interior Room Door Frames): Hot-dipped 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.

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 be18 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.

F. Ventilation Louvers: Roll formed steel with overlapping frame; finish same as door components; factory-installed.

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 on center and not more than 2 inches on center 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. Regional Materials: Wood doors shall be manufactured within 500 miles of Project site.

C. 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.

D. 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.

E. Mineral- Core Doors:

1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as follows:
   a. 5-inch top-rail blocking.
   b. 5-inch bottom-rail blocking, in doors indicated to have protection plates.
   c. 5-inch midrail blocking, in doors indicated to have armor plates.
   d. 4-1/2 by 10 inch lock blocks in doors indicated to have exit devices.
3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

F. 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. Core Fire-rated: Mineral.
13. 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."
3. Louvers: Factory install louvers in prepared openings.

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.

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.
   a. Comply with NFPA 80 for fire-rated doors.

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 09 Section "Acoustical Ceilings" for suspended acoustical tile ceilings.
5. 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 PERFORMANCE REQUIREMENTS

A. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics per the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. NFPA 252 or UL 10B for fire-rated access door assemblies installed vertically.
2. NFPA 288 for fire-rated access door assemblies installed horizontally.

2.02 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.

E. Plaster Beads: Casing bead formed from 0.0299-inch zinc-coated steel sheet with flange formed out of expanded metal lath and in size to suit thickness of plaster.

2.03 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.

F. Fire-Rated, Insulated, Flush Access Doors and Frames with Exposed Trim: Fabricated from steel sheet.

1. Locations: Wall surfaces.
2. Fire-Resistance Rating: Not less than that of adjacent construction.

3. Temperature Rise Rating: 250 deg F at the end of 30 minutes.
4. Door: Flush panel with a core of mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 0.036 inch.
5. Frame: Minimum 0.060-inch- thick sheet metal with 1-inch- wide, surface-mounted trim.
6. Hinges: Continuous piano.
7. Automatic Closer: Spring type.
8. Latch: Self-latching device operated by flush key with interior release.
9. Lock: Self-latching device with mortise cylinder lock.
   a. Lock Preparation: Prepare door panel to accept cylinder specified in Division 8 Section "Door Hardware (Scheduled by Describing Products)."

2.04 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 (IF) 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: Insulated Flat (IF).
   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 41 13 ALUMINUM-FRAMED ENTRANCE AND STOREFRONT

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Aluminum-framed entrance and storefront system includes tubular aluminum sections with supplementary internal support framing as required, aluminum and glass entrances, shop fabricated, factory finished, glass and glazing, related flashing, anchorage and attachment devices.

B. Related Sections:

1. Section 07 92 00 – Joint Sealants.
2. Section 08 71 00 – Door Hardware.
3. Section 08 80 00 – Glazing.
4. Section 09 05 15 - Color Design.
5. Division 26 & 28 Sections for Electrical & Security Systems.

1.02 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.03 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's specifications for materials and fabrication of aluminum-framed entrance and storefront, and instructions and recommendations for installation and maintenance. Include certified test reports showing compliance with requirements where a test method is indicated. Submit product data for door hardware and accessories.

B. Shop Drawings: Submit drawings showing adaptation of manufacturer's standard system to project; include typical unit elevations at 1/2 inch scale and details at 3 inch scale, to show dimensioning, member profiles, anchorage system, interface with building construction, and glazing. Show section moduli of wind-load-bearing members, and calculations of stresses and deflections for performance under design loading. Show clearly on shop drawings where and how manufacturer's system deviates from Contract Drawings and these Specifications.

C. Samples: Submit samples of each type and color of aluminum finish, on l2 inch long sections of extrusions of formed shapes and on 6 inch squares of sheet/plate. Include 2 or more samples in each set, showing near-limits of variations (if any) in color and texture of finish.

D. Delegated-Design Submittal: For glazed aluminum-framed entrance and storefront walls 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. Energy Performance Certificates: NFRC-certified energy performance values from manufacturer.

B. Product test reports.

C. Field quality-control reports.

D. Sample warranties.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Installer experienced to perform work of this section who has at least five years experience in the installation of work similar to that required for this project and who is acceptable to product manufacturer.

B. Manufacturer Qualifications: Manufacturer capable of providing field service representation during construction, approving acceptable installer and approving application method.

C. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.

D. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.07 DELIVERY, STORAGE AND HANDLING

A. Ordering Comply with manufacturer’s ordering instructions and lead time requirements to avoid construction delays.

B. Packing, Shipping, Handling, and Unloading: Deliver materials in manufacturer’s original, unopened, undamaged containers with identification labels intact.

C. Storage and Protection: Store materials protected from exposure to harmful weather conditions. Handle storefront material and components to avoid damage. Protect material against damage from elements, construction activities, and other hazards before, during and after installation.

1.08 WARRANTY

A. Special Assembly Warranty: Manufacturer agrees to repair or replace components of glazed aluminum curtain wall that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Final Completion.

B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Warranty Period: 20 years from date of Final Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design glazed aluminum curtain walls.

B. General Performance: Comply with performance requirements specified, as determined by testing of glazed aluminum-framed entrance and storefront walls representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Glazed aluminum-framed entrance and storefront walls shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:
   a. Thermal stresses transferring to building structure.
   b. Glass breakage.
   c. Noise or vibration created by wind and thermal and structural movements.
   d. Loosening or weakening of fasteners, attachments, and other components.
   e. Failure of operating units.

C. Uniform Loads:

1. A static air design load of 40 psf shall be applied in the positive and negative direction in accordance with ASTM E 330. There shall be no deflection in excess of L/175 of the span of any framing member at design load. At structural test load equal to 1.5 times the specified design load, no glass breakage or permanent set in the framing members in excess of 0.2 percent of their clear spans shall occur.

D. Air Infiltration:

1. The test specimen shall be tested in accordance with ASTM E 283. Air infiltration rate shall not exceed 0.06 cfm/ft^2 at a static air pressure differential of 6.24 pounds per square foot.

E. Water Resistance, (Static):

1. The test specimen shall be tested in accordance with ASTM E 331. There shall be no leakage at a static air pressure differential of 12 pounds per square foot as defined in AAMA 501.

F. Water Resistance, (Dynamic): The test specimen shall be tested in accordance with AAMA 501.1. There shall be no leakage at an air pressure differential of 12 pounds per square foot as defined in AAMA 501.

G. Condensation Resistance (CRF): When tested to AAMA Specification 1503, the condensation resistance factor shall not be less than 73 for frame.

H. Seismic: When tested to AAMA 501.4, system must meet design displacement of 0.010 x the story height and ultimate displacement of 1.5 x the design displacement.

I. Sound Transmission Loss: When tested to ASTM E90, the Sound Transmission Class (STC) shall not be less than 34 based upon one inch insulating glass (1/4 inch glass, 1/2 inch air space, 1/4 inch glass).

2.02 MANUFACTURERS

A. Drawings and Specifications are based on products as manufactured by Kawneer Company, Inc., 555 Guthridge Court, Norcross, GA 30092. Tel. (770) 449-5555.

B. Equivalent products by the following manufacturers are acceptable:

1. EFCO Corporation, Monett, MO. Tel. (800) 221-4169.
2. Oldcastle Building Envelope, Terrell, TX. Tel. (866) 653-2278.
3. Traco, Cranberry Township, PA. Tel. (724) 776-7000.

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. Aluminum-framed Storefront Framing: Kawneer Trifab VG 451 - 2 inches by 4-1/2 inches nominal dimensions; Screw Spline Fabrication.

1. Material Standard: Extruded Aluminum, ASTM B 221, 6063-T5 or 6063-T6 alloy and temper.
2. Member Wall Thickness: Each framing member shall have a wall thickness sufficient to meet the specified structural requirements
3. Tolerances: Reference to tolerances for wall thickness and other cross-sectional dimensions of storefront wall members are nominal and in compliance with AA Aluminum Standards and Data.

2.04 ACCESSORIES

A. Fasteners: Where exposed, shall be Stainless Steel.

B. Gaskets: Glazing gaskets shall comply with ASTM C 864 and be extruded of a silicone compatible EPDM rubber that provides for silicone adhesion.

C. Perimeter Anchors: Aluminum. When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.

D. Thermal Barrier: Thermal separator shall be extruded of a silicone compatible elastomer that provides for silicone adhesion.

2.05 ENTRANCES

A. Aluminum entrance doors shall be equal to Kawneer Series 350 Medium Style Swing Doors. Electrical Door Access Control shall be provided for openings where indicated and as specified in Divisions 26 and 28; and, shall be connected to existing access control system.

2.06 HARDWARE

A. Refer to Section 08 71 00 – Door Hardware for requirements for hardware items other than those indicated herein to be provided by manufacturer of aluminum entrances.

B. Provide door manufacturer's standard heavy-duty hardware units as shown, schedule, or required for operation of each door, including the following items of size, number, and type recommended by manufacturer for service required, finish to match door, unless otherwise indicated:

1. Top, Bottom, and Intermediate Pivots: Cast aluminum ally with steel pins and oilite bearings (ball-bearing bottom pivots).
2. Overhead Closers: Equal to LCN 4040 Parallel Arm with Cush-N-Stop and custom powder coat metal cover.
3. Deadlocks: Mortised maximum security type, with 1 inch minimum length pivoted bolt, stainless steel strike box.
4. Keyed Cylinders: 5-pin tumbler, with cast aluminum face.
5. Magnetic Locks: Refer to Division 28 Sections for Security Systems.
6. Pull Handles: Equal to Kawneer style CO-12 stainless steel US 32D.
7. Panic Device: Unless indicated otherwise in Divisions 26 and 28, provide panic device equal to Dor-O-Matic RXEL 1690 NL, EPT-10 electric power transfer, PS 873-2B power supply.
8. Thresholds: Extruded aluminum in clear anodized finish, complete with anchors and clips, coordinate with pivots. Size and shape of thresholds as indicated on the Drawings.

2.07 FABRICATION

A. General:

1. Fabricate components per manufacturer's installation instructions and with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.
2. Accurately fit and secure joints and corners. Make joints flush, hairline and weatherproof.
3. Prepare components to receive anchor devices. Fabricate anchors.
4. Arrange fasteners and attachments to conceal from view.

2.08 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.

1. Color and Gloss: As selected by Architect from manufacturer's full range. Refer to Section 09 05 15 - Color Design for color selection.

2.09 SOURCE QUALITY CONTROL

A. Source Quality: Provide aluminum-framed entrance and storefront specified herein from a single source.

1. Building Enclosure System: When aluminum-framed entrance and storefront are part of a building enclosure system, including entrances, entrance hardware, windows, storefront framing and related products, provide building enclosure system products from a single source manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Site Verification of Conditions: Verify substrate conditions (which have been previously installed under other sections) are acceptable for product installation in accordance with manufacturer's instructions. Verify openings are sized to receive curtain wall system and sill plate is level in accordance with manufacturer's acceptable tolerances.

1. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements, fabrication schedule with construction progress to avoid construction delays.

3.02 INSTALLATION

A. General: Install aluminum-framed entrance and storefront systems plumb, level, and true to line, without warp or rack of frames with manufacturer's prescribed tolerances and installation instructions. Provide support and anchor in place.

1. Dissimilar Materials: Provide separation of aluminum materials from sources of corrosion or electrolytic action contact points.
2. Glazing: Glass shall be outside glazed and held in place with extruded aluminum pressure plates anchored to the mullion using stainless steel fasteners spaced no greater than 9" on center.
3. Water Drainage: Each light of glass shall be compartmentalized using joint plugs and silicone sealant to divert water to the horizontal weep locations. Weep holes shall be located in the horizontal pressure plates and covers to divert water to the exterior of the building.

3.03 PROTECTION AND CLEANING

A. Protection: Protect installed product's finish surfaces from damage during construction. Protect aluminum-framed entrance and storefront system from damage from grinding and polishing compounds, plaster, lime, acid, cement, or other harmful contaminants.

B. Cleaning: Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions. Clean units and glazing again no more than one week prior to Substantial Completion. Remove construction debris from project site and legally dispose of debris.

END OF SECTION

SECTION 08 45 19 POLYCARBONATE WALL SYSTEM

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. The design, manufacture and installation of an aluminum and polycarbonate insulating translucent system. A complete assembly of extruded cellular UV resistant polycarbonate glazing panels incorporated into a complete aluminum framing system, tested and warranted by the manufacturer.

B. All anchors, brackets, and hardware attachments necessary to complete the specified structural assembly, when included within project scope.

C. Weatherability and water-tightness performance as specified.

D. All flashings up to adjoining work are also required as part of the system and shall be included, unless specifically noted as being supplied by others.

E. Installation of the system.

1.02 RELATED SECTIONS

A. Section 13 34 19 – Metal Building Systems

B. Sealants: 79 92 00 – Joint Sealants.

1.03 SYSTEM DESCRIPTION

A. An aluminum-framed wall system that is to be glazed with translucent cellular polycarbonate panels that interconnect via extruded tongue and groove edges.

B. Design Requirements:

1. Support structure, constructed of materials of adequate load bearing capacity and to maintain visual design concepts, and for attachment to and support of the specified system, supplied by other trades.
2. Glazing panels, extruded and supplied in one single length whenever possible. In addition, they shall be extruded with integral tongue and groove vertical edges that facilitate connecting the panels together.
3. Whenever possible, fasteners shall be concealed.
4. System shall be dry glazed.
5. Bottom edges of glazing panels shall rest on [a continuous integral setting fin] [non-continuous supports], which is [are] designed to allow atmospheric air to reach their bottom edges, which shall be covered by a continuous air permeable tape. EPDM, silicone rubber, or neoprene setting blocks, or any other support method that would tend to restrict the flow of air through the panels is not acceptable.
6. Air permeable tape shall also be applied to the top edge of the glazing panels.

7. Unrestricted thermal movement of the glazing panels shall be allowed to occur within the framing system without compromising its weathertightness.
8. The rabbet depth of all framing members shall, at a minimum, be based on a 3/4" (.75") engagement of the glazing panel, plus 1/8" (.125") cutting tolerance, plus .005 x the glazing dimension (in inches) that affects that rabbet. For example, a glazing panel that is 100" long will require a minimum rabbet depth of .75" + .125" + (.005 x 100") = 1.375".

C. Performance Requirements:

1. Air Infiltration: Not to exceed 0.072 cfm/sq. ft. of glazing area when tested at a pressure of 6.24 psf (0.03 kPa) in accordance with ASTM E-283.
2. Water Penetration: None when tested vertically at a pressure equal to 15% of the design pressure for the project, in accordance with ASTM E-331.
3. Structural Performance: The system shall be capable of supporting the design loading for this project as indicated on sheet S100.
4. Testing by a certified independent testing laboratory, in accordance with ASTM E-330, shall evidence this. In addition, the deflection of all framing members oriented normal to the glazing plane shall not exceed L/175.

1.04 Submittals

A. Submit for each of the following to the Project Engineer / MDOT Architect's for review:

1. Each aluminum frame section – 6 inches long.
2. Samples of aluminum illustrating the specified finish.
3. Glazing gaskets – 6 inches long – each type.
4. Samples of glazing, each minimum 6 inches by 6 inches, in specified color.
5. Test reports.
6. Product Data.

B. Shop Drawings:

1. Shall include plans and/or elevations and details of the system and its installation. Flashings, sealants, and anchorage shall be clearly indicated.
2. Shall note gauges of brake metal, the finish(es) on the framing members, and any other information necessary to properly describe and install the system.

1.05 Quality Assurance

A. Materials and Products shall be manufactured by a company continuously and regularly employed in the manufacture of glazing systems using cellular polycarbonate panel systems for a period of at least ten (10) years. Manufacturers shall provide a list of at least ten (10) projects having been in place a minimum of five (5) years.

B. Erection shall be by the manufacturer or an installer experienced in erection of systems of the type specified.

C. The manufacturer shall be responsible for the configuration and fabrication of the complete system, and will ensure that it fully meets all requirements of this specification.

D. Approved Manufacturers: All manufacturers acceptable for use on this project under this section must be approved prior to bid. Manufacturers must submit evidence of compliance with all performance criteria specified herein. Any exceptions taken to this specification must be noted on the approval request. If approval is granted and non-compliance is subsequently discovered, the previously given approval will be invalidated and use of the product on the project will be disallowed. Requests for approval, with all test reports, submittals, and samples as specified herein, must be received no less than twelve (12) days prior to bid date. A list of all approved manufacturers and products will be issued by addendum. No verbal approvals will be given.

1.06 Delivery, Storage and Handling

A. Deliver materials to the jobsite in the manufacturer's original and unopened containers and bearing labels as to type of material and manufacturer's name. Delivered materials shall be identical to approved samples.

B. Store materials under cover in a dry, clean location, off the ground. Remove from the jobsite any materials that are damaged or otherwise not suitable for installation and replace with acceptable materials.

C. Protective coverings containing PVC shall not be used in contact with polycarbonate.

1.07 Warranty

A. The Manufacturer shall provide a written warranty certifying that if, within one (1) year from the Date of Completion as determined by MDOT, the system experiences water leakage owing to defects in fabrication or materials, the Manufacturer will, in a timely manner, furnish (only) new components to replace all of those found to be defective.

B. The above warranty does not apply in the cases of structural movement of the building(s), negative air pressure inside the building(s), acts of God, alteration or abuse of the products, or unreasonable use.

C. The liability of the Warrantor shall be limited to the above and shall not include incidental or consequential damages of any kind.

D. The polycarbonate or glass glazing materials or any other materials or system (example… finishes on metals) furnished and warranted by others, shall be covered by only those warranties.

E. These additional written warranties will also be provided:

1. The polycarbonate manufacturer's ten (10) year prorated warranty against defective materials, color change and damage.
2. The framing finish applicator's warranty as specified below:
   a. Fluoropolymer Finish: Five (5) years from date of application against peeling, checking, cracking, chalking, and fading.

PART 2 - PRODUCTS

2.01 MANUFACTURER AND PRODUCT

A. EXTECH/Exterior Technologies, Inc., 200 Bridge Street, Pittsburgh, PA 15223; Phone (800) 500-8083, Fax (800) 500-8012, website www.extechinc.com or approved equal. Series #3440 Interconnecting Cellular Polycarbonate Translucent Wall System.

2.02 MATERIALS

A. Framing:

1. Shall be extruded aluminum of 6063-T5, 6005-T5 or 6105-T5 alloy and temper. All sections shall be formed true to detail and free from defects impairing appearance, strength or durability.
2. Thermally broken perimeter aluminum framing members, exclusive of cover caps, shall incorporate an integral structural polyurethane thermal break.
3. Perimeter framing members are to be dry glazed profiles, using no welding, or adhesives.

B. Glazing Gaskets:

1. Shall be elastomeric, having low friction surfaces where they contact the glazing.
2. Shall be tested for chemical compatibility with the glazing, and test reports evidencing same shall be presented to the Architect.

C. Fasteners:

1. In general, concealed fasteners are to be used for all aluminum framing.
2. In system construction, the use of adhesives, plastic welding, or sealants is not allowed.
3. Where exposed, shall be stainless steel, 300 Series, with stainless steel backed neoprene washers.
4. Concealed fasteners they may be stainless or zinc-plated steel in accordance with ASTM Specifications A165-55 or A164-55.
5. Bolts, anchors and other fastening devices shall be as required for the strength of the connections and shall be suitable for conditions encountered. Washers shall be of the same metals as fasteners.

D. Flashing:

1. Minimum 0.040 thick Aluminum [painted finish: 3105-H14] [anodized finish: 5005-H34].
2. Factory formed to required profile(s) in 10-ft lengths, whenever practical, to allow for field trimming to suit as-built conditions.
3. The finish on this metal shall match as closely as possible that which is on the extruded aluminum framing members.

E. Polycarbonate Glazing Panels:

1. Appearance:
   a. The extruded panels shall be uniform in color with an integral extruded multi-cell core. The panel's exterior skins shall be interconnected and spaced apart by continuous ribs, perpendicular and/or be diagonal "X" Pattern to the skins. The space between the two exterior skins, in a cross section, shall be divided by multiple parallel intermediate walls.

b. Panels shall consist of a polycarbonate resin with permanent, co-extruded, ultraviolet (UV) protective layers on both sides of the panels. These protective layers shall be co-extruded by the manufacturer during the original extrusion of the panel and shall be a permanent part of both the interior and exterior of the panels. Post-applied coating or films of dissimilar materials are unacceptable.
c. Panel thickness shall be a minimum of 40mm (1-9/16").
d. Panel width shall be nominally 19-11/16"
e. Panel weight shall be nominally 0.82 lbs. per sq. ft.
f. The panels shall be designed and formed with interlocking sides so that multiple panel installations can be achieved without the need to introduce independent mullion framing members.
g. The panels shall be designed and formed in a manner that allows the insertion of optional internal reinforcement bars, each in close proximity to the interlocking joints of a multiple panel application.
h. Panel shall be extruded in one single length. Transverse connections are not acceptable.
i. Free thermal movement of the panels shall be allowed to occur without compromising the weather tightness of the completed system.
j. Panels shall be supplied with closed cell, factory applied, and continuous gasket material on the panel tongue.
k. The interior cells of the cellular polycarbonate sheets shall be blown clean prior to being sealed. The top and bottom of each sheet shall be sealed with an air permeable filter tape.
l. The open end of each panel shall rest on a continuous metal setting fin or setting block which is designed to allow atmospheric air to reach the air permeable tape at the bottoms of the panels.
m. Glazing shall be installed in accordance with panel and system manufacturer's guidelines.

2. Thermal and Solar Performance:
   a. Insulation Value ("U-Value"): 0.264 BTU/hr. – sq. ft. degree F.
   b. Light Transmission (LT %): 47%
   c. Shading Coefficient (SC): 0.52
   d. Solar Heat Gain Coefficient (SHGC): 0.45
3. Flammability:
   a. The panel shall have a CC1 fire rating classification when tested in accordance with ASTM D-635 or equivalent.
   b. The panel shall have a [Class A] [Class C] flame spread and smoke development rating when tested in accordance with ASTM E-84.

2.03 FABRICATION AND WORKMANSHIP

A. Construct wall(s) using extruded aluminum members.

B. Carefully and accurately design, fabricate and assemble work with proper provision for thermal contraction and expansion. Work shall conform to profiles and sections noted on the shop drawings. Work shall be assembled with joints in a neat and finished manner.

C. All framing members shall be factory fabricated and assembled to the greatest degree possible, including the following:

1. Cutting members to length.
2. Installation of glazing gaskets, to be glued within extruded gasket tracks.
3. Drilling straight and countersunk mounting holes, fastener access holes, and weep holes.
4. Fabricating miter joints with concealed joint reinforcements and joint gaskets.

5. Installation of non-metallic thermal isolation spacers.
6. Removal of extrusion portions to accommodate tight over-lapping joinery and connections, including coped ends, mid-span notches, etc.
7. Fabrication and installation of splice plates at jointed connections.

2.04 FINISHES

A. Exposed surfaces of the aluminum framing members shall be finished as follows:

1. High-Performance Organic Coatings:
   a. Pigmented organic coatings: Fluoropolymer, 2-Coat 70% KYNAR 500 complying with AAMA 2605. Color custom.

Part 3 – EXECUTION

3.01 EXAMINATION

A. All submitted opening sizes, dimensions and tolerances are to be field verified by the installer unless otherwise stipulated.

B. Installer to examine site conditions to verify readiness. Notify general contractor or owner about any defects requiring correction, including but not limited to improperly sloping sill substrates and uneven planar substrates. Do not work until conditions are satisfactory.

3.02 INSTALLATION

A. Install components in strict accordance with manufacturer's instructions and approved shop drawings. Use proper fasteners and hardware for material attachments as specified.

B. Use methods of attachment to structure which include provisions for thermal movement.

C. Glazing shall be installed in accordance with panel and system manufacturer's guidelines.

D. Remove all protective coverings on polycarbonate panels during or immediately after installation.

E. Installation shall be performed by a company with ten (10) years continuous experience in commercial construction.

F. Protect contact points between unprotected dissimilar metals (except stainless steel) using continuous separators of FRP, PVC tape (or approved equal)

3.03 CLEANING AND PROTECTION

A. During installation, protect exposed surfaces against accumulation of paint, caulking, disfiguration and damage.

B. Interior glazing surfaces shall be cleaned as the panels are being installed. The exterior shall be cleaned as each phase of the work is completed.

C. Follow panel manufacturer instructions when cleaning exposed panel surfaces. Clean polycarbonate and frame at time of installation.

D. Follow panel manufacturer's guidelines when removing foreign substances from panel surfaces. Use only solvents that are deemed acceptable for use.

E. Before final acceptance, repair and/or replace any defective materials or work.

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 access control requirements.

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 samples for color of finishes (Black WILL NOT Be Acceptable In Lieu Of Antique Bronze Oiled Finish) and 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. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated, provide door hardware rated for use in assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C, unless otherwise indicated.

E. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meet requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.

1. Air Leakage Rate: Maximum air leakage of0.3 cfm/sq. ft. at the tested pressure differential of 0.3-inch wg of water.

F. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

G. 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.

H. 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.

I. 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/Russwin, Sargent, Schlage.
4. Flushbolts and Accessories – Hager, Ives, Rockwood.
5. Locksets – Baldwin, Corbin/Russwin, Sargent, Schlage.
6. Deadbolts – Baldwin, Corbin/Russwin, Sargent, Schlage.
7. Exit Devices – Precision, Sargent, Von Duprin.
8. Door Closers – Corbin/Russwin (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. Existing System:
   a. Master key or grand master key locks to Owner's existing system.
3. 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 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.

2.05 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
102B, 102C, 107, 113, 121A, 127
Each Opening Shall Have:

3 – Each Hinges	Hager	BB1279 4 1/2 X 4 1/2 X NRP X 652
1 – Lockset	Schlage	ND10S Rhodes X 626
1 – Closer	LCN	P1460/1460 AL X TBGN
1 – Kickplate	Rockwood	8 X 2 LDW 0.050 X 630 (Mounted push side)
1 – Threshold	Pemko	2005AV
1 – W/Strip	Pemko	303AV
1 – Door Bottom	Pemko	2211AV (for Hollow Metal Doors)
1 – Stop		(As Required)
3 – Silencers		

Provide the following items to be installed by Owner:
1 - Card reader equal to – RP40SE by HiD
1 - Maglock equal to – Securitron M62 series
1 - Motion sensor equal to – XMS by Securitron
1 - Push to exit equal to – TS2T by Sentrol

HW1B
114
Each Opening Shall Have:

3 – Each Hinges	Hager	BB1279 4 1/2 X 4 1/2 X 652
1 – Lockset	Schlage	ND80PD Rhodes X 626
1 – Closer	LCN	P1460/1460 AL X TBGN
1 – Kickplate	Rockwood	8 X 2 LDW 0.050 X 630 (Mounted push side)
1 – W/Strip	Pemko	303AV
1 – Door Bottom	Pemko	221AV (for Hollow Metal Doors)
1 – Stop		(As Required)
3 – Silencers		

Provide the following items to be installed by Owner:
1 - Card reader equal to – RP40SE by HiD
1 – Electric Strike equal to – HES 1006
1 - Motion sensor equal to – XMS by Securitron

HW2
109A, 110A, 121B
Each Opening Shall Have:

3 – Each Hinges	Hager	BB1279 4 1/2 X 4 1/2 X 652
1 – Lockset	Schlage	ND50PD Rhodes X 626
1 – Closer	LCN	P1460/1460 AL X TBGN
1 – Kickplate	Rockwood	8 X 2 LDW 0.050 X 630 (Mounted push side)
1 – W/Strip	Pemko	303AV
1 – Door Bottom	Pemko	221AV (for Hollow Metal Doors)
1 – Stop		(As Required)
3 – Silencers		

HW2B
111, 120B
Each Opening Shall Have:

3 – Each Hinges	Hager	BB1279 4 1/2 X 4 1/2 X NRP X 652
1 – Push Plate	Rockwood	70 (4 X 16) X 630
1 – Pull	Rockwood	70 (4 X 16) X 630
1 – Closer	LCN	P1460/1460 AL X TBGN
1 – Kickplate	Rockwood	8 X 2 LDW 0.050 X 630 (Mounted push side)
1 – W/Strip	Pemko	303AV
1 – Door Bottom	Pemko	221AV (for Hollow Metal Doors)
1 – Stop		(As Required)
3 – Silencers		

HW2C
115A, 115B
Each Opening Shall Have:

3 – Each Hinges	Hager	BB1279 4 1/2 X 4 1/2 X 652
1 – Lockset	Schlage	ND80PD Rhodes X 626
1 – Overhead Stop		(As Required)
3 – Silencers		

HW3
122, 123A, 124, 125, 126
Each Opening Shall Have:

3 – Each Hinges	Hager	BB1279 4 1/2 X 4 1/2 X 652
1 – Lockset	Schlage	ND50PD Rhodes X 626
1 – Cylinder	Best	As Required
1 – Stop	Rockwood	440 X 626
3 – Silencers		

HW4
116, 117, 120A
Each Opening Shall Have:

3 – Each Hinges	Hager	BB1279 4 1/2 X 4 1/2 X 652
1 – Push Plate	Rockwood	70 (4 X 16) X 630
1 – Pull	Rockwood	70 (4 X 16) X 630
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)
3 – Silencers		

HW5
109E
Each Opening Shall Have:

3 – Each Hinges	Hager	BB1279 4 1/2 X 4 1/2 X 652
1 – Lockset	Schlage	ND50PD Rhodes X 626
1 – Cylinder	Best	As Required
1 – Stop	Rockwood	555-12” X 626
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, Aluminum Framed Entrances and Storefronts, 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 41 13 - Aluminum Framed Entrances and Storefronts.

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-45l.
2. Heat-Treated Glass Standard: FS DD-G-l403.
3. Safety Glass Standard: CPSC l6 CFR l20l.
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. Safti First, San Francisco, CA. Tel. (888) 653-3333.
5. Viracon, Inc., Owatonna, MN. Tel. (800) 533-2080.
6. Walker Glass Co. Ltd., Quebec Canada, tel. (514) 352-3030.
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.

1. Single Vision Glazing: Type GL-3.
2. Application: Interior glazing unless otherwise indicated.
3. Type: Fully tempered float glass.
4. Tint: Clear.
5. Thickness: 1/4 inch.
6. Glazing Method: interior dry method, tape and tape.

2.04 INSULATING GLASS

A. Material (GL-1 and GL-2): 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 air.
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 –“Atalantica” with Solarban 70XL MSVD (Sputter) Low-E on 2nd (air space) surface by PPG Industries, Inc.

8. Interior Pane: Clear.
9. Unit Performance Requirements for “Atlantica”
   a. Light Transmission (visible): 51 percent
   b. U-Value, Summer: 0.28.
   c. U-Value, Winter: 0.29.
   d. Relative Heat Gain: 88 BTU per Hour Ft^2.
   e. Solar Heat Gain Coefficient (SHGC): 0.24
   f. Shading Coefficient: 0.28

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.

F. Unframed Mirrors: Install unframed mirrors with a combination of metal clips and construction adhesive securely attached to the wall studs and/or concealed blocking.

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 SECTION INCLUDES

A. Louvers, frames, and accessories not specified in other sections.

1.02 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels; 2013.

B. AMCA 511 - Certified Ratings Program Product Rating Manual for Air Control Devices; 2013.

1.03 SUBMITTALS

A. Product Data: Provide data describing design characteristics, maximum recommended air velocity, design free area, materials and finishes.

B. Shop Drawings: Indicate louver layout plan and elevations, opening and clearance dimensions, tolerances; head, jamb and sill details; blade configuration, screens, blankout areas required, and frames.

C. Samples: Submit two samples 2 by 2 inches in size illustrating finish and color of exterior and interior surfaces.

D. Test Reports: Independent agency reports showing compliance with specified performance criteria.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum three years of documented experience.

1.05 WARRANTY

A. Provide twenty year manufacturer warranty against distortion, metal degradation, and failure of connections.

1. Finish: Include coverage against degradation of exterior finish.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Wall Louvers:

1. Basis of Design: Greenheck Model EHH-601.

2. 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 LOUVERS

A. Louvers: Factory fabricated and assembled, complete with frame, mullions, and accessories; AMCA Certified in accordance with AMCA 511.

1. Wind Load Resistance: Design to resist positive and negative wind load (see wind load component and Cladding table on sheet S100) without damage or permanent deformation.
2. Louver Performance: As per "Wall Louver Schedule", Sheet M602.
3. Wall Cap: Equal to Greenheck Model "WC".
   a. Size: As per "Wall Louver Schedule", Sheet M602.
4. Drainable Blades: Continuous rain stop at front or rear of blade aligned with vertical gutter recessed into both jambs of frame.
5. Screens: Provide insect screens at intake louvers and bird screens at exhaust louvers.

B. Stationary Louvers: Horizontal blade, extruded aluminum construction, with formed aluminum sill pan and drainable head.

1. Blades: V-shaped, sight-proof.
   a. Rain resistant blades as tested by AMCA 500L test procedures.
2. Frame: 6 inches deep, channel profile; corner joints mitered and, with continuous recessed caulking channel each side.
3. Aluminum Thickness: Frame 12 gage, 0.0808 inch minimum; blades 12 gage, 0.0808 inch minimum.
4. Aluminum Finish: Superior performing organic coatings; finish welded units after fabrication.

2.03 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Bird Screen: Interwoven wire mesh of aluminum, 0.063 inch diameter wire, 3/4 inch open weave, diagonal design, in removable frame, inside mount (rear).

C. Insect Screen: 18 x 16 size aluminum mesh.

D. Security Bars: Provide security bars at Louver 101E.

2.04 FINISHES

A. Superior Performing Organic Coatings: AAMA 2605 multiple coat, thermally cured two-coat polyvinylidene fluoride system.

1. Polyvinylidene fluoride (PVDF) multi-coat thermoplastic two-coat fluoropolymer coating system, including minimum 70 percent PVDF color topcoat and minimum total dry film thickness of 0.9 mil; color and gloss as indicated on drawings.
2. Manufacturer to furnish an extended 20 year limited warranty for the PVDF Coating. This warranty shall begin on the date of material shipment.

B. Color: As selected from manufacturer's standard 24 colors.

2.05 ACCESSORIES

A. Screens: Frame of same material as louver, with reinforced corners; removable, screw attached; installed on inside face of louver frame.

B. Fasteners and Anchors: Galvanized steel.

C. Flashings: Of same material as louver frame, formed to required shape, single length in one piece per location.

D. Sealant for Setting Sills and Sill Flashing: Non-curing butyl type.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that prepared openings and flashings are ready to receive work and opening dimensions are as indicated on shop drawings.

3.02 INSTALLATION

A. Install louver assembly in accordance with manufacturer's instructions.

B. Install louvers level and plumb.

C. Install flashings and align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.

D. Secure louver frames in openings with concealed fasteners.

3.03 CLEANING

A. Strip protective finish coverings.

B. Clean surfaces and components.

3.04 SCHEDULES

A. See "Wall Louver Schedule", Sheet M602.

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. Manufacture'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 / MATERIAL	MANUFACTURER / NUMBER & COLOR NAME
04 20 00 – Brick	Cherokee Brick - Carolina Ceramics Brick Company – Shadow Gray
04 20 00 – Architectural Masonry Units	Northfield Block, Cordova Stone - Alabaster
04 20 00 – Mortar	Custom Color to match Cordova Stone.
04 20 00 – Weep Vents	Match Mortar Color

05 50 00 – Pipe Railing	P2 (Trim Paint)
05 50 00 – Bollard Cover	Yellow
05 50 00 – Steel Fabricated Work Tables	Painted with Benjamin Moore #2126-10 Black Tar
05 50 00 – Downspout Boots	Match Downspout color
06 40 00 – Plastic Laminate – PLAM-1	Formica; Color: 5881-58 Chocolate Warp
06 40 00 – Plastic Laminate – PLAM-2	Wilsonart Laminate; Color: 1787-60 Oxide
06 40 00 – Plastic Laminate – PLAM-3	Wilsonart Laminate; Color: 4885-38 Green Soapstone
06 40 00 – Wood Veneer	To match Graham door color #375 Hazel
06 40 00 – Architectural Millwork Hardware	Satin Chrome
06 40 00 – Grommet	Black
06 40 00 – Edge mold	Laminate to match adjacent surface
06 40 00 – Workstation Support Bracket	Paint to match adjacent wall finish
07 62 00 – Metal Flashing - Trim	Match adjacent metal finishes
07 62 00 – Metal Flashing – Downspout	Match adjacent Wall Panel
07 92 00 – Joint Sealants	Match adjacent lighter color
08 14 29 – Prefinished Wood Doors	ST1 Graham #375 Hazel
08 31 13 – Access Doors and Frames	Paint to match adjacent wall
08 33 23 – Overhead Coiling Doors	Trim – Match Bone White
08 33 23 – Overhead Coiling Doors	Door – Match Brick Color
08 41 13 – Aluminum Framed Storefronts	Bone White
08 45 19 – Polycarbonate Wall System	Framing – Kynar Bone White
08 45 19 – Polycarbonate Wall System	Wall Panel - Opalescent
08 71 00 – Door Hardware	Noted in Schedule
08 80 00 – Glazing	PPG Atlantica, SOLARBAN 70XL
08 91 19 – Fixed Louvers - In Metal Panel Walls	Greenheck, Herring Bone GF107
08 91 19 – Fixed Louvers - In AMU Walls	Greenheck, Herring Bone GF107
08 91 19 – Fixed Louvers - In Brick Walls	Greenheck, Sierra Tan GF118
09 31 13 – Ceramic Wall Tile CT-1	Daltile - Series: “Polaris”; Color: Gloss Almond
09 31 13 – Grout (Walls)	To be selected from manufacturers standard color options.
09 31 13 – Porcelain Floor Tile POR - 1	Daltile – Series: “Unity”; Color: Tobacco P403
09 31 13 – Porcelain Tile Base POR - 1	Daltile – Series: “Unity”; Color: Tobacco P403
09 31 13 – Grout (Porcelain Tile)	To be selected from manufacturers standard color options.
09 51 00 – Acoustical Ceilings	Armstrong Lay-In Ceiling Tile (24” x 24”) Item #1728 Square Lay-In; Color: White
09 65 00 – Resilient Floor – LVP-1	Shaw Commercial Hard Surface (6” x 36”) Luxury Vinyl Plank; Series: Uncommon Ground; Color: 02560 Skyline
09 65 00 – Rubber Base	Johnsonite 4” Base; Color: Burnt Umber
09 65 00 – Resilient Edge Strips	Johnsonite; Color: Burnt Umber
09 65 00 – Stair Treads and Risers	Johnsonite; Color: Burnt Umber
09 90 00 – Paint – P1 (General Wall Paint)	Benjamin Moore #HC-83 Grant Beige
09 90 00 – Paint – P2 (Trim Paint)	Benjamin Moore #978 Raccoon Hollow
09 90 00 – Paint – P3 (Accent Wall Paint)	Benjamin Moore #2142-40 Creekside Green
09 90 00 – Paint – P4 (Exterior HW & Railings)	P2 (Trim Paint)
09 90 00 – Paint – P5 (Ceiling)	Benjamin Moore #967 Cloud White
10 11 00 – Visual Display Board	All finishes to be selected when submitted
10 14 00 – Signage	To be selected from manufacturers standard color options.

10 21 15 – Solid Plastic Toilet Partition	To be selected from manufacturers standard color options.
10 26 13 – Corner Guards	to be selected when submitted
10 51 13 – Metal Lockers	Penco; Color: 028 Gray
10 73 16 – Canopies	Mapes Bone White
11 31 15 – Residential Appliances (Range)	GE – Stainless Steel
11 31 15 – Residential Appliances (Microwave)	GE – Stainless Steel
11 31 15 – Residential Appliances (Refrigerators)	GE – Stainless Steel
12 21 14 – Horizontal Blinds	To be selected from manufacturers standard color options.
13 34 19 – Metal Building System	Roof Panels - Brownstone
13 34 19 – Metal Building System	Gutters – Snow White
13 34 19 – Metal Building System	Fascia, Rake – Snow White
13 34 19 – Metal Building System	Wall Panels - Almond

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 21 16 GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Performance criteria for gypsum board assemblies.
2. Metal stud wall framing.
3. Metal channel ceiling framing.
4. Acoustic insulation.
5. Gypsum sheathing.
6. Gypsum wallboard.
7. Joint treatment and accessories.

A. Reference Standards:

1. AISI S100-12 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2012.
2. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
3. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2012.
4. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2014.
5. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2012.
6. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2015.
7. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2013.
8. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2011.
9, ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2014.
10. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2014a.
11. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2013.
12. ASTM C1280 - Standard Specification for Application of Gypsum Sheathing; 2013.
13. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2014.
14. ASTM C1658/C1658M - Standard Specification for Glass Mat Gypsum Panels; 2013.
15. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2012.
16. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009.
17. ASTM E413 - Classification for Rating Sound Insulation; 2010.
18. GA-216 - Application and Finishing of Gypsum Board; Gypsum Association; 2013.

1.03 SUBMITTALS

A. Shop Drawings: Indicate special details associated with acoustic seals.

B. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.

C. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

D. Samples: Submit two samples of predecorated gypsum board, 12 by 12 inches in size, illustrating finish color and texture.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing gypsum board application and finishing, with minimum 5 years of documented experience.

B. Copies of Documents at Site: Maintain at the project site a copy of each referenced document that prescribes execution requirements.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.

1. See PART 3 for finishing requirements.

B. Interior Partitions: Provide completed assemblies with the following characteristics:

1. Acoustic Attenuation: STC of 45-49 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

2.02 METAL FRAMING MATERIALS

A. Manufacturers - Metal Framing, Connectors, and Accessories:

1. Clarkwestern Dietrich Building Systems LLC: www.clarkdietrich.com.
2. Marino: www.marinoware.com.
3. 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.

B. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf.

1. Studs: "C" shaped with flat or formed webs with knurled faces.
   a. At no time can the gauge be less than 20 regardless of the listing in the manufacturer's tables.
2. Runners: U shaped, sized to match studs.

3. Ceiling Channels: C-shaped.
   a. Designation on drawings; CRC = (Cold Rolled Channel)
   b. Size: As required by length.
4. Ceiling Framing: L/240 Load Deflection with sizes for fully braced mid-span support.
   a. Size: Pro 20DW (all sizes).
5. Furring: Hat-shaped sections, minimum depth of 7/8 inch.
6. Resilient Furring Channels: 1/2 inch depth, for attachment to substrate through one or two legs.
   a. Size: One Leg 1/2 inch x 2-1/4 inch.
   b. Size: Two Leg 1/2 inch x 1-1/4 inch.

C. Loadbearing Studs for Application of Gypsum Board: As specified in Section 05 40 00.

D. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.

E. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.

1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI SG02-1.
2. Material: ASTM A653/A653M steel sheet, SS Grade 50/340, with G60/Z180 hot dipped galvanized coating.
3. Provide components UL-listed for use in UL-listed fire-rated head of partition joint systems of fire rating and movement required.
4. Deflection and Firestop Track:
   a. Provide mechanical anchorage devices as described above that accommodate deflection while maintaining the fire-rating of the wall assembly.

2.03 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:

1. CertainTeed Corporation: www.certainteed.com.
2. Georgia-Pacific Gypsum: www.gpgypsum.com.
3. National Gypsum Company: www.nationalgypsum.com.
4. USG Corporation: www.usg.com.
5. 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.

B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.

1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
2. Glass mat faced gypsum panels as defined in ASTM C1658/C1658M, suitable for paint finish, of the same core type and thickness may be substituted for paper-faced board.
3. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   a. Mold resistant board is required at all locations, except wet areas specified for tile backer board - See 09 31 13.
4. Thickness:
   a. Vertical Surfaces: 5/8 inch.
   b. Ceilings: 5/8 inch.

5. Mold Resistant Paper Faced Products:
   a. CertainTeed Corporation; ProRoc Brand Moisture & Mold Resistant Gypsum Board.
   b. Georgia-Pacific Gypsum; ToughRock Mold-Guard.
   c. National Gypsum Company; Gold Bond Brand XP Gypsum Board.
   d. USG Corporation; Sheetrock Brand Mold Tough Gypsum Panels.
   e. 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.

C. Backing Board For Non-Wet Areas: Water-resistant gypsum backing board as defined in ASTM C1396/C1396M; sizes to minimum joints in place; ends square cut.

1. Application: All toilet walls.
2. Type: Regular, in locations indicated.
3. Regular Board Thickness: 1/2 inch.
4. Edges: Tapered.
5. Products:
   a. Georgia-Pacific Gypsum; DensShield Tile Backer.
   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.

D. Exterior Sheathing Board: Sizes to minimize joints in place; ends square cut.

1. Application: Exterior sheathing, unless otherwise indicated.
2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
3. Glass Mat Faced Sheathing: Glass mat faced gypsum substrate as defined in ASTM C1177/C1177M.
4. Regular Board Thickness: 1/2 inch.
5. Edges: Square, for vertical application.
6. Weight: 1.9 lb/sq. ft.
7. Surfacing: Fiberglass mat on face, back, and long edges.
8. Racking Strength (Ultimate, not design value) (ASTM E72): Not less than 540 pounds per square foot, dry.
9. Flexural Strength, Parallel (ASTM C473): 80 lbf, parallel.
10. Humidified Deflection (ASTM C1177): Not more than 2/8 inch.
11. Permeance (ASTM E96): 23 perms.
12. R-Value (ASTM C518): 0.56.
13. Mold Resistance (ASTM D3273): 10, in a test as manufactured.
14. Microbial Resistance (ASTM D6329, GREENGUARD 3-week protocol): Will not support microbial growth.
15. Glass Mat Faced Products:
    a. Georgia-Pacific Gypsum; DensGlass Sheathing.
    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.

2.04 ACCESSORIES

A. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced. Thickness: 3-1/2 inches.

1. Metal Stud Wall Framing: Owens Corning EcoTouch Sound Attenuation Batts.
   a. STC (glass fiber): 49 with 5/8 inch gypsum board ea. side.
2. Substitutions: See Section 01 6000 - Product Requirements.
3. Thermal Resistance: R of 11.

B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.

C. Water-Resistive Barrier: See Section 07 2500.

D. Finishing Accessories: ASTM C1047, 6063 T5 Aluminum, unless noted otherwise.

1. Types: As detailed or required for finished appearance.
2. Finish: White
3. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead at exposed panel edges.
   a. Fry "J" Molding.
   b. Fry Corner Trim.
   c. Fry Edge Trim.

E. Beads, Joint Accessories, and Other Trim: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.

F. Joint Materials: ASTM C475 and as recommended by gypsum board manufacturer for project conditions.

1. Tape: 2 inch wide, coated glass fiber tape for joints and corners, except as otherwise indicated.
2. Tape: 2 inch wide, creased paper tape for joints and corners, except as otherwise indicated.
3. Ready-mixed vinyl-based joint compound.
4. Control Joints: #093 as manufactured by USG, for use in gypsum board walls and ceilings or Fry #DRMV-25.
5. Chemical hardening type compound.

G. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inch in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion resistant.

H. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws, corrosion resistant.

I. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.

B. Suspended Ceilings and Soffits: Space framing and furring members at 24 inches on center.

1. Level ceiling system to a tolerance of 1/1200.
2. Laterally brace entire suspension system.
3. Install bracing as required at exterior locations to resist wind uplift.

C. Studs: Space studs at 16 inches on center.

1. Extend partition framing to structure in all locations.
2. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.

D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.

E. Standard Wall Furring: Install at masonry walls scheduled to receive gypsum board, not more than 4 inches from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 24 inches on center.

F. Blocking: Install wood blocking for support of:

1. Framed openings.
2. Wall mounted cabinets.
3. Plumbing fixtures.
4. Toilet partitions.
5. Toilet accessories.
6. Wall mounted door hardware.

3.03 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

B. Acoustic Sealant: Install in accordance with manufacturer's instructions.

1. Place continuous bead at perimeter of each layer of gypsum board.
2. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

3.04 BOARD INSTALLATION

A. Comply with ASTM C 840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

1. When gypsum board is to be applied to both the ceiling and walls, the gypsum board is to be applied to the ceiling and then the walls.
2. Deflection at design load of horizontal (ceiling) framing members supporting gypsum board shall be not more than L/240 of the span.

B. Single-Layer Non-Rated: Install gypsum board perpendicular to framing, with ends and edges occurring over firm bearing.

C. Double-Layer Non-Rated: Use gypsum board for first layer, placed parallel to framing or furring members, with ends and edges occurring over firm bearing. Use glass mat faced gypsum board at exterior walls and at other locations as indicated. Place second layer perpendicular to framing or furring members. Offset joints of second layer from joints of first layer.

D. Exterior Sheathing: Comply with ASTM C1280. Install sheathing vertically, with edges butted tight and ends occurring over firm bearing.

1. DensGLass Sheathing:
   a. Fasteners should be driven flush with the panel surface (not countersunk) and into the framing system. Locate fasteners at least 3/8 inch from the ends and edges of the sheathing.
   b. Nails or screws shall be in accordance with the manufacturer's application specifications.
   c. For horizontal applications install with end joints staggered.

E. Installation on Metal Framing: Use screws for attachment of gypsum board except face layer of non-rated double-layer assemblies, which may be installed by means of adhesive lamination.

F. Moisture Protection: Treat cut edges and holes in moisture resistant gypsum board and exterior gypsum soffit board with sealant.

3.05 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as follows:

1. Control joints shall be manufactured devices for this purpose.
2. Control joints shall be installed where indicated on the plans. Full height door frames shall be considered equivalent to a control joint.
3. A control joint shall be installed where a partition, wall or ceiling traverses a construction joint (expansion, seismic, or building control element) in the base building structure.
4. Control joints shall be installed where a partition, wall, or ceiling runs in a uninterrupted straight plane exceeding 30 linear ft.
5. Control joints in interior ceilings with perimeter relief shall be installed so the linear dimensions between control joints do not exceed 50 ft and total area between control joints does not exceed 2500 sq. ft.
6. Control joints in exterior ceilings and soffits shall be installed so that linear dimensions between control joints do not exceed 30 ft. and total area between control joints does not exceed 900 sq. ft.

7. A control joint or intermediate blocking shall be installed where ceiling framing members change direction.
8. Where a control joint occurs in an acoustical or fire-rated system, blocking shall be provided behind the control joint by using a backing material such as 5/8-inch Type X gypsum board, mineral fiber or other tested equivalent.
9. At exterior soffits, not more than 30 feet apart in both directions.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.06 JOINT TREATMENT

A. Glass Mat Faced Gypsum Board and Exterior Glass Mat Faced Sheathing: Use fiberglass joint tape, bedded and finished with chemical hardening type joint compound.

B. Paper Faced Gypsum Board: Use paper joint tape, bedded with ready-mixed vinyl-based joint compound and finished with ready-mixed vinyl-based joint compound.

C. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:

1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
2. Level 1: All wall surfaces in the interstitial areas above finished ceilings, whether or not accessible in the completed construction.

D. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.

1. Feather coats of joint compound so that camber is maximum 1/32 inch.
2. Taping, filling, and sanding is not required at surfaces behind adhesive applied ceramic tile and fixed cabinetry.
3. Taping, filling and sanding is not required at base layer of double layer applications.

3.07 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

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. Provide equivalent tile products as indicated on Interior Finish Schedule.

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. Paver Tile, Type POR-1 (Porcelain Tile) as indicated on Interior Finish Schedule and Section 09 05 15; ANSI A137.1 and as follows:

1. Size and Shape: 12 inches square.
2. Thickness: 3/8 inch.
3. Edges: Cushioned.
4. Surface Finish: Unglazed.

C. Wall Tile, Type CT-1 (Ceramic Tile) as indicated on Interior Finish Schedule and Section 09 05 15; ANSI A137.1 and as follows:

1. Size and Shape: 9 inches by 12 inches.
2. Edges: Cushioned.

D. 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.

E. Epoxy Grout: ANSI A 118.3, with Tile Contractor's Association certification of conformance. Equal to Laticrete Type SpectraLOCK Pro Grout.

1. Application: Toilet floors and walls.
2. Color: Selected by Architect from manufacturer's full range of standard colors.
3. Equivalent products by Custom Building Products and Mapei are acceptable.

F. Accessories: Three way cove-shaped profiles made of recycled rigid PVC for inside wall corners equal to Schluter®-DILEX-EKE.

1. Equivalent products by Blanke Corp are acceptable.
2. Color 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. Porcelain Tile: 1/16 inch.
2. Ceramic Wall Tile: 1/16 inch.

G. Lay out full height wall tile 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. Metal Edge Strips:

1. Non-Ceramic Trim: Brushed stainless steel, style and dimensions to suit application, for setting using tile mortar or adhesive.
2. Product: Equal to RENO-RAMP, as manufactured by Schluter-Systems, Inc.

J. Accessories: Comply with manufacturer’s installation instructions.

K. 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 51 00 ACOUSTICAL CEILINGS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Lay-in acoustical panels (2 ft. by 2 ft. grids) and exposed suspension systems for ceilings.
2. Suspended metal grid system complete with wall trim.

B. Related Sections:

1. Section 09 29 00 – Gypsum Board.
2. Division 23 for Mechanical Requirements.
3. Division 26 for Electrical Requirements.

1.02 ACTION SUBMITTALS

A. Product Data: Manufacturer's product specifications, and installation instructions for each acoustical ceiling material required, and for each suspension system, including certified laboratory test reports and other data as required to show compliance with these specifications.

1. Include manufacturer's recommendations for cleaning and refinishing acoustical units, including precautions against materials and methods that may be detrimental to finishes and acoustical performances.

B. Samples: For each exposed product and for each color and texture specified.

1.03 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Evaluation reports.

C. Field quality-control reports.

1.04 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.05 QUALITY ASSURANCE

A. Installer: A company with not less than 3 years of documented successful experience in installation of acoustical ceilings similar to requirements for this Project.

1. References required for approval.

1.06 PROJECT CONDITIONS

A. Do not install acoustical ceilings until the following conditions are met:

1. Space is enclosed and weatherproof.
2. Wet work in space completed and nominally dry.
3. Work above ceilings is completed.
4. Ambient conditions of temperature and humidity will be continuously maintained at values near those indicated for final occupancy.

B. Maintain a light level of a minimum of 50 fc during entire installation.

1.07 COORDINATION

A. It shall be this contractor's responsibility to coordinate with mechanical and electrical trades with respect to their requirements for additional suspension system components. Additional components required shall be furnished and installed by this contractor.

1.08 MAINTENANCE STOCK

A. At time of completing installation, deliver stock of maintenance material to Owner.

1. Furnish full size units matching units installed, packaged with protective covering for storage, and identified with appropriate labels.
2. Furnish amount equal to 3 percent of acoustical units and exposed suspension installed.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.
2. Smoke-Developed Index: 50 or less.

2.02 ACOUSTICAL PANEL CEILINGS, GENERAL

A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 20 percent.

B. Glass-Fiber-Based Panels: Made with binder containing no urea formaldehyde.

1. Type LAT-1 as indicated on Interior Finish Schedule and Section 09 05 15.

C. Acoustical Panel Standard: Comply with ASTM E 1264.

D. Metal Suspension System Standard: Comply with ASTM C 635.

E. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

2.03 ACOUSTICAL PANELS

A. Manufacturers: Provide manufacturer's standard lay-in panels of type recommended by manufacturer for application indicated. Provide sizes shown by reflected ceiling plans or, if not otherwise indicated, 2 ft. by 2 ft. grid-size panels, with white washable finish.

B. Mineral Fiber Acoustical Tile: Provide units that are sag resistant and with Antimicrobial solution (MOLD AND MILDEW GUARD) not less than 5/8-inch thick and of density not less than l0 pounds per cubit foot, medium-coarse non-directional texture, NRC 0.50 to 0.60, CAC 25 to 33, light reflectance over 75 percent. Products offered by manufacturers to comply with requirements include the following:

1. No. 1728 Fine Fissured Square Edge; Armstrong World Industries, Inc.
2. Van-157 Vantage 10 Trim Edge; CertainTeed Corp.
3. No. 2210 Radar ClimaPlus Square Edge; U.S. Gypsum Co.

2.04 METAL SUSPENSION SYSTEM

A. Comply with ASTM C 635, as applicable to type of suspension system required for type of ceiling units indicated. Coordinate with other work supported by or penetrating through ceilings, including light fixtures, HVAC equipment, and partition system (if any). Structural Class of the system shall be intermediate-duty.

B. Attachment Devices: Size for 5 times design load indicated in ASTM C 635, Table l, Direct Hung.

1. Hanger Wires: Galvanized carbon steel, ASTM A 64l, soft temper pre-stretched, yield-stress load of at least 3 times design load, but not less than l2 gage (0.l06 inch).
2. Type of System: Either direct or indirect-hung suspension system, at Contractor's option.
3. System Manufacturer: Same as acoustical unit manufacturer or one of the following:
   a. Armstrong World Industries, Inc.
   b. CertainTeed Corp.
   c. Chicago Metallic Corp.
   d. USG Interiors, Inc.

C. Edge Moldings: Manufacturer's standard channel molding for edges and penetrations of ceiling, with single flange of molding exposed, white baked enamel finish unless otherwise indicated.

D. Exposed Suspension System: Manufacturer's standard exposed runners, cross-runners and accessories, or types and profiles indicated, with exposed cross runners coped to lay flush with main runners. Provide uniform factory-applied finish on exposed surfaces of ceiling suspension system, including moldings, trim, and accessories. Use manufacturer's standard baked enamel finish, color white, unless otherwise selected by MDOT Architect.

2.05 MISCELLANEOUS MATERIALS

A. Edge Trim Molding: Metal or extruded PVC plastic, of types and profiles indicated, white finish unless otherwise indicated.

B. Hold-Down Clips: Where required for wind uplift resistance or fire-resistance rating, provide standard spring steel clips, except provide accessible type at locations indicated on drawings.

PART 3 - EXECUTION

3.01 COORDINATION

A. Mechanical and electrical work above suspended ceiling shall be strictly coordinated with the work in this Section.

3.02 EXAMINATION

A. Installer must examine conditions under which acoustical ceiling work is to be performed and must notify Contractor in writing of unsatisfactory conditions.

1. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.03 PREPARATION

A. Furnish layouts for inserts, clips, or other supports required to be installed by other trades for support of acoustical ceilings.

1. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling.
2. Avoid use of less-than-half width units at borders, and comply with reflected ceiling plans wherever possible.

3.04 INSTALLATION

A. Install acoustical panel ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

1. Comply with governing regulations, fire resistance rating requirements as indicated, and industry standards applicable to the Work.
2. Hangers: Support only from building structural members.
   a. Locate hangers near each end and spaced 4 feet along each carrying channel or direct-hung runner, unless otherwise indicated, leveling to tolerance of l/8 inch in l2 feet.
   b. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eye-screws, or other devices which are secure and appropriate for substrate, and which will not deteriorate or fail with age or elevated temperatures.

3. Edge Molding: install edge moldings of type indicated at perimeter of acoustical ceiling area and at locations where necessary to conceal edges of acoustical units.
   a. Screw-attach moldings to substrate at intervals not over l6 inches on center and not more than 3 inches from ends, leveling with ceiling suspension system to tolerance of l/8 inch in l2 feet. Miter corners accurately and connect securely.
4. Install acoustical panels in coordination with suspension system, with edges concealed by support of suspension members.
   a. Scribe and cut panels to fit accurately at borders and at penetrations.
   b. Install hold-down clips in areas indicated, and in areas where required by governing regulations or for fire- resistance ratings; space as recommended by panel manufacturer, unless otherwise indicated or required.

B. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.05 ADJUSTING AND CLEANING

A. Adjust sags or twists which develop in the ceiling system and replace parts that are damaged or faulty.

B. Clean exposed surfaces of acoustical ceilings, including trim, edge moldings, and suspension members; comply with manufacturer's instructions for cleaning and touch-up of minor finish damage.

1. Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

SECTION 09 65 00 RESILIENT FLOORING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Luxury Vinyl Plank (LVP), Vinyl Composition Tile (VCT), rubber 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.

1.06 WARRANTY

A. Special Warranty for LVP: Manufacturer agrees to repair or replace components of LVP installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of due to unusual traffic, failure of substrate, vandalism, or abuse.
2. Warranty Period: Limited 10 year commercial wear from date of completion Commercial Warranty and limited 5 year from date of completion under bed warranty (when installed with Shaw 4100 or S150 adhesive).

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Luxury Vinyl Plank is based on products manufactured by Shaw Commercial Hard Surface, Dalton, GA 30722, Tel. No. (800) 241-2073.

B. Vinyl Composition Tile is based on products manufactured by Mannington Commercial, P.O. Box 12281, Calhoun, GA 30701, Tel. No. (800) 241-2262.

C. Equivalent products by the following manufacturers are acceptable:

1. Armstrong Commercial Flooring, Lancaster, PA. Tel. No. (800) 292-6308.
2. Johnsonite, Chagrin Falls, OH. Tel. No. (800) 899-8916.
3. Patcraft, Dalton, GA. Tel. No. (800) 241-4014.

D. 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 LUXURY VINYL FLOOR PLANK

A. Style / Number: Uncommon Ground 6 inch / 0188V.

B. Construction: High Performance Luxury Vinyl Plank.

C. Class / ASTM F-1700: Class III Printed Film Vinyl Tile.

D. Finish: ExoGuard™ Quartz Enhanced Urethane.

E. Nominal Dimensions: 6 inches wide, by 36 inches long.

F. Pattern: “Row by Row fashion” (Refer to Drawing for directions).

G. Overall Thickness: Nominal 1/8 inch.

H. Wearlayer Thickness: 0.020 inches.

I. Installation Method: Glue down.

J. Adhesive: Shaw 4100 or S150.

K. Color: Color to be selected by Project Engineer / MDOT Architect from manufacturer's full range of colors. Refer to Section 09 05 15 – Color Design for color selection.

L. Testing:

1.	Slip Resistance (ASTM D-2047):	ADA Compliant.
2.	Heat Stability (ASTM F-1514):	Passes.
3.	Light Resistance (ASTM F-1515):	Passes.
4.	Stain & Chemical Stability (ASTM F-925):	Passes.
5.	Flooring Radiant Panel (ASTM E-648):	≥ 0.45 watts/cm², NFPA Class I.
6.	N.B.S. Smoke Chamber (ASTM E-662):	< 450, Passes.
7.	FloorScore Indoor Air Quality:	SCS Certified.

2.03 VINYL COMPOSITION FLOOR TILE

A. Floor 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: Unless indicated otherwise, color(s) 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.

2.04 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.

2.05 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 LVP and VCT floor and adhesive manufacturer(s) to suit LVP and VCT floor, rubber wall base and substrate conditions indicated.

1. Adhesives shall comply with the following limits for VOC content:
   a. LVP and VCT Adhesives: 50 g/L or less.
   b. Rubber Floor Base Adhesives: 60 g/L or less.

C. Concrete Slab Primer: Non-staining type as recommended by flooring manufacturer.

D. Floor Polish (VCT): 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 LVP and VCT floor 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 luxury vinyl plank floor manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by luxury vinyl plank floor 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 LVP and VCT floor 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 LVP and VCT 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 LVP and VCT.

3.03 LUXURY VINYL PLANK (LVP)INSTALLATION

A. Comply with manufacturer's written instructions for installing floor plank.

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. Scribe, cut, and fit floor planks to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

D. Extend floor planks into toe spaces, door reveals, closets, and similar openings. Extend floor planks to center of door openings.

E. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor planks as marked on substrates. Use chalk or other nonpermanent marking device.

F. Install floor planks 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.

G. Adhere floor planks 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 VINYL COMPOSITION TILE (VCT) 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. Unless indicated otherwise, 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 VCT 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 VCT 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.

3.05 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.

3.06 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting floor plank and wall base.

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 planks 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. VCT: Apply3 coats of manufacturers recommended high-quality cross-linked acrylic floor polish, allowing 60 minutes drying time between applications.

D. Finishing VCT: 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.

E. Protection: Protect installed flooring from damage by covering with floor protection paper. 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.

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, and duct 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. Coating Maintenance Manual: Upon conclusion of the project, the Contractor or paint manufacturer / supplier shall furnish a coating maintenance manual, such as Sherwin-Williams "Custodian Project Color and Product Information" report or equal. Manual shall include an Area Summary with finish schedule, Area Detail designating where each product / color / finish was used, product data pages, Material Safety Data sheets (MSDS), care and cleaning instructions, including touch-up procedures.

F. 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, including surface preparation.
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 Paints, Inc., Pittsburgh, PA. Tel (412) 434-3131.
4. Rust-Oleum, Vernon Hills, IL. 60061. Tel. (800) 323-3584.
5. 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 written instructions and as herein specified, for each particular substrate condition.

1. 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.
2. Remove, if necessary, for the complete painting of the items and adjacent surfaces.
3. Following completion of painting of each space or area, re-install the removed items by workmen skilled in the trades involved.
4. Clean surfaces to be painted before applying paint or surface treatments.
5. Remove oil and grease prior to mechanical cleaning.
6. Schedule the cleaning and painting so that contaminates 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 Mechanical, Plumbing and Electrical 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. Upon completion of painting work, clean window glass and other paint-spattered surfaces. 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 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 and steel stairs and handrails)
   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
3. Painted Woodwork
   a. Prime Coat: #N023 Fresh Start Acrylic All Purpose Primer
   b. Intermediate Coat: #N449 Ultra Spec Exterior Acrylic House & Trim
   c. Topcoat: #N449 Ultra Spec Exterior Acrylic House & Trim
4. Stained Woodwork (Solid Color)
   a. Prime Coat: 640 Arborcoat Acrylic Solid Siding Stain
   b. Intermediate Coat: 640 Arborcoat Acrylic Solid Siding Stain
   c. Topcoat: 640 Arborcoat Acrylic Solid Siding Stain
5. Stained Woodwork (Semi-Transparent)
   a. Prime Coat: #328 Premium Exterior Semi Transparent Stain
   b. Topcoat: #328 Premium Exterior Semi Transparent Stain
6. Concrete Walls
   a. Prime Coat: #068 Moore's Hi-build Acrylic Masonry Primer
   b. Topcoat: #056 Moorlastic Elastomeric Waterproofing Coating
7. Concrete Masonry Units
   a. Prime Coat: #N068 Moore's Hi-build Acrylic Masonry Primer
   b. Topcoat: #056 Moorlastic Elastomeric Waterproofing Coating

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 and steel stairs and handrails)
   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)
3. Painted Woodwork
   a. Prime Coat: F/C #235 Interior/Exterior 100% Acrylic Latex Undercoater (1.7 mils DFT) If tannin bleeding occurs, use F/C #160 Oil-Base Undercoater (2.1 mils DFT)
   b. Intermediate Coat: F/C #2400 Line 100% Acrylic Exterior Gloss House Paint (2 mils DFT)
   c. Topcoat: F/C #2400 Line 100% Acrylic Exterior Gloss House Paint (2 mils DFT)
4. Stained Woodwork (Solid Color)
   a. Prime Coat: F/C #160 Oil-Base Undercoater. Use ONLY if wood has tannins that will bleed through latex stain.(2.1 mils DFT)
   b. Topcoat: F/C #260 Line 100% Acrylic Exterior Latex Stains (1.5 mils DFT)
5. Stained Woodwork (Semi-Transparent) Not for horizontal foot traffic
   a. Prime Coat: F/C #171 Line Wood Kraft Exterior Oil-Base Stain
   b. Topcoat: F/C #171 Line Wood Kraft Exterior Oil-Base Stain
6. Concrete Walls
   a. Prime Coat: F/C #697 100 % Acrylic Latex Bonding Primer (1.7 mils DFT)
   b. Intermediate Coat: F/C #200 Line 100% Acrylic Latex Flat (1.9 mils DFT)
   c. Topcoat: F/C #200 Line 100% Acrylic Latex Flat (1.9 mils DFT)
7. Concrete Masonry Units
   a. Filler Coat: F/C #470A Interior/Exterior Acrylic Latex Masonry Block Filler (10 mils DFT)
   b. Prime Coat: F/C #200 Line 100% acrylic Latex Flat (1.9 mils DFT)
   c. Topcoat: F/C #200 Line 100% acrylic Latex Flat (1.9 mils DFT)

C. Provide the following PPG Paints, 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 and steel stairs and handrails)
   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)

3. Painted Woodwork
   a. Prime Coat: PPG Speedhide Exterior Latex Wood Primer, 6-609 (1.6 mils dry) If tannin bleeding occurs, use PPG Seal Grip Alkyd Universal Primer 17-941NF.
   b. Intermediate Coat: PPG Speedhide Exterior Acrylic Semi-Gloss, 6-900Xl (1.1 mils dry)
   c. Topcoat: PPG Speedhide Exterior Acrylic Semi-Gloss, 6-900Xl (1.1 mils dry)
4. Stained Woodwork (Solid Color)
   a. Prime Coat: PPG Pittsburgh Paints Sunproof Acrylic Solid Color Stain, 77-1110 Series (350-500 sq ft/gal).
   b. Intermediate Coat: If tannin bleeding occurs, use PPG Seal Grip Alkyd Universal Primer 17-941NF.
   c. Topcoat: PPG Pittsburgh Paints Sunproof Acrylic Solid Color Stain, 77-1110 Series (350-500 sq ft/gal)
5. Stained Woodwork (Semi-Transparent)
   a. Prime Coat: PPG Pittsburgh Paints Sunproof Semi Transparent Alkyd Oil Stain, 77-1660 Series (250-350 sq ft/gal)
   b. Topcoat: Pittsburgh Paints Sunproof Semi Transparent Alkyd Oil Stain, 77-1660 Series (250-350 sq ft/gal)
6. Concrete Walls
   a. Prime Coat: PPG Perma Crete High Build 100% Acrylic Primer, 4-2 Series (2.6-3.2 mils dry)
   b. Topcoat: PPG Perma Crete High Build 100% Acrylic Topcoat, 4-22 Series (3.2-5.8 mils dry) OR PPG Perma Crete Acrylic Texture Coating , 4-50 Fine Texture (6.8-9.3 mils dry)
7. Concrete Masonry Units
   a. Prime Coat: PPG Perma Crete LTC Concrete Block & Masonry Surfacer Filler, 4-100 Series (9.3-11.6 mils dry)
   b. Topcoat: PPG Perma Crete High Build 100% Acrylic Topcoat, 4-22 Series (3.2-5.8 mils dry) OR PPG Perma Crete Acrylic Texture Coating , 4-50 Fine Texture (6.8-9.3 mils dry)

D. Provide the following Rust-Oleum paint systems for various substrates, as indicated:

1. Ferrous and Zinc Coated Metal
   a. Prime Coat: Rust-Oleum Universal Primer, (1.0-2.0 mils dry)
   b. Intermediate Coat: Rust-Oleum 3700 Series DTM Acrylic, (2.0-3.0 mils dry)
   c. Topcoat: Rust-Oleum 3700 Series DTM Acrylic, (2.0-3.0 mils dry)
2. Steel Shop Primed: (structural steel framing exposed to view including steel lintels and steel stairs and handrails)
   a. Prime Coat: Rust-Oleum Universal Primer (1.0-2.0 mils dry)
   b. Intermediate Coat: Rust-Oleum Sierra Performance Beyond No VOC UMA (2.0-3.0 mils dry)
   c. Topcoat: Rust-Oleum Sierra Performance Beyond No VOC UMA (2.0-3.0 mils dry)
3. Painted Woodwork
   a. Prime Coat: Rust-Oleum Zinsser Bulls Eye 1-2-3 Acrylic Primer (1.0-2.0 mils dry)
   b. Intermediate Coat: Rust-Oleum Zinsser Perma White Exterior Semi Gloss Acrylic (1.5-2.0 mils dry)
   c. Topcoat: Rust-Oleum Zinsser Perma White Exterior Semi Gloss Acrylic (1.5-2.0 mils dry)

4. Stained Woodwork (Solid Color)
   a. Prime Coat: Rust-Oleum Wolman Dura Stain Acrylic Solid Color Stain (200-400 sq ft/gal).
   b. Intermediate Coat: If tannin bleeding occurs, use Zinsser Bulls Eye 1-2-3 Acrylic Primer.
   c. Topcoat: Rust-Oleum Wolman Dura Stain Acrylic Solid Color Stain (200-400 sq ft/gal)
5. Stained Woodwork (Semi-Transparent)
   a. Prime Coat: Rust-Oleum Wolman Dura Stain Semi-Transparent Stain (200-350 sq ft/gal)
   b. Topcoat: Rust-Oleum Wolman Dura Stain Semi-Transparent Stain (200-350 sq ft/gal)
6. Concrete Walls
   a. Prime Coat: Rust-Oleum Zinsser Water Tite Flexible Primer & Finish, (5-6 mils dry)
   b. Topcoat: Rust-Oleum Zinsser Water Tite Flexible Primer & Finish (5-6mils dry)
7. Concrete Masonry Units
   a. Prime Coat: Rust-Oleum Zinsser Water Tite Flexible Primer & Finish (5-6 mils dry)
   b. Topcoat: Rust-Oleum Zinsser Water Tite Flexible Primer & Finish (5-6 mils dry)

E. 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 and steel stairs and handrails)
   a. Prime Coat: S-W ProCryl® Universal Primer, B66-310 Series (2.0-4.0 mils dry)
   b. Intermediate Coat: S/W Sher-Cryl™ HPA Acrylic, B66-350 Series (2.5-4.0 mils dry)
   c. Topcoat: S/W Sher-Cryl™ HPA Acrylic, B66-350 Series (2.5-4.0 mils dry)
3. Painted Woodwork
   a. Prime Coat: S-W A-100® Exterior Latex Wood Primer, B42W41 (1.4 mils dry) If tannin bleeding occurs, use A-100 Exterior Stain Blocking Primer, Y24 Series.
   b. Intermediate Coat: S-W A-100 Exterior Latex Gloss, A8 Series (1.3 mils dry)
   c. Topcoat: S-W A-100 Exterior Latex Gloss, A8 Series (1.3 mils dry)
4. Stained Woodwork (Solid Color)
   a. Prime Coat: S-W WoodScapes Solid Color Stain, A15 Series (200-400 sq ft/gal).
   b. Intermediate Coat: If tannin bleeding occurs, use A-100 Exterior Stain Blocking Primer, Y24 Series.
   c. Topcoat: S-W WoodScapes Solid Color Stain, A15 Series (200-400 sq ft/gal)

5. Stained Woodwork (Semi-Transparent)
   a. Prime Coat: S-W WoodScapes Semi-Transparent Stain, A15T5 (200-350 sq ft/gal)
   b. Topcoat: S-W WoodScapes Semi-Transparent Stain, A15T5 (200-350 sq ft/gal)
6. Concrete Walls
   a. Prime Coat: S-W Loxon® XP Waterproofing, A24 Series (6.4-8.3 mils dry)
   b. Topcoat: S-W Loxon® XP Waterproofing, A24 Series (6.4-8.3 mils dry)
7. Concrete Masonry Units
   a. Prime Coat: S-W Loxon® XP Waterproofing, A24 Series (6.4-8.3 mils dry)
   b. Topcoat: S-W Loxon® XP Waterproofing, A24 Series (6.4-8.3 mils dry)

3.08 INTERIOR PAINTING SCHEDULE

A. Provide the following Benjamin Moore paint systems for the various substrates, as indicated:

1. Gypsum Drywall(Egg Shell)
   a. Prime Coat: #N534 Ultra Spec 500 Interior Latex Primer
   b. Intermediate Coat: #N538 Ultra Spec 500 Interior Eggshell Enamel
   c. Topcoat: #N538 Ultra Spec 500 Interior Eggshell Enamel
2. Gypsum Drywall (in wet areas)
   a. Prime Coat: #N534 Ultra Spec 500 Interior Latex Primer
   b. Intermediate Coat: #V341 Waterborne Epoxy
   c. Topcoat: #V341 Waterborne Epoxy
3. Concrete Masonry Units (Epoxy)
   a. Prime Coat: #206 Super Spec Hi-Build Block Filler
   b. Intermediate Coat: #V341 Waterborne Epoxy
   c. Topcoat: #V341 Waterborne Epoxy
4. Ferrous and Zinc Coated Metal
   a. Prime Coat: P04 Super Spec HP Acrylic Metal Primer
   b. Intermediate Coat: #N539 Ultra Spec 500 Interior Semi-Gloss Enamel
   c. Topcoat: #N539 Ultra Spec 500 Interior 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: #N110 SK 5000 Dry Fall Flat
   c. Topcoat: #N110 SK 5000 Dry Fall Flat
6. Painted Woodwork
   a. Prime Coat: #N534 Ultra Spec 500 Interior Latex Primer Sealer
   b. Intermediate Coat: #N539 Ultra Spec 500 Interior Semi-Gloss Enamel
   c. Topcoat: #N539 Ultra Spec 500 Interior 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. Stained Woodwork (Floors)
   a. Prime Coat: Old Masters 240 VOC Stains
   b. Intermediate Coat: #30531 All Pro Waterborne Polyurethane
   c. Topcoat: #30531 All Pro Waterborne Polyurethane
9. Concrete Garage Floor (Industrial Epoxy Floor)
   a. Prime Coat: V150 Corotech 100% Solids Epoxy Pre-Primer
   b. Top Coat(2 coats): V400 Polyamide Epoxy Hi-Build
10. Concrete Floor Stain & Sealer (Opaque Color)
    a. Prime Coat:TuffCrete Solvent Acrylic Stain
    b. Topcoat:TuffCrete Solvent Acrylic Stain; Zinsser Skid Tex Anti-Slip Additive. Note-New concrete shall be etched prior to application.

11. Concrete Floor Sealer (Clear)
    a. Prime Coat: TuffCrete Solvent Acrylic Stain Clear
    b. Topcoat: TuffCrete Solvent Acrylic Stain Clear.
12. Exposed Concrete Retaining Wall Waterproofing Sealer
    a. Primer coat: TuffCrete Solvent Acrylic Clear
    b. Topcoat: TuffCrete Solvent Acrylic Clear

B. Provide the following Ferrell-Calhoun paint systems for the various substrates, as indicated:

1. Gypsum Drywall(Egg Shell)
    a. Prime Coat: F/C #380 Perfik-Seal Interior Latex Primer/Sealer (1.8mils DFT)
    b. Intermediate Coat: F/C #3900 Line Evergreen “Zero Voc” Acrylic Int/Ext Latex Eggshell Enamel (2.1 mils DFT)
    c. Topcoat: F/C #3900 Line Evergreen “Zero Voc” Acrylic Int/Ext Latex Eggshell Enamel (2.1 mils DFT)
2. 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)
3. Concrete Masonry Units (Epoxy)
    a. Prime Coat: F/C #470A Interior/Exterior Acrylic Latex Masonry Block Filler (10 mils DFT)
    b. Intermediate Coat: F/C #1200WB Tuff-Boy 100% Acrylic Waterborne Epoxy (2.0 mils DFT)
    c. Topcoat: F/C #1200WB Tuff-Boy 100% Acrylic Waterborne Epoxy (2.0 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 Enamel (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: F/C #1500 Line Wood Kraft Waterborne Penetrating Wiping Stains
   b. Intermediate Coat: FC #1900 Line Wood Kraft Waterborne Acrylic-Polyurethane Varnish (1.2 mils DFT)
   c. Topcoat: FC #1900 Line Wood Kraft Waterborne Acrylic-Polyurethane Varnish (1.2 mils DFT)
8. Stained woodwork (Floors)
   a. Prime Coat: Minwax 250 VOC Stains
   b. Intermediate Coat: Minwax Waterbased Polyurethane for Floors (0.6 mils DFT)
   c. Topcoat: Minwax Waterbased Polyurethane for Floors (0.6 mils dry)
9. Concrete Garage Floor Stain & Sealer (Opaque Color)
   a. Prime Coat: Rust-Oleum S6511 System Penetrating Prime & Sealer
   b. Topcoat: Rust-Oleum 8000 System Overcrete S (Anti-Skid Safety Surface when used in conjunction with a broadcasted aggregate)
10. Concrete Floor Stain & Sealer (Opaque Color)
    a. Prime Coat: Rust-Oleum S6511 System Penetrating Prime & Sealer
    b. Topcoat: Rust-Oleum 8000 System Overcrete S (Anti-Skid Safety Surface when used in conjunction with a broadcasted aggregate)
11. Concrete Floor Sealer (Clear)
    a. Prime Coat: F/C #1106 Tuff-Boy Clear Acrylic Waterproofing Sealer
    b. Topcoat: F/C #1106 Tuff-Boy Clear Acrylic Waterproofing Sealer: Add Skid-Tex Slip Resistant to topcoat.
12. Exposed Concrete Retaining Wall Waterproofing Sealer
    a. Primer coat: F/C #1106 Tuff-Boy Clear Acrylic Waterproofing Sealer
    b. Topcoat: F/C #1106 Tuff-Boy Clear Acrylic Waterproofing Sealer

C. Provide the following PPG Paints, Inc. paint systems for the various substrates, as indicated:

1. 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, 9-300Xl (1.4 mils dry)
   c. Topcoat: PPG Pure Performance Zero VOC Interior Latex Eggshell, 9-300Xl (1.4 mils dry)
2. 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)
3. Concrete Masonry Units (Epoxy)
   a. Prime Coat: PPG Speedhide Interior Exterior Latex Block Filler, 6-7 Series (7.4 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. Stained woodwork (Floors)
   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)
9. 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- Etch floor prior to application.
10. Concrete Floor Stain & Sealer Waterborne (Opaque Color)
    a. Prime Coat: PPG Perma Crete Color Seal WB Waterborne Acrylic Concrete Stain, 4-4210.
    b. Topcoat: PPG Perma Crete Color Seal WB Waterborne Acrylic Concrete Stain, 4-4210; Anti Slip Additive to the topcoat. Note- Etch floor prior to application.
11. Concrete Floor Sealer (Clear)
    a. Prime Coat: PPG Perma Crete Plex Seal WB Waterborne Clear Acrylic Concrete Sealer, 4-6200.
    b. Topcoat: PPG Perma Crete Plex Seal WB Waterborne Clear Acrylic Concrete Sealer, 4-6200; Anti Slip Additive to the topcoat. Note- Etch floor prior to application.
12. Exposed Concrete Retaining Wall Waterproofing Sealer
    a. Primer coat: PPG Perma Crete Color Seal WB Waterborne Acrylic Concrete Stain (Opaque), 4-4210 or PPG Perma Crete Plex Seal WB Waterborne Clear Acrylic Concrete Sealer, 4-6200
    b. Topcoat: PPG Perma Crete Color Seal WB Waterborne Acrylic Concrete Stain (Opaque), 4-4210 or PPG Perma Crete Plex Seal WB Waterborne Clear Acrylic Concrete Sealer, 4-6200

D. Provide the following Rust-Oleum paint systems for the various substrates, as indicated:

1. Gypsum Drywall(Egg Shell)
   a. Prime Coat: Rust-Oleum Zinsser Dry Wall Primer (1.0-1.5 mils dry)
   b. Intermediate Coat: Rust-Oleum Zinsser Perma White Interior Acrylic Satin, (1.5-2.0 mils dry)
   c. Topcoat: Rust-Oleum Zinsser Perma White Interior Acrylic Satin, (1.5-2.0 mils dry
2. Gypsum Drywall (in wet areas)
   a. Prime Coat: Rust-Oleum Zinsser Dry Wall Primer (1.0-1.5 mils dry)
   b. Intermediate Coat: Rust-Oleum 5300 Series WB Epoxy (2.5-3.0 mils dry)
   c. Topcoat: Rust-Oleum 5300 Series WB Epoxy (2.5-3.0 mils dry)
3. Concrete Masonry Units (Epoxy)
   a. Prime Coat: Rust-Oleum Zinsser Water Tite Flexible Primer & Finish (5.0-6.0 mils dry)
   b. Intermediate Coat: Rust-Oleum 5300 Series WB Epoxy (2.5-3.0 mils dry)
   c. Topcoat: Rust-Oleum 5300 Series WB Epoxy (2.5-3.0 mils dry)
4. Ferrous and Zinc Coated Metal
   a. Prime Coat: Rust-Oleum Universal Primer, (1.0-2.0 mils dry)
   b. Intermediate Coat: Rust-Oleum Zinsser Perma White Interior Semi Gloss Acrylic (1.5-2.0 mils dry)
   c. Topcoat: Rust-Oleum Zinsser Perma White Interior Semi Gloss Acrylic (1.5-2.0 mils dry)
5. Exposed Structural steel and Roof Deck (shop primed steel)
   a. Prime Coat: Rust-Oleum Universal Primer, (1.0-2.0 mils dry)-Spot prime if needed.
   b. Intermediate Coat: Rust-Oleum 5100 Series Waterborne Acrylic Dry Fall Flat
   c. Topcoat: Rust-Oleum 5100 Series Waterborne Acrylic Dry Fall Flat
6. Painted Woodwork
   a. Prime Coat: Rust-Oleum Zinsser Bulls Eye 123 Acrylic Primer (1.0-1.5 mils dry)
   b. Intermediate Coat: Rust-Oleum Zinsser Perma White Interior Acrylic Semi Gloss, (1.5-2.0 mils dry)
   c. Topcoat: Rust-Oleum Zinsser Perma White Interior Acrylic Semi Gloss, (1.5-2.0 mils dry
7. Stained woodwork
   a. Prime Coat: Rust-Oleum Varathane 250 VOC Alkyd Stains
   b. Intermediate Coat: Rust-Oleum Varathane WoodClassics Waterborne Polyurethane Varnish, (1.0 mils dry)
   c. Topcoat: Rust-Oleum Varathane Waterborne Polyurethane Varnish, (1.0 mils dry)
8. Stained woodwork (Floors)
   a. Prime Coat: Rust-Oleum Nano Shield Fast Dry Floor Stains
   b. Intermediate Coat: Rust-Oleum Nano Shield Advanced Waterbased Polyurethane for Floors (1.0 mils dry)
   c. Topcoat: Rust-Oleum Nano Shield Advanced Waterbased Polyurethane for Floors (1.0 mils dry)
9. Concrete Garage Floor (Chip Resistant High Build Industrial Floor)
   a. Prime Coat: Rust-Oleum Penetrating Prime & Seal (8 mils.)
   b. Intermediate Coat: Rust-Oleum Over Flex E Epoxy/Broadcast Wedron 480 aggregate to rejection (20 mils.)
   c. Seal Coat: Rust-Oleum 9800 Series Urethane (5 mils DFT.)
   d. Topcoat: Rust-Oleum 9800 Series Urethane (5 mils DFT.)

10. Concrete Floor Stain & Sealer (Opaque Color)
    a. Prime Coat: Rust-Oleum Epoxy Shield 1 Part Concrete Paint
    b. Topcoat: Rust-Oleum Epoxy Shield 1 Part Concrete Paint; Slip Resistant Additive to the topcoat. Note- Etch floor prior to application.
11. Concrete Floor Sealer (Clear)
    a. Prime Coat: Rust-Oleum® Natural Look Concrete Sealer – Clear
    b. Topcoat: Rust-Oleum® Natural Look Concrete Sealer – Clear; Slip Resistant Additive to the topcoat.
12. Exposed Concrete Retaining Wall Waterproofing Sealer
    a. Primer coat: Rust-Oleum Okon Plugger Water Proofing Water Based Sealer- Clear
    b. Topcoat: Rust-Oleum Okon Plugger Water Proofing Water Based Sealer-Clear

E. Provide the following Sherwin-Williams paint systems for the various substrates, as indicated:

1. Gypsum Drywall(Egg Shell)
    a. Prime Coat: S-W ProMar 200 Zero VOC Interior Latex Primer, B28-2600 (1.0 mils dry)
    b. Intermediate Coat: S-W ProMar 200 Zero VOC Interior Latex EgShel, B20-2600 (1.6 mils dry)
    c. Topcoat: S-W ProMar 200 Zero VOC Interior Latex EgShel, B20-2600 (1.6 mils dry)
2. Gypsum Drywall (in wet areas)
    a. Prime Coat: S-W ProMar 200 Zero VOC Interior Latex Primer, B28-2600 (1.0 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)
3. Concrete Masonry Units (Epoxy)
    a. Prime Coat: S-W PrepRite Block Filler, B25W25 (8.0 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 ProMar 200 Zero VOC Interior Latex Primer, B28-2600 (1.0 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. Stained woodwork (Floors)
   a. Prime Coat: S-W Minwax 250 VOC Stains
   b. Intermediate Coat: S-W Minwax Waterbased Polyurethane for Floors (0.6 mils dry)
   c. Topcoat: S-W Minwax Waterbased Polyurethane for Floors (0.6 mils dry)
9. Concrete Garage Floor (Chip Resistant High Build Industrial Floor)
   a. Prime Coat: S-W 3579 Standard Primer (8 mils.)
   b. Intermediate Coat: 3555 EPO-FLEX HD Epoxy/Broadcast 5310-7 aggregate to rejection (20 mils.)
   c. Seal Coat: S-W 4638 HS Polyurethane Enamel (8 mils.)
   d. Topcoat: S-W 4638 HS Polyurethane Enamel (8 mils.)
10. Concrete Floor Stain & Sealer (Opaque Color)
   a. Prime Coat: H&C Concrete Stain Solid Color Water Based
   b. Topcoat: H&C Concrete Stain Solid Color Water Based; H&C SharkGrip Slip Resistant Additive to the topcoat. Note- Etch floor prior to application.
11. Concrete Floor Sealer (Clear)
   a. Prime Coat: H&C Concrete Stain Solid Color Water Based - Clear
   b. Topcoat: H&C Concrete Stain Solid Color Water Based - Clear; H&C SharkGrip Slip Resistant Additive to the topcoat. Note- Etch floor prior to application.
12. Exposed Concrete Retaining Wall Waterproofing Sealer
   a. Primer coat: H&C Concrete Stain Solid Color Water Based - Clear or Opaque
   b. Topcoat: H&C Concrete Stain Solid Color Water Based - Clear or Opaque

END OF SECTION

SECTION 10 11 00 VISUAL DISPLAY UNITS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Tack boards.

B. Related Sections:

1. Section 09 05 15 – Color Design (for color selections).

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. Field Measurements: Take field measurements prior to preparation of Shop Drawings and fabrication where possible, to ensure proper fitting of Work. However, allow for trimming and fitting wherever taking of field measurements before fabrication might delay Work.

C. 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. Manufacturer's standard form in which manufacturer agrees to repair or replace face sheets that fail in materials or workmanship within warranty period.

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. 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 CLEANING

A. Clean visual display surfaces according to manufacturer's written instructions. Cover and protect visual display surfaces until Final Completion..

END OF SECTION

SECTION 10 14 00 SIGNAGE

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Signage for room identification system.

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. 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 signage are based on products manufactured by ASI Sign Systems, Inc., 3890 W. NW Hwy, Suite 102, Dallas, TX. 75220. Tel. (800) 274-7732..

B. Equivalent products by the following manufacturers are acceptable:

1. Gemini Incorporated, Cannon Falls, MN. Tel. (800) 538-8377.
2. Matthews International Corp., Pittsburgh, PA. Tel. (800) 628-8439.
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. 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.

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: 12 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 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.

3.03 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 SCHEDULES – INTERIOR SIGNAGE

A. Sign Type No. 1: Offices, Single Occupant
Break Room
Storage Room
Mechanical Room

B. Sign Type No. 2: Toilet Room

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 25 years.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Drawings and Specifications are based on products manufactured by Scranton Products Inc., 801 East Corey Street, Scranton, PA 18505. Tel. (800) 445-5148.

B. Equivalent products by the following manufacturers are acceptable:

1. Bradley Corp / Mills Partitions, Menomonee Falls, WI. Tel (414) 354-0100.
2. General Partitions Mfg. Corp., Erie, PA. (814) 833-1154.
3. Knickerbocker Partition Corp, Freeport, NY. Tel. (516) 546-0550.

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 48 inches high with 47 inch continuous aluminum wall brackets.

5. Finish shall be similar and equal to standard color chart selections from Scranton Products. Color of doors and pilasters to be selected by the Project Engineer / MDOT Architect from Manufacturer's Classic and Mosaic color collection with orange peel texture.
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 one door pull and one wall stop.
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 panel 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.

C. Urinal screens or panels used beside urinal screens shall be set at 12 inches maximum above finishes floor to bottom of panel. Height of screen or panel shall be a minimum of 60 inches above finished floor to top of panel.

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 22 14 CHAIN LINK PARTITIONS AND GATES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Vinyl coated chain link partitions, framing and gates. The Work includes, but is not limited to, posts, framing, chain link fabric, tie wire, tension wire, hardware and miscellaneous framing & supports.

1.02 REFERENCES

A. ASTM- American Society for Testing and Materials:

1. ASTM A123 – Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products.
2. ASTM A153 – Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
3. ASTM A392 – Zinc-Coated Steel Chain-Link Fence Fabric.
4. ASTM F567 – Standard Practice for Installation of Chain-Link Fence.
5. ASTM F1083 – Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures.
6. ASTM F1345 – Standard Specification for Zinc-5% Aluminum-Mischmetal Alloy- Coated Steel Chain-Link Fence Fabric.

B. NPS – National Pipe Standards.

C. CLFMI Product Manual – Chain Link Fence Manufacturers Institute.

D. AASHTO – American Association of State Highway Transportation Officials.

1.03 ACTION SUBMITTALS

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

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each exposed product and for each color and texture specified.

D. Certification: Submit manufacturer’s or fabricator’s test results and other data certifying that all materials furnished for construction of chain link partitions comply with the requirements of the Drawings and Specifications. The Owner reserves the right to retest all materials.

1.04 CLOSEOUT SUBMITTALS

A. 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. AMICO (Alabama Metal Industries Corp.), Birmingham, AL. Tel. (800) 366-2642.
2. Master-Halco, Anchor Fence Division, Edgewood, MD. Tel. (800) 229-5615.
3. Southwest Wire, Inc., Norman, OK. Tel. (800) 348-9473.

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 CHAIN LINK FABRIC

A. Provide chain link fabric for partitions and gates in configurations as shown on the Drawings and conforming with the following:

1. Gage: 9.
2. Mesh Size: 2 inches square.
3. Height: As required by Drawings.
4. Coating: Class C spelter coating (vinyl coated).

2.03 FRAMING

A. Metal posts shall be of the size, configuration and minimum weight per foot as specified herein and as shown on the Drawings. Round steel posts shall be galvanized steel pipe, coated inside and out, and shall comply with ASTM F 1083, Schedule 40.

1. Line Post: 2 inch diameter nominal.
2. Corner and Terminal Posts: 2 inch diameter nominal.
3. Gate Posts: 3-1/2 inch diameter nominal.
4. Top and brace Rail: 1-1/4 inch diameter nominal, plain end, sleeve coupled.
5. Gate Frame: 1-1/2 inch nominal.
6. Gate Truss Rod: 3/8 inch diameter steel truss rod with 3/8 inch minimum turn buckles.
7. Tension Wire: 6 gage.

2.04 FABRIC FILLED GATES

A. Gate frame shall be constructed from pipe complying with ASTM F 1083, Schedule 40 and to the design and dimensions as shown on the Drawings.

1. Connections shall be welded and watertight.
2. Frame shall be hot dip galvanized after welding.

2.05 TENSION WIRE

A. Tension wire shall be of the same material as the partition wire being used, shall be of good commercial quality, and shall meet the following requirements:

1. Base metal of zinc coated tension wire shall be steel wire having a minimum tensile strength of 60,000 psi.
2. Spelter coating shall comply with AASHTO M 279, Class 1.

2.06 TIE WIRE

A. Tie wire shall be of good commercial quality zinc coated steel of the size and spacing as shown on the Drawings. Spelter coating shall comply with AASHTO M 279, Class 1.

2.07 HARDWARE

A. Provide industrial duty steel, malleable iron or ductile iron hardware galvanized in accordance with ASTM A153.

1. Provide hinges, drop rods and hold-open fittings at all gates.
2. Provide with heavy-duty cantilever latch with padlock equal to Schlage 45-101.
3. Provide anchors, sleeves and all required fasteners to secure the Work.

2.08 CONCRETE FOR ANCHORS AND FOOTINGS

A. Concrete for anchors and footings shall conform to requirements of Section 03 30 00 Cast-in-Place Concrete.

B. Foundation Tube Sleeve: AASHTO M-36, corrugated 16-gage steel, galvanized, depth as indicated.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General:

1. Perform cutting, drilling and fitting required for installation.
   a. Set Work accurately in location, alignment and elevation measured from established lines and levels.
   b. Provide anchorage devices and fasteners where necessary for installation to other Work.
2. The bottom of partitions shall not be more than one inch from the surface of finished floor slab.
3. Attachment: Wire shall be stretched taut and firmly attached to posts and braces by methods and spacing as indicated. All wire shall be installed to the required elevation.

B. Partition Posts: Install foundation tube and posts in accordance with manufacturer's instructions.

C. Gate Frames: Provide gates and frames constructed of round tubular members continuously welded at all corners and intersections. Install gates plumb, level and secure for full opening without interference. Hang swing gates in hinges so they will remain motionless in any position.

END OF SECTION

SECTION 10 26 13 CORNER GUARDS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Vinyl / Acrylic surfaced mounted Corner Guards.

1.02 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's technical data and installation instructions for corner guards.

B. Samples: Submit 3 samples of material finishes, profiles and colors for corner guards.

1.03 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.04 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products per ASTM E 84, NFPA 255, or UL 723 by UL or another qualified testing agency.

PART 2 - PRODUCTS

2.01 CORNER GUARDS

A. Surface-Mounted, Resilient, Plastic Corner Guards: Assembly consisting of snap-on plastic cover installed over continuous retainer; including mounting hardware; fabricated with 90 degree turn to match wall condition. Install full height, unless height indicated otherwise on the Drawings, at all outside corners in corridors and elsewhere as shown on the Drawings.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Construction Specialties, Inc. Model SSM-20 or comparable product by one of the following:
   a. Arden Architectural Specialties, Inc.
   b. IPC Door and Wall Protection Systems; Division of InPro Corporation.
   c. Korogard Wall Protection Systems; a division of RJF International Corporation.
2. Cover: Extruded rigid plastic, minimum 0.078-inch wall thickness; in dimensions and profiles indicated on Drawings.
   a. Color and Texture: As selected by Project Engineer / MDOT Architect from manufacturer's full range. Refer to Section 09 05 15 – Color Design (for color selected).
3. Retainer: Minimum 0.060-inch- thick, one-piece, extruded aluminum.
4. Retainer Clips: Manufacturer's standard impact-absorbing clips.
5. Top and Bottom Caps: Prefabricated, injection-molded plastic; color matching cover; field adjustable for close alignment with snap-on cover.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: Install impact-resistant corner guards level, plumb, and true to line without distortions. Comply with manufacturer's written installation instructions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

1. Install impact-resistant corner guards in locations and at mounting heights indicated on Drawings.
2. Provide mounting hardware, anchors, and other accessories required for a complete installation.

B. Immediately after completion of installation, clean plastic covers and accessories using a standard, ammonia-based, household cleaning agent.

C. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

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 (“MIRR”): 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 (“TPD”): 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 (“GB”): 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 812-2. 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 (“SD”): Provide surface mounted liquid type stainless steel soap dispenser units equal to Bradley model 6562 as indicated on the Drawings. Locate at each lavatory at heights shown.

F. Paper Towel Dispenser (“PTD”): 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 (“CH”): 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 Holder (“MH”): 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 (“ULG”):

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.

1. 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 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. 78th 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. 78th 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. Locate in Kitchen.

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. Provide Fire-FX option where located in a fire rated wall. 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. Provide Fire-FX option where located in a fire rated wall. 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 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. Units shall be required within 20 feet of all Mechanical Rooms and exits. Type K units shall be required in all Break Rooms.

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. Locate as indicated on the Drawings.

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 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

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.

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 DESCRIPTION OF WORK

A. Work in this section includes furnishing and installation of extruded aluminum overhead hanger rod and post supported canopies.

B. Related Items and Considerations

1. Flashing of various designs may be required.
2. Determine wall construction, make-up and thickness.
3. Ensure adequate wall condition to carry canopy loads where required.
4. Consider water drainage away from canopy where necessary.
5. Any necessary removal or relocation of existing structures, obstructions or materials.

1.02 REFERENCES

A. American Architectural Manufacturers Association (AAMA):

1. AAMA 605 - Voluntary Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.

1.03 SUBMITTALS

A. Product Data: Manufacturer's catalog data, detail sheets, and specifications.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

C. Samples: Color selection samples consisting of actual coating material or anodizing process on aluminum extrusions.

D. Quality Assurance/Control Submittals:

1. Qualifications: Letter certifying manufacturer's required qualifications.
2. Structural Design Calculations.
3. Manufacturer's Installation Instructions.

1.04 QUALITY ASSURANCE

A. Overall Standard: Structural engineering design documents stamped by a structural engineer registered to practice in the State in which the Project is located.

B. Manufacturer Qualifications: Minimum five years experience in producing covers/canopies with welded bents and of the type specified.

C. Installer Qualifications: Minimum two years experience in erecting covers/canopies of the type specified.

1.05 FIELD MEASUREMENT

A. Confirm dimensions prior to preparation of shop drawings when possible.

B. If requested, supply manufacturer's standard literature and specifications for canopies.

C. Submit shop drawings showing structural component locations/positions, material dimensions and details of construction and assembly.

1.06 PERFORMANCE REQUIREMENTS

A. Canopy must conform to local building codes.

B. Drawings must be stamped by an Engineer registered in the state that the project is located.

C. The canopy must handle a minimum of 20 PSF live load.

1.07 DELIVER, STORAGE, HANDLING

A. Follow manufacturer's instructions.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Basis of Design: Products based on Mapes Industries, Inc., Lincoln, Nebraska, Tel: (888) 273-1132, Fax: (877) 455-6572; www.mapes.com.

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 HANGER ROD CANOPIES

A. Super Lumideck Flat Soffit Hanger Rod Canopy.

1. Materials:
   a. Decking shall be extruded aluminum, alloy 6063-T6, flat soffit decking (3 inches by 0.078 extruded aluminum interlocking decking, perpendicular to wall).
   b. Fascia shall be standard 8 inches extruded (minimum 0.125 aluminum)
      1) Type "JM" fascia (8 inches) on front of canopy.
      2) Type "J" fascia on mounting side at exterior wall.
   c. Hanger rods and attachment hardware shall be galvanized and powder coated to match canopy.
   d. See drawings for location and size.

B. Super Lumideck (Post supported) Canopy.

1. Post/Columns:
   a. Radius-cornered 4 inches by 4 inches minimum aluminum tubular extrusion as required by structural engineering design.

b. Grout Key: Provide two 1-1/2 inch (38 mm) diameter holes in column base, one each in opposite sides.
c. Provide clear acrylic protection coat on surfaces in contact with grout.

2. Beams: Open top aluminum tubular extrusions.
3. Deck: Aluminum decking sections, self-flashing, interlocking sections.
   a. Profile: Super Lumindeck Post Supported (5 inches).
   b. Provide welded end plate water dams where sections terminate at other than drainage channels.
   c. Provide smooth underside to decking system with no exposed openings for spans.
4. Fascia/Gutter and Drain Beam: Manufacturer's standard J (8 inches tall) extruded aluminum fascia sections as required to complete the installation resulting in a neat finished appearance.
5. Drainage type: Standard Post Drain.
6. Flashing: Aluminum sheet, thickness as recommended by manufacturer for specific condition.

2.03 FINISHES

A. Fluoropolymer Coating: 70 percent PVDF resin based fluoropolymer, AA-C-12C-42R-1, color as selected by Architect, comply with AAMA 605.

B. Colors: See Section 09 05 15 - Color Design.

2.04 FABRICATION

A. All connections shall be mechanically assembled utilizing 3/16” fasteners with a minimum shear stress of 350 lb. Pre-welded or factory-welded connections are not acceptable.

B. Decking shall be designed with interlocking extruded aluminum members with mechanical fasteners field applied to provide structural integrity for the completed assembly.

C. Concealed drainage. Water shall drain from covered surfaces into integral rear gutter and directed to ground level discharge via one or more designated downspouts.

PART 3 - EXECUTION

3.01 INSPECTION

A. Confirm that surrounding area is ready for the canopy installation.

B. Installer shall confirm dimensions and elevations to be as shown on drawings provided by Mapes Industries.

C. Erection shall be performed by an approved installer and scheduled after all concrete, masonry and roofing in the area is completed.

D. Embed all wall anchor washers in sealant to provide watertight seal at wall.

3.02 INSTALLATION

A. Installation shall be in strict accordance with manufacturer's shop drawings. Particular attention should be given to protecting the finish during handling and erection.

B. Install canopy with positive camber.

C. Flashing and sealant per manufacturer's recommendations.

D. Surround wall anchors with tight sealant.

E. Embed all wall anchor washers in sealant to provide water tight seal at wall mounting.

F. Canopy to have positive camber and field drill drain holes in fascia @ scupper locations.

3.03 CLEANING

A. Clean surfaces soiled by work as recommended by manufacturer.

B. After installation, entire system shall be left in a clean condition.

C. Remove protective coverings.

D. Remove surplus materials and debris from the site.

3.04 PROTECTION

A. Protect finished aluminum surfaces from damage due to subsequent construction operations.

END OF SECTION

SECTION 10 73 26 WALKWAY COVERINGS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Extruded aluminum free standing style walkway coverings as shown on the Drawings and specified herein.

B. Related Sections:

1. Section 03 30 00 – Cast-in-Place Concrete.
2. Section 07 92 00 – Joint Sealants.
3. Section 09 05 15 – Color Design.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Showing fabrication and installation of walkway coverings including plans, elevations and details of components and attachments. 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. Architectural Covers & Enclosures, LLC, Cordova, TN. Tel. (901) 355-2180.
2. Ballew's Aluminum Products, Inc., Greenville, SC. Tel (800) 231-6666.
3. Dittmer Arch. Alum., Winter Springs, FL. Tel (800) 822-1755.
4. Mason - Florida, LLC, Leesburg, FL. Tel. (877) 577-0300.

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. Equal to "Super Lumideck" Walkway Cover (free standing style) decking, beams, posts and fascia shall be extruded aluminum, alloy 6063-T6 in profile and thickness shown in current Mapes brochures. Fasteners shall be stainless steel or cadmium plated as provided by the manufacturer.

2.04 MANUFACTURED UNITS

A. Support columns and gutter beams shall be designed such that the columns will be notched to create a "saddle" that will receive and secure the gutter beams.

B. Post and beams shall be mechanically assembled utilizing 3/16 fasteners with a minimum shear stress of 350 lb.

C. Decking shall be designed with interlocking extruded members with mechanical fasteners field applied to provide structural integrity for the complete assembly.

D. Concealed Drainage: Water shall drain from covered surfaces into integral gutter beams and directed to ground level discharge via one or more support posts as designated by the manufacturer on the shop drawings.

2.05 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.

1. Color and Gloss: As selected by Architect from manufacturer's full range. Refer to Section 09 05 15 - Color Design for color selection.

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. Installer: Erection shall be performed by the manufacturer or manufacturer’s approved installer.
3. Extreme care shall be taken to prevent damage or scratching. Workmanship must be of the very best with neat miters and fitted joints.

3.02 REPAIR AND PROTECTION

A. Protect exiting materials from damage during the installation process. When installation is complete, repair or replace any items damaged. 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 11 31 15 RESIDENTIAL APPLIANCES AND EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Electric Range.
2. Refrigerator.
3. Microwave.
4. Overhear Exhaust Hood
5. Pressure Washer
6. Clothes Washer
7. Clothes Dryer

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. Alkota Cleaning System, Alcester, SD. Tel. (800) 255-6823.
2. General Electric Company (GE), Louisville, KY. Tel. (800) 626-2000.
3. Magic Chef Co., Cleveland, TN. Tel. (423) 472-3371.
4. Sears Brands LLC (Kenmore). Hoffman Estates, IL. Tel. (847) 286-2994.
5. 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 JS630SFSS, stainless steel, Cooktop Burner radiant smoothtop, cooktop surface black ceramic glass, self-clean oven, with Optional Backguard JXS32SS. Approx. Dimensions (HxWxD) 36-1/4 inches by 31-1/4 inches by 28-1/2 inches.

B. Refrigerator: 24.7 cu. ft. capacity Side-By-Side with Dispenser equal to GE® Model GSE25ESHSS with factory-installed icemaker, Stainless steel. Approx. Dimensions (HxWxD) 69-3/4 inches by 35-3/4 inches by 33-5/8 inches.

C. Microwave: 2.2 cu. ft. oven capacity, 1100 watts countertop type, equal to GE® Model PEB7226FSS, stainless steel, with GE Deluxe built-in trim kit Model JX7230SFSS. Approx. Dimensions (HxWxD) 14 inches by 24-1/8 inches by 19-3/4 inches.

D. Overhead Exhaust Hood: 30” Deluxe Range Hood equal to GE® JV348LSS, stainless steel, 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. Pressure Washer: Equal to Natural Gas Fired Series Pressure Washer Model 5181as manufactured by Alkota Cleaning Sys. with the following attributes:

1. Flow Rate: 4.8 gpm.
2. Pressure: 1800 psi.
3. Motor Power: 6 hp.
4. Coil Type: Schedule 80.
5. Coil Length: 243 ft.
6. Natural Gas Apirated Burner Temperature: 440,000 Btu.
7. Length: 55 inches.
8. Size: 55 inches (Length) by 54 inches (Width) by 25-1/2 inches (Height).

F. Clothes Washer: Provide 4.0 IEC Cu. Ft King-Sized capacity frontload washer with stainless steel basket equal to ADA compliant GE Model WCVH6800JWW (White) with Energy Star qualification, Hydro Heater option, Sanitize water temp option, 1100 RPM spin speed, 26 wash cycles, save custom cycles option, delay start, quiet operation, and ADA Compliant.

G. Clothes Dryer: Provide 7.0 Cu. Ft. super capacity frontload electric dryer equal to ADA compliant GE Model GFDN110EDWW (White on White) with HE sensor dry , six dry cycles, 4 heat selections, dura-drum, Speed Dry, e Dry option, and ADA compliant

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 14 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.

1. Include methods of installation for each type of opening and supporting structure.
2. 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.

1. 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.

1. 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.

1. Color to be selected by the Project Engineer / MDOT Architect from manufacturers’ full line of standard colors.
2. 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.

1. Increase metal thickness as recommended by the manufacturer for large blind units. Cross-brace for extra rigidity.
2. 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.

1. Contour top surface to match slat curvature, with flat or slightly curved bottom.
2. Close ends with manufacturer's standard metal or plastic end caps of the same color as rail.
3. Finish rails the same color as slats, unless otherwise indicated.

D. Slats: Standard, spring tempered aluminum slats not less than 0.008 inches thick.

1. Provide l inch narrow slats, with other components sized to suit.

E. Braided Ladders: Standard polyester support cords with integrally braided ladder rungs.

1. 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.

1. Furnish wand (or rod) type tilter consisting of standard tilter mechanism adopted for rotating wand operation.
2. 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.

1. 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.

1. 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.

1. Adjust blind dimensions for proper fit in all openings.
2. 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.

1. Space supporting tapes or cords in accordance with manufacturer's standards, unless otherwise indicated.
2. 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 l80 degrees.
   a. 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.
   a. Place pull cords on right-hand side of blind units.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install horizontal louver blinds level and plumb, aligned and centered on openings, and aligned with adjacent units according to manufacturer's written instructions.

1. Locate so exterior slat edges are not closer than 1 inch 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.

3.03 ADJUSTING AND CLEANING

A. Adjust horizontal louver blinds to operate free of binding or malfunction through full operating ranges.

B. Clean horizontal louver blind surfaces after installation according to manufacturer's written instructions.

3.04 WINDOW LOCATION SCHEDULE

A. Exterior Window Locations:

1. Rooms 109,110, 116, 123, 124, 125, 126, and 127.

B. Interior Window Locations:

1. Rooms 109, 122, and 123.

END OF SECTION

SECTION 12 48 43 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.
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 to greatest extent possible in sizes indicated. Unless otherwise indicated, provide single unit for each mat installation; do not exceed manufacturer's recommended maximum sizes for units that are removed for maintenance and cleaning. Where joints in mats are necessary, space symmetrically and away from normal traffic lanes. 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 19 METAL BUILDING SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Building Type: The building is an existing single-story, single-span, rigid-frame-type pre-engineered metal building.
2. Exterior Walls: Remove existing metal wall panels and replace with Insulated panels with vapor seal cavity and concealed clips attached to framing.
3. Roof system: Remove existing metal roof panels and replace with Standing-seam roof with insulated panels, and concealed clips.
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 are specified in Sections 08 11 13.
4. Finish hardware are specified in Sections 08 71 00.
5. Overhead service doors, including operators, are specified in Section 08 33 23.
6. Colors are specified in Section 09 05 15 - Color Design.
7. Painting for ferrous metal exposed to view is specified in Section 09 90 00.
8. Canopies are specified in Section 10 73 16.

1.02 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. Wall Panels: Provide panel layouts and details of edge conditions, joints, corners, custom profiles, supports, anchorage, trim, flashing, closures, and special details.
2. 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 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.

1.03 CLOSEOUT SUBMITTALS

A. Maintenance data.

B. Executed copies of Paint Finish Guarantee and Weather Tightness Warranty.

1.04 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. 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.

E. Preinstallation Conference: Conduct conference at Project site.

1.05 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 Ceco 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. MBCI, Hernando, MS. Tel. (800) 206-6224
4. VP Buildings; a United Dominion Company. Memphis, TN. Tel. (901) 748-8000.

C. Substitutions shall fully comply with specified requirements and Section 01 62 14 - 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. Exterior wall and roof system shall withstand imposed loads with maximum allowable deflection of 1/240 minimum of span.
2. Metal panel assemblies shall withstand the effects of gravity loads and loads and stresses within limits and under conditions indicated according to ASTM E 1592.

C. Thermal Movements: Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F material surfaces.

D. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for Class 90.

E. General Requirements for Metal Building System shall include:

1. New wall girts and wall panels on the entire building.
2. Covered bay on south side shall be a new pre-engineered metal building structure and insulated metal roof panels.

3. Administration Area at south covered bay shall have new roof purlins.
4. Provide new gutters and downspouts. Refer to Section 05 50 00 Metal Fabrication for downspout boots.

2.03 INSULATED ROOFING AND SIDING PANELS

A. Standing-Seam Metal Roof Panels: Equal to Ceco IBL (Straight Rib Architectural Roof Panel) formed as an insulated panel system with the following properties:

1. Panel Thickness: 2 inches and 4 inches where indicated.
2. R-Values by ASTM C518 at 40 degrees: Varies with panel thickness.
3. Panel Widths: 36 inches or 42 inches as standard with manufacturer.
4. Panel Lengths: As indicated on Drawings.
5. Insulation Material: Non-CFC foamed-in-place polyisocyanurate foam cured to achieve a minimum density of 2.2 pounds.
6. Joint Configuration: Concealed Clips.
7. Panel Exterior: 24 gage Galvalume®.
8. Panel Interior: 26 gage Galvalume®.
9. Coatings: Kynar 500® / Hylar 5000®.
10. Color: Standard colors from manufacturer’s full range of colors to be selected by Project Engineer / MDOT Architect.
11. Accessories: Fasteners, Sealants, Standard and Custom Trim as required for a complete system.

B. Wall Panel Equal to Ceco Striated formed as an insulated panel system with the following properties:

1. Panel Thickness: 2-1/2 inches.
2. R-Value by ASTM C518 at 40 degrees F: R = 19.9.
3. Panel Widths: 36 inches or 42 inches as standard with manufacturer.
4. Panel Lengths: As indicated on Drawings.
5. Insulation Material: Non-CFC foamed-in-place polyisocyanurate foam cured to achieve a minimum density of 2.2 pounds.
6. Joint Configuration: Concealed Clips.
7. Panel Exterior: 26 gage Galvalume®.
8. Panel Interior: 26 gage Galvalume®.
9. Coatings: Kynar 500® / Hylar 5000®.
10. Color: Standard colors from manufacturer’s full range of colors to be selected by Project Engineer / MDOT Architect.
11. Accessories: Fasteners, Sealants, Standard and Custom Trim and flashing as required for a complete system.

2.04 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. Screws shall be color matched with neoprene washers.

D. Flashing and Trim: Formed from 0.022-inch nominal-thickness, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match adjacent metal panels.

E. Gutters: Formed in sections not less than 20 feet in length complete with required special pieces. Join sections with riveted and soldered or sealed joints. Provide required expansion joints with cover plate. Provide gutter supports spaced at maximum 48 inches on center, constructed of same metal as gutters. Provide aluminum wire ball strainers at each outlet. Gutters shall be, 26-gage, roll formed, galvanized steel, ASTM A653 with G90 coating and Kynar 500 (70 percent PVDF) finish. Color shall match roof fascia and rake. Gutters are box-shaped with face profile shaped to match rake trim. .

F. Downspouts: Formed in full-length sections complete with required special pieces. Downspouts shall be, 26-gage, roll formed (smooth, not corrugated), galvanized steel, ASTM A653 with G90 coating and Kynar 500 (70 percent PVDF) finish. Color shall match roof fascia and rake. Downspouts are rectangular-shaped and unless indicated otherwise, shall have a 45 degrees elbow at the bottom. Straps shall be spaced 5 feet on center maximum (minimum of 3 required per downspout) and be the same material and finish as downspout. Strap edges shall be rolled or smooth.

G. Pipe Flashing: Premolded, EPDM pipe collar with flexible aluminum ring bonded to base.

H. Column Covers: Pre-finished column covers as indicated.

1. Products by one of the following manufacturers are acceptable:
   a. Ceco Building System, Columbus, MS. Tel (662) 328-6722.
   b. Petersen Aluminum Corp., Elk Grove Village, IL. Tel. (800) 323-1960.
   c. Firestone Metal Products/ Una-Clad, Jackson, MS. Tel: (800) 426-7737.
   d. SAF Metal Fabrication, Villa Rica, GA. Tel. (800) 241-7429.
2. Finish: Match metal wall panel color; Kynar 500® (70 percent PVDF) finish.

I. Vinyl Faces Wall Insulation: ASTM C991 Type II; 1-layer R-19 insulation with .0032 inch thick vinyl sheet (white), 6 inches thick where indicated.

2.05 FABRICATION

A. 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 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 unless approved in writing by manufacturer and Project Engineer.
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. 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.

C. 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. Prepare joints and apply sealants to comply with requirements in Section 07 92 00 "Joint Sealants."

3.02 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 and hip caps as metal roof panel work proceeds.
2. Flash and seal metal roof panels with weather closures at eaves and rakes. Fasten with self-tapping screws.

B. Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each standing-seam joint, at location and spacing and with fasteners recommended by manufacturer.

1. Install clips to supports with self-drilling or self-tapping fasteners.
2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
4. Seamed Joint: Crimp standing seams with manufacturer-approved motorized seamer tool so that clip, metal roof panel, and factory-applied sealant are completely engaged.

5. Rigidly fasten eave end of metal roof panels and allow ridge end free movement due to thermal expansion and contraction. Predrill panels for fasteners.
6. Provide metal closures at peaks, rake edges, rake walls, and each side of ridge and hip 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.

3.03 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. Rigidly fasten base end of metal wall panels and allow eave end free movement due to thermal expansion and contraction. Predrill panels.
4. Flash and seal metal wall panels with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws.
5. Install screw fasteners in predrilled holes.
6. Install flashing and trim as metal wall panel work proceeds.
7. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated; or, if not indicated, as necessary for waterproofing.
8. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws.
9. 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.

3.04 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 o.c. in between.

1. Provide elbows at base of downspouts to direct water away from building.
2. Tie downspouts to underground drainage system indicated.

E. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to panel as recommended by manufacturer.

3.05 CLEANING AND TOUCH-UP

A. Clean component surfaces. Touch up abrasions, marks, skips, or other defects to shop-primed surfaces with same material as shop primer.

END OF SECTION

SECTION 21 13 00 FIRE SUPPRESSION SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. These heating, ventilating and air conditioning (HVAC) provisions specified herein apply to all Sections of Division 23.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 23.

1.02 WORK INCLUDED

A. Furnish all labor, materials, tools, and equipment to complete the automatic fire sprinkler system as hereinafter described, ready for service to the entire satisfaction of the Owner. Provide hydraulically calculated systems as defined in the adopted edition of NFPA 13 and in accordance with State Fire Marshall requirements.

B. This section is a performance specification section only. The design build fire protection contractor shall be fully responsible for the design and to provide necessary equipment and hardware per local fire protection codes.

C. Fire Sprinkler System Notes:

1. The automatic sprinkler system shall conform to the requirements of the adopted edition of NFPA Standard 13.
2. Installation of the sprinkler system shall not be started until complete plans and specifications including water supply design information and type of existing sprinkler system, if any have been submitted and approved by the State Fire Marshal, Fire/Life Safety Section. At various stages and upon completion, the system must be tested in the presence of the Inspector of Record (IOR) and/or Authority Having Jurisdiction (AHJ).

D. Verify electrical requirements of alarm valves, flow switches, valve supervision switches, alarm bells and pumps with electrical contractor.

1.03 RELATED WORK AND REQUIREMENTS

A. All Division 21 sections.

B. Section 230010 – Mechanical General Provisions.

1.04 REFERENCE STANDARDS

A. American National Standards Institute (ANSI).

1. B16.1 Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800.
2. B16.3 Malleable-Iron Castings.

3. B16.4 Cast-Iron Threaded Fittings Class 125 and 300.
4. B16.5 Pipe Flanges and Flanged Fittings.
5. B16.9 Factory-Made wrought Steel Butt welding Fittings.
6. B16.11 Forged Fittings, Socket-Welding and Threaded.
7. B16.22 Wrought Copper and Bronze Solder Joint Pressure Fittings.
8. B16.25 Butt welding Ends.

B. American Society for Testing and Materials (ASTM).

1. A36 Structural Steel.
2. A47 Ferritic, Malleable Iron Castings.
3. A53 Pipe, Steel, Black and Hot-Dipped, Zinc Coated.
4. A135 Specification for Electric-Resistance-Welded Steel Pipe.
5. A194 Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure and High-Temperature Service.
6. A320 Specification for Alloy Steel Bolting Materials for Low-Temperature Service.
7. A795 Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use.
8. B88 Seamless Copper Water Tube.

C. American Water Works Association (AWWA).

1. C200 Steel Water Pipe 6” and larger.

D. International Association of Plumbing and Mechanical Officials (IAPMO).

1. PS 31 Backflow Prevention Devices.

E. National Fire Protection Association (NFPA).

1. 13 – Standard for the Installation of Sprinkler Systems.

F. Underwriter’s Laboratory (UL).

1. 262 Gate Valves for Fire Protection Service.
2. Indicator Post for Fire-Protection Service.

1.05 DESIGN CRITERIA

A. Design sprinkler systems and obtain approval from AHJ.

B. Determine the static and residual pressure for the site as required for accurate determination of system requirements. Base system calculations on the lowest expected static and residual pressure for the area.

1. Test data for static and residual pressure shall be measured by the Contractor. Test shall be made within the presence of the Architect and at a time approved by the Architect and Owner.

C. It is the intent of these Specifications and Drawings to provide for a complete and operating automatic fire protection sprinkler system in full compliance with the standards of the National Fire Protection Association as set forth in NFPA Pamphlet No. 13, currently adopted editions.

D. Review Architectural and Structural Drawings to determine the extent of construction and resultant fire protection coverage to comply with NFPA. Interstitial spaces, if utilized, will require sprinkler protection.

E. Provide fire sprinklers to protect all building overhangs greater than 4 feet wide, or as required by local authority.

F. Provide additional fire sprinklers where required to meet the requirements of NFPA13. Coordinate with the work of other trades especially when it may create interferences and or obstructions requiring special protection, additional piping and heads and drains.

G. The maximum permissible flow velocity through automatic sprinkler piping shall be 15 feet per second. The minimum starting pressure at the most remote sprinkler head shall be not less than the minimum required to operate the sprinkler head.

H. Reduction in area of operation when use of quick response sprinkler heads as defined in NFPA 13 will not be allowed.

I. Use of piping lighter than Schedule 10 is not allowed.

J. Design shall comply with the Owner's Insurance Underwriters' requirements.

1.06 COORDINATION/SPECIAL CONSIDERATIONS

A. Coordinate with other trades all equipment locations, pipe, duct and conduit runs, electrical outlets and fixtures, air inlets and outlets, and structural and architectural features. Provide information on location of piping and bracing to all other trades as required for a completely coordinated project.

B. Contract Drawings: All piping required for the sprinkler and standpipe systems is not shown, but general arrangement of system piping, required standpipes, outlets and valves, alarm valves and areas requiring sprinkler protection are shown.

C. Where heads are located at suspended ceiling, spacing shall be as required by NFPA 13, except as follows: In all locations, sprinkler heads shall be equidistant between lights, between wall and lights, between lights and air diffusers, and between wall, lights, and air diffusers. Provide uniform and repetitive pattern for each room. Locate by reflected ceiling plan where shown.

D. Install sprinkler all sprinkler heads in center of ceiling tiles.

E. Provide approved dry pendant sprinkler heads in spaces subject to freezing.

F. Provide high temperature sprinkler heads in all electrical rooms or other areas with elevated temperatures such as mechanical rooms.

G. Coordinate Work among the trades in accordance with Division 01 avoid any interference with the effectiveness of the fire protection system. Shop drawings shall include elevations of equipment and piping to assure coordination. The fire protection system shall be coordinated with other trades to assure that conflicts will not arise with structural, mechanical, electrical or architectural features of the building.

H. Coordinate with the fire alarm contractor to ensure full awareness of the location of control valves, flow switches, tamper switches, and alarm and signal switches.

1.07 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of fire protection products, of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer: A firm with at least five years of successful installation experience on projects with fire sprinkler piping similar to that required for this project.

C. Requirements of Regulatory Agencies:

D. Fire stop penetrations with an approved material as prescribed in the International Building Code (IBC).

E. Installation of the sprinkler system shall not be started until complete plans and specifications (including water supply information and type of existing sprinkler system, if any) have been reviewed and approved by the AHJ and the Owner's Insurance Underwriter.

F. At various stages and upon completion, the system must be tested in the presence of the enforcing agency.

G. The fire extinguishing system shall be installed by a licensed fire systems contractor.

1.08 SUBMITTALS

A. See Section 230010 Mechanical General Provisions.

B. Submit product data, O&M data, and samples and show item on shop and coordination drawings according to the following table.

1. "R" means required.
2. "R2" means required only for products and equipment differing for the specified manufacturer and model and for "or equals" where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Pipe, fittings, valves	R			
Sprinkler heads	R			R
Gauges	R			R
Sleeves and Escutcheons	R			
Flow and tamper switches	R			R
Alarm bells	R			R
Pipe hangers and supports	R			R
Identification signs	R			
Sprinkler head cabinets	R			R
Hose Valve cabinets	R			R
Coordination drawings				R
AHJ approval letter				R

Item	Product Data	O&M Manual	Samples	Shop Drawing
Insurance Underwriter's approval letter				R
Hydraulic calculations				R
Static and residual flow tests results				R

C. Submit shop drawings as follows:

1. Prepare and submit preliminary drawing to the Owner showing the proposed location of the fire sprinkler heads coordinated with and in relation to the ceiling tile pattern, light fixture and duct inlets/outlets. Review of this drawing and the AHJ's review stamp thereon shall be a prerequisite for the preparation of further working plans.
2. Detailed working drawings and hydraulic calculations shall be prepared and submitted for approval before fabrication of the project. Working drawings shall be submitted in complete sets (partial submission will not be acceptable) and shall bear the Contractor's license stamp, identity of the system designer and computer program used in the calculation of hydraulic information.
3. AHJ approval of submittals is for permission to proceed and does not authorize design, products or installation not conforming to referenced codes and standards and this specification. Substitutions or alternates require specific approval by the Owner.
4. Upon completion of the Work, the Contractor shall provide AutoCAD Record Drawings to the Architect. Refer also to Division 01. Final approvals are subject to receipt of acceptable Record Drawings.

D. Deferred Approval Documents: Do not proceed with fabrication or installation of fire sprinkler system until deferred approval documents have been approved by AHJ and Architect.

1. General: Provide detailed drawings, specifications, and hydraulic calculations.
2. AHJ approval letter.
3. Make additions, changes and corrections as directed by Architect and resubmit.
4. Agency Review: Submit documents to Owner and AHJ. Make additions, changes and corrections required by Owner / AHJ at no cost to Owner and resubmit to Architect.

E. Provide all necessary information to ceiling suspension work of Division 09, Finishes, to provide coordinated submittals.

F. Discharge patterns and application data shall be included in submittals for sidewall, water curtain, and similar special purpose sprinklers.

G. Operating Instructions: Provide instruction charts describing operation and proper maintenance of system equipment per Division 01 and Section 230100 Mechanical General Provisions.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Provide piping materials and factory-fabricated piping products of sizes, types, pressure rating, temperature ratings, and capacities as required. Provide sizes and types matching piping and equipment connections; provide fittings of materials that match pipe materials used in fire protection systems.

B. Equipment to be furnished under this specification shall be essentially standard product of manufacturer. Where two or more units of same class of equipment are required, these units shall be products of a single manufacturer. However, component parts of system need not be products of same manufacturer.

C. Manufacturers: Subject to compliance with requirements, manufacturer offering automatic sprinklers which may be incorporated in the work include the following:

1. Specialty Valves and Devices:

a. Badger Fire Protection, Inc.
b. Grinnell Corp.
c. Viking Corp.

2. Water-Flow Indicators and Supervisory Switches:

a. Grinnell Corp.
b. Potter Electric Signal Co.
c. Viking Corp.

3. Sprinkler, Drain and Alarm Test Fittings:

a. Central Sprinkler Corp.
b. Grinnell Corp.
c. Victaulic Co.

4. Sprinkler, Branch-Line Test Fittings:

a. Badger Fire Protection, Inc.
b. Elkhart Brass Mfg. Co. Inc.
c. Smith Industries, Inc; Potter-Roemer Div.

5. Sprinkler, Inspector's Test Fittings:

a. Badger Fire Protection, Inc.
b. G/J Innovations, Inc.
c. Triple R Specialty of Ajax, Inc.

6. Sprinklers:

a. Badger Fire Protection, Inc.
b. Grinnell Corp.
c. Viking Corp.

7. Fire-Protection-Service Valves:

   a. Grinnell Corp.
   b. McWane, Inc.; Kennedy Valve Div.
   c. Nibco, Inc.

2.02 VALVE AND ALARM SYSTEM IDENTIFICATION

A. Provide identification complying with Section 230553, Mechanical System Identification in accordance with the following listing:

1. Fire Protection Valves: Brass valve tags.
2. Fire Protection Signs: Provide the following signs:

   a. At each sprinkler valve, including roof manifold, sign indicating what portion of system valve controls.
   b. At each outside alarm device, sign indicating what authority to call if device is activated.

2.03 BASIC PIPES AND TUBES

A. Piping shall be new, designed for 300 psi working pressure, conforming to ASTM specifications and have the manufacturer's name or brand along with the pipe applicable ASTM standard marked on each length of pipe.

B. All piping shall be UL listed and FM approved.

C. Piping installed above ground 2 inch and smaller shall be Schedule 40 black steel pipe. Pipe shall be manufactured in accordance with specifications ASTM A-135 and A-53.

D. Piping installed above ground 2-1/2 inch and larger shall be Schedule 10 black steel pipe. Pipe shall be manufactured in accordance with specification ASTM A 135.

E. All fire protection piping shall be provided with factory-applied antimicrobial coatings to inhibit Microbiologically-Influenced Corrosion (MIC). Allied Tube and Conduit "ABF II", Wheatland Tube Company "MIC Shield".

F. Sprinkler piping and fittings exposed to weather, used in a corrosive atmosphere or as noted on drawings shall be galvanized.

G. In-Building Risers shall be installed as indicated on the plans. Risers shall be composed of a single extended 90 degree fitting of fabricated 304 stainless steel tubing, maximum working pressure 300 psi. The fitting shall have a grooved-end connection on the outlet (building) side and a CIPS coupler on the inlet (underground) side. The In-Building Riser shall be an Ames Fire & Waterworks Series IBR (or equal).

2.04 PIPE AND TUBE FITTINGS

A. Cast-Iron Threaded Flanges: ASME B16.1.

B. Cast-Iron Threaded Fittings: ASME B16.4.

C. Ductile-Iron Fitting: AWWA C110, ductile-iron or cast-iron type; or AWWA C153, ductile-iron, compact mechanical-joint type. Include cement-mortar lining and seal coat according to AWWA C104 and glands, rubber gaskets, and bolts and nuts according to AWWA C111.

D. Ductlie-Iron Fittings: ASTM A47, malleable-iron or ASTM A 536 ductile-iron casting complying with AWWA pipe size; with ends factory grooved according to AWWA C606.

E. Malleable-Iron Threaded Fittings: ASME B16.3.

F. Steel, Threaded Couplings: ASTM A 865.

G. Steel Welding Fittings: ASTM A 234/A 234M, ASME B16.9, or ASME B16.11.

H. Steel Flanges and Flanged Fittings: ASME B16.5.

2.05 PIPING SPECIALTIES

A. Provide piping specialties in accordance with the following listing:

1. Pipe escutcheons.
2. Dielectric unions.
3. Pipe sleeves.
4. Sleeve seals.

2.06 JOINING MATERIALS

A. Grooved-End Pipe Couplings: UL 213 and AWWA C606, rigid pattern, unless otherwise indicated; gasketed fitting matching steel pipe OD. Include ductile-iron housing with keys matching steel pipe fitting grooves, prelubricated rubber gasket listed for use with housing and steel bolts and nuts. Include listing for dry-pipe service for couplings for dry piping.

B. Steel, Grooved-End Fittings: UL-listed and FM approved, ASTM A47, malleable iron or ASTM A 536, ductile iron, with dimensions matching steel pipe and ends factory grooved according to AWWA C606.

C. Transition Couplings: AWWA C219, sleeve type, or other manufactured fitting the same size as, with pressure rating at least equal to, and with ends compatible with piping to be joined.

2.07 SUPPORTS AND ANCHORS

A. Spacing and details of the support and bracing of fire sprinkler piping shall comply with the currently adopted edition of NFPA 13. U-hook hangers used as sway bracing must have legs bent out 10 degrees and must have a slenderness ratio not exceeding 200.

B. Concrete Inserts: Uni-Strut P-3200 continuous insert or M24 spot insert Kin-line or equal. Do not use powder actuated fasteners for support of overhead piping unless approved by Architect.

2.08 VALVES

A. Provide valves, UL listed and FM approved, in accordance with the following listing. Provide sizes and types which mate and match piping and equipment connections.

1. Gate Valves: Provide iron gate control valve, outside screw and yoke (OS&Y), 175-lb rated working pressure, of sizes indicated, to close by turning to the right and to be sealed with approved metal seals. Valves shall be iron body, bronze fitted. Valves 2 inches and smaller shall be screwed and valves over 2 inches shall be flanged. For reference purposes, Mueller A-2073-6. Grinnell, Kennedy, or Stockham.
2. Butterfly Valve: Provide UL listed FM approved butterfly valves (slow-close) with position indicators. Electric motor operated valves shall be normally open and shall fail in the open position. For reference purposes, Mueller B-3211. Grinnell, Kennedy, or Stockham.
3. Swing Check Valves: Provide UL listed flanged, swing type, iron body, bronze seat ring and disc ring, and 175 psi pressure rating. For reference purposes, Mueller A-2120-6, Grinnell, Kennedy, or Stockham.
4. Riser Drain Valves: Main Riser Drain valves shall be angle or globe type, bronze body, screwed, 200 psi pressure rating, 2 inches size, with renewable composition soft disc. For reference purposes, Grinnell 3210, Stockham, NIBCO, or Fairbanks.
5. Auxiliary Drain Valve: Valves for auxiliary drains and Owner's Test connections shall be globe type, bronze body, screwed, 200 psi pressure rating, 1 inch size, with a renewable composition soft disc, For reference purposes, Grinnell 3210, Stockham, NIBCO, or Fairbanks.
6. Indicating Valves, 2-1/2 inches and Smaller: UL 1091; butterfly or ball-type, bronze body with threaded ends; and integral indicating device.
7. Indicator Posts: UL 789, vertical type, cast iron body, with windows for target plates that indicate valve position, extension rod and coupling, locking device, and red enamel finish.
8. Swing Check Valves, 2 inches and Smaller: UL 312 or MSS SP-80, Class 150; bronze body with bronze disc and threaded ends.
9. Swing Check Valves, 2-1/2 inches and Larger: UL 312, cast-iron body and bolted cap, with bronze disc or cast-iron disc with bronze-disc ring and flanged ends.
10. Split-Clapper Check Valves, 4 inches and Larger: UL 312, cast-iron body with rubber seal, bronze-alloy discs, and stainless-steel spring and hinge pin.
11. For other valves not required to be UL listed and FM approved refer to Section 210523 – General-Duty Valves for Fire Protection Piping.

2.09 METERS AND GAUGES

A. Provide meters and gauges complying with Section 230513 Piping Specialties, in accordance with the following listing:

1. Pressure gauges: UL 393, 3-1/2- to 4-1/2-inch- diameter dial with dial range of 0 to 300 psig.

2.10 SPECIALTY VALVES

A. Sprinkler System Control Valves: UL listed or FMG approved, cast or ductile-iron body with flanged or grooved ends, and 175-psig minimum pressure rating.

1. Available Manufacturers:

   a. Grinnell Corp.
   b. Victaulic Co.
   c. Viking Corp.

2. Alarm Check Valves: UL 193, designed for horizontal or vertical installation, with bronze grooved seat with O-ring seals, single-hinge pin, and latch design. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, retarding chamber, and fill-line attachment with strainer.

   a. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.

3. Ball Drip Valves: UL 1726, automatic drain valve, NPS 3/4, ball check device with threaded ends.

2.11 FIRE PROTECTION SPECIALTIES

A. Provide fire protection specialties, UL listed, in accordance with the following listing. Provide sizes and types that match piping and equipment connections.

1. Install drains on main risers and auxiliary drains at all low points in the system.
2. One Owner's test drain shall be installed for each sprinkler system.
3. Drains and Owner's tests shall be at locations approved by the Architect.
4. Drains and Owner's tests shall be installed at locations as shown on the Drawings.
5. Provide drain line to floor sink or to outside, as required, to suit Project conditions.
6. Five or fewer trapped heads will not require a drain valve but may be drained through a plugged fitting.
7. Drain valve shall be of the angle type. Install in accordance with the requirements of NFPA Pamphlet No. 13.
8. Pipe drain valves to a floor sink or to the outside of the building. Discharge shall be visible from sight drain fitting or open end drain pipe. Provide flushing connections at ends of all cross mains.
9. Flow Alarm: Furnish and install a flow alarm system for each main sprinkler riser as shown on the Drawings. The systems shall be complete with Grinnell F-620, Viking or equal, flow switch. As part of Division 26, wire flow alarm to the fire alarm control panel. Provide 3/4-inch conduit and two #14 wires from the tamper switch to the fire department control panel.
10. Provide wiring between switch, bell, and junction box. Provide junction box under Division 26. Wiring shall meet the requirements of Division 26. All controls shall be identified by permanent metal tags or other approved means. Alarm switch shall be UL or FM approved and shall have adjustable retard mechanism and two sets of contacts. Wiring between electrical distribution panel and junction box will be provided under Division 26.
11. Water-Flow Indicators: UL 346; electrical-supervision, vane-type water-flow detector; with 250-psig pressure rating; and designed for horizontal or vertical installation. Include two single-pole, double-throw, circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.

12. Pressure Switches: UL 753; electrical-supervision-type, water-flow switch with retard feature. Include single-pole, double-throw, normally closed contacts and design that operates on rising pressure and signals water flow.
13. Valve Supervisory Switches: UL 753; electrical; single-pole, double throw; with normally closed contacts. Include design that signals controlled valve is in other than fully open position, Grinnell Model F640, Viking or equal, with single pole double throw switch actuator installed to change switch position when OS&Y valve is being closed.
14. Indicator-Post Supervisory Switches: UL 753; electrical; single-pole, double throw, with normally closed contacts. Include design that signals controlled indicator-post valve is in other than fully open position.
15. As part of Division 26, wire supervisory switch to the fire alarm control panel. Provide 3/4-inch conduit and two #14 wires from the tamper switch to the fire department control panel.

2.12 AUTOMATIC SPRINKLERS

A. Provide automatic sprinklers in accordance with the following listing. Provide fusible links for 165 degrees F. unless otherwise noted; UL or FM approved.

B. Automatic Sprinklers: With heat-responsive element complying with the following:

1. UL 199, for applications except residential.
2. UL 1767, for early suppression, fast-response applications.

C. Type: Spray pattern type, automatic closed-type heads of ordinary degree temperature rating, except that sprinklers to be installed in vicinity of heating equipment shall be of temperature ratings required for such locations by the currently adopted edition of NFPA 13.

1. Flush ceiling sprinklers, including escutcheon.
2. Pendent, dry-type sprinklers.
3. Quick-response sprinklers.
4. Sidewall, dry-type sprinklers.
5. Upright sprinklers.
6. Concealed ceiling sprinklers, including cover plate.

D. Sprinkler heads shall be UL or FM listed.

1. Exposed Locations: Provide upright type heads at all areas with no finished ceilings.
2. Where heads are located at height of less than 8 feet above finished floor, or where heads are located in mechanical equipment areas, provide wire guards to protect heads from damage.
3. Concealed Locations: Provide upright-type heads or pendent-type heads.
4. Sidewall Locations: Where required and where approved by the Architect.
5. Finished Ceilings: Locate at all ceilings with lay-in acoustical tile ceiling and at plaster or gypsum board type ceilings. Provide satin chrome finish and adjustable chrome finish metal ceiling escutcheons. Provide fully recessed pendant type and white enamel metallic cover in ceilings of finished spaces.
6. Where fire sprinkler heads are located in rooms with surface mounted lights, provide 2 piece adjustable sprinkler escutcheon, with adjustment from 1-7/8" to 3-1/8" below finished ceiling. Fire sprinkler drop nipple should be mounted 2-1/4" below the finished ceiling surface.

7. Sprinkler heads in light hazard area shall be quick response type.
8. Extended coverage sprinklers shall not be used.

E. Sprinkler Finishes: Chrome-plated, bronze, and painted.

F. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

1. Ceiling Mounting: Chrome-plated steel, one piece, flat.
2. Sidewall Mounting: Chrome-plated steel, one piece, flat.

G. Sprinkler Guards: Wire-cage type, including fastening device for attaching to sprinkler.

H. Sprinkler Cabinet and Wrench: Furnish steel, baked red enameled, sprinkler box with capacity to store sprinklers and wrench sized to sprinklers. Spare sprinklers and wrenches called for under "Extra Stock."

2.13 SPECIALTY SPRINKLER FITTINGS

A. Specialty Fittings: UL listed and FM approved; made of steel, ductile iron, or other materials compatible with piping.

B. Drop-Nipple Fittings: UL 1474, with threaded inlet, threaded outlet, and seals; adjustable.

C. Sprinkler, Drain and Alarm Test Fittings: UL-listed, cast- or ductile-iron body; with threaded inlet and outlet, test valve, and orifice and sight glass.

D. Sprinkler, Branch-Line Test Fittings: UL-listed, brass body; with threaded inlet and capped drain outlet and threaded outlet for sprinkler.

E. Sprinkler, Inspector's Test Fittings: UL-listed, cast- or ductile-iron housing; with threaded inlet and drain outlet and sight glass.

F. Flexible Hose Assemblies: FlexHead Industries flexible stainless steel hose assembly consisting of a mounting bracket and a one-piece, leak tested sprinkler drop. The mounting bracket shall be compatible with any suspended or gypsum board ceiling system and FM/UL approved sprinklers. Assembly shall be FM approved and UL listed for use intended. Lengths of assemblies shall be selected with minimum length required to connect sprinkler without loops, traps, etc.

PART 3 - EXECUTION

3.01 PRODUCT HANDLING AND PROTECTION

A. Deliver packaged materials in their original, unopened wrapping with labels intact. Protect materials from water, the elements and other damage during delivery, storage and handling.

3.02 PREPARATORY PROVISIONS

A. The Contractor shall be responsible for the examination and acceptance of all conditions affecting the proper construction and/or installation of the Work of this Section and shall not proceed until all unsatisfactory conditions have been corrected. Commencing work shall be construed as acceptance of all conditions by the Contractor as satisfactory for the construction and/or installation of the Work

B. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations.

C. Report test results promptly and in writing

3.03 PIPING APPLICATIONS

A. Do not use welded joints with galvanized steel pipe.

B. Flanges, unions, and transition and special fittings with pressure ratings the same as or higher than system's pressure rating may be used in aboveground applications, unless otherwise indicated.

C. Piping between Fire Department Connections and Check Valves: Use galvanized, standard-weight steel pipe with threaded ends; cast- or malleable-iron threaded fittings; and threaded joints.

3.04 SPRINKLER SYSTEM PIPING APPLICATIONS

A. Pipe and Fitting Schedule:

1. 1-1/2 inches and Smaller: Standard-weight black steel pipe with threaded ends, cast-or malleable-iron threaded fittings, and threaded joints.
2. 2 inch: Standard-weight black steel pipe with threaded ends, cast- or malleable-iron threaded fittings, and threaded joints.
3. 2 inch: Standard-weight black steel pipe with grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
4. 2-1/2 to 3-1/2 inches: Schedule 40 black steel pipe with threaded ends, cast- or malleable-iron threaded fittings, and threaded joints.
5. 2-1/2 to 3-1/2 inches: Schedule 10 black steel pipe with roll-grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
6. 2-1/2 to 3-1/2 inches: Schedule 30 black steel pipe with plain ends, steel welding fittings, and welded joints.
7. 4 inch: Schedule 40 steel pipe with threaded ends, cast-or malleable-iron threaded fittings, and threaded joints.
8. 4 inch: Schedule 10 black steel pipe with roll-grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
9. 4 inch: Schedule 40 black steel pipe with plain ends, steel welding fittings, and welded joints.
10. 5 and 6 inches: Standard-weight black steel pipe with threaded ends, cast- or malleable-iron threaded fittings, and threaded joints.
11. 5 and 6 inches: Standard-weight black steel pipe with grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
12. 5 and 6 inches: Standard-weight black steel pipe with plain ends, steel welding fittings, and welded joints.

3.05 VALVE APPLICATIONS

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Fire-Protection-Service Valves: UL listed and FM approved for applications where required by NFPA 13.

a. Shutoff Duty: Use gate valves.

2. General-Duty Valves: For applications where UL-listed and FM-approved valves are not required by NFPA 13.

a. Shutoff Duty: Use gate, ball, or butterfly valves.
b. Throttling Duty: Use globe, ball, or butterfly valves.

3.06 JOINT CONSTRUCTION

A. Threaded Joints: Comply with NFPA 13 for pipe thickness and threads. Do not thread pipe smaller than NPS 8 with wall thickness less than Schedule 40 unless approved by authorities having jurisdiction and threads are checked by a ring gage and comply with ASME B1.20.1.

B. Steel-Piping, Grooved Joints: Use Schedule 10 steel pipe with cut or roll-grooved ends and Schedule 30 or Schedule 10 steel pipe with roll-grooved ends; steel, grooved-end fittings; and steel, keyed couplings. Assemble joints with couplings, gaskets, lubricant, and bolts according to coupling manufacturer's written instructions. Use gaskets listed for dry-pipe service for dry piping.

C. Dissimilar-Metal Piping Joints: Construct joints using dielectric fittings compatible with both piping materials.

1. 2 inch and Smaller: Use dielectric couplings or nipples.
2. 2-1/2 to 4 inches: Use dielectric flanges.
3. 5 inch and Larger: Use dielectric flange insulation kits.

D. Dissimilar-Piping-Material Joints: Construct joints using adapters or couplings compatible with both piping materials. Use dielectric fittings if both piping materials are metal. Refer to Division 21 Section "Common Work Results for Fire Suppression" for dielectric fittings.

3.07 INSTALLATION OF FIRE SPRINKLER PIPING

A. General: Comply with the requirements of the Division 21 sections and referenced NFPA standards for installation of fire sprinkler piping material. Install fire sprinkler piping products where shown, in accordance with the manufacturer's written instructions, and in accordance with recognized industry practices to ensure that fire sprinkler piping complies with requirements and serves its intended purpose.

B. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.

C. Coordination: Coordinate all piping, heads, and sprinkler work to Architectural, Structural, Mechanical, and Electrical Work. Conceal piping, except where so indicated otherwise or where absolutely necessary. Place exposed piping where required by the Architect. Provide any offsets or additional piping required to coordinate this system with all other Work.

1. If piping is installed such that it is exposed to view in any location normally available to the users of the building or the public, it shall be relocated and concealed to the Architect's satisfaction, and at no additional cost to the Owner.

D. Any differences or disputes concerning coordination, interference, head and pipe locations or extent of work shall be decided by Architect and his decision shall be final.

E. Supply System: Provide supply connections as required to service the sprinkler system.

1. Installation shall conform to the applicable requirements of NFPA 13 and IBC.
2. Make joints as specified herein and in a manner approved by Architect. Leave joints exposed until final inspection and tests have been made.
3. Brace or clamp bends in accordance with the requirements. The clamp rods at the flange and spigot piece shall be long enough to pass through the flange.
4. Before connection of sprinkler system to underground supply, flush supply connections out thoroughly in accordance with NFPA.

F. Supply System: Provide supply connections as required to service the sprinkler system.

1. Install pipe, fittings, and hangers in accordance with requirements of IBC current adopted edition, "Fire Protection Systems".
2. Cutting structural members for passage of sprinkler piping or for pipe hanger fastening will not be permitted except on review of Architect for each specific case.
3. Holes through walls, floors, and ceilings shall be large enough to accommodate pipe expansion. Provide suitable plates at each hole to ensure the effectiveness of floor or wall as a fire stop. Foundation penetration shall have a 2-inch annular space around pipe sealed watertight.
4. Provide long runs of pipe with suitable means to permit free movement due to expansion and contraction.
5. Make reduction in pipe sizes with one-piece concentric tapered reducing fittings. Bushings will not be acceptable.
6. Couplings shall not be used except where the length of pipe between fittings exceeds 20 feet 0 inches.
7. Use flanged fittings in control valves and drain assembly and at the base of risers.
8. Use malleable iron unions of the ground joint type in looped sprinkler systems where pipe is 2 inches in diameter or smaller. Where loops larger than 2 inches are used, companion flanges shall be installed.
9. Special couplings approved for use in sprinkler systems may be used in place of unions and flanged connections where applicable.
10. Install sectional valves in inlet piping, at bottom of each riser, and in all loops as required.
11. Mount supervisory switches on each sectional valve.
12. Install pressure gages at top of each standpipe.

13. Install valved hose connections 3/4-inch size on sprinkler at ends of branch lines and cross mains.
14. Install Owner’s test connection at most remote point from riser.

G. Install flanges or flange adapters on valves, apparatus, and equipment having 2-1/2 inches and larger connections.

H. Install "Inspector's Test Connections" in sprinkler piping, complete with shutoff valve, sized and located according to NFPA 13.

I. Install sprinkler zone control valves, test assemblies, and drain risers adjacent to sprinkler risers when sprinkler branch piping is connected to sprinkler risers.

J. Install ball drip valves to drain piping between fire department connections and check valves. Drain to floor drain or outside building.

K. Install sectional valves in piping.

L. Mount supervisory switches on each sectional valve.

M. Install valved hose connections of the sizes indicated, or 3/4 inch size, if not otherwise indicated, on sprinklers at ends of branch lines and cross mains at locations where indicated.

N. Install drain piping at low points of fire sprinkler piping.

O. Identification: Apply signs to control, drain, test and alarm valves to identify their purpose and function. Provide lettering size and style selected by Authority Having Jurisdiction.

P. Hangers and Supports: Comply with NFPA 13 for hanger materials and installation.

Q. Install piping with grooved joints according to manufacturer's written instructions. Construct rigid piping joints, unless otherwise indicated.

R. Install new pressure gages on riser or feed main, at each sprinkler test connection. Include pressure gages with connection not less than NPS 1/4 and with soft metal seated globe, valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.

S. Fill wet-pipe sprinkler piping with water.

3.08 SPECIALTY SPRINKLER FITTING INSTALLATION

A. Install specialty sprinkler fittings according to manufacturer's written instructions.

3.09 VALVE INSTALLATION

A. Install fire-protection specialty valves, trim, fittings, controls, and specialties according to NFPA 13, manufacturer's written instructions, and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Specialty Valves:

1. Alarm Check Valves: Install in vertical position for proper flow, including bypass check valve and retarding chamber and drain-line connections.

3.10 SPRINKLER APPLICATIONS

A. General: Use sprinklers according to the following applications:

1. Rooms with Suspended Ceilings: Concealed sprinklers.
2. Mechanical Rooms, Basement, and Central Plant: Upright sprinklers.
3. Wall Mounting: Sidewall sprinklers.
4. Spaces Subject to Freezing: Upright; pendent, dry-type; and sidewall, dry-type sprinklers.
5. Special Applications: Use extended-coverage, flow-control, and quick-response sprinklers were applicable.
6. Sprinkler Finishes: Use sprinklers with the following finishes:

a. Upright, Pendent, and Sidewall Sprinklers: Polished bronze in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view.
b. Concealed Sprinklers: Rough brass with white cover.

3.11 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Connect water-supply piping to fire-suppression piping. Include backflow preventer between potable-water piping and fire-suppression piping. Refer to Division 21 for backflow preventers.

D. Connect piping to specialty valves, hose valves, specialties, fire department connections, and accessories.

E. Connection of alarm devices to fire alarm system by Division 26 Contractor.

3.12 SLEEVES AND FLASHINGS

A. All sleeves shall be properly anchored in place during pouring of slabs. All pipe sleeves through water resistant floors shall extend at least 1-1/2 inches above the finished floor and shall be watertight with the pipes passing through the sleeves. Sleeves passing through all other floors shall be of sufficient length to be flush with bottom of slab and extend one inch above the finished floor, and shall be securely anchored to the slab.

B. All piping passing through membrane water resistant walls and floors shall be provided with a water resistant type pipe sleeve, with Schedule 40 pipe extension or equal. Pack water resistant sleeves with white oakum and mastic.

C. Wherever pipes are exposed and pass through walls, floors, partitions or ceilings, they shall be fitted with chromium plated cast steel escutcheons held in place with setscrews. Care shall be taken to protect the escutcheons during the course of construction.

D. Sleeves in masonry or other walls shall be put in place as the construction progresses, avoiding the cutting of completed work.

E. All piping passing through fire-rated assemblies shall be installed within fire-rated pipe sleeves.

3.13 INSPECTION

A. Examine areas and conditions under which fire protection materials and products are to be installed.

B. After completion of the fire protection installation and at the start of the guarantee period, execute the National Automatic Sprinkler and Fire Control Association, Inc. standard form of “Inspection Agreement”, at no increase in Contract Sum, calling for four inspections of the sprinkler system during the guarantee year, plus the following maintenance to be performed during the course of the fourth inspection.

1. Operating of all control valves.
2. Lubrication of operating stems of all control valves.
3. Operating of electrical alarms.
4. Cleaning of alarm valves.

C. Fill out “Inspection Agreement” in triplicate after each inspection and send copies to the Owner, Insurance Carrier and Fire Department.

3.14 INSTALLATION OF BASIC IDENTIFICATION

A. Install mechanical identification in accordance with Section 210553.

B. Install fire protection signs on piping in accordance with NFPA requirements.

C. Paint all exposed piping and including fire protection riser, color shall be selected by the Architect. See Division 09 Painting.

3.15 FIELD QUALITY CONTROL

A. Sprinkler Piping Flushing: Prior to connecting sprinkler risers for flushing, flush water feed mains, lead-in connections, and control portions of sprinkler piping. After fire sprinkler piping installation has been completed and before piping is placed in service, flush entire sprinkler system as required to remove foreign substances under pressure as specified in NFPA 13. Continue flushing until water is clear, and check to ensure that debris has not clogged sprinklers.

B. Hydrostatic Testing: After flushing system, test fire sprinkler piping hydrostatically for period of 2 hours at not less than 200 psi or at 50 psi greater than system pressure where pressure is anticipated to be in excess of 150 psi. Check system for leakage of joints. Measure hydrostatic pressure at low point of each system or zone being tested.

C. Repair or replace broken, damaged, or otherwise defective parts, materials, and work. Leave entire work in condition satisfactory to Architect. At completion, carefully clean and adjust equipment and trim that are installed as part of this work. Leave systems and equipment in satisfactory operating condition. Repair or replace piping system as required to eliminate leakage in accordance with NFPA standards for "little or no leakage," and retest as specified to demonstrate compliance.

3.16 EXTRA STOCK

A. Heads: For each style and temperature range required, furnish additional sprinkler heads, amounting to one unit for every 100 installed units but not less than 10 heads, in proportion to the total number of each style of head.

B. Wrenches: Furnish two sprinkler wrenches for each type and size of sprinkler connection.

C. Obtain receipt from Owner that extra stock has been received.

3.17 CLEANING AND PROTECTION

A. Clean dirt and debris from sprinklers and other equipment.

B. Remove and replace sprinklers having paint other than factory finish.

C. Protect sprinklers from damage until Substantial Completion.

END OF SECTION

SECTION 22 11 16 DOMESTIC WATER PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. These Plumbing provisions specified herein apply to all Sections of Division 22.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 22.

1.02 SUMMARY

A. Work included in this section: materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Domestic water piping for fixtures and equipment inside the building

B. Related Sections

1. Section 01 91 13 – General Commissioning Requirements
2. Section 22 16 00 – Plumbing Specialties
3. Section 23 00 10 – Mechanical General Provisions
4. Section 23 05 00 – Basic Mechanical Materials and Methods
5. Section 23 05 23 – Valves
6. Section 23 05 16 – Piping Specialties

1.03 REFERENCE STANDARDS

A. ANSI/ASME B16.18 – Cast Copper Alloy Solder Joint Pressure Fittings

B. ANSI/ASME B16.22 – Wrought Copper and Copper Alloy Solder Joint Pressure Fittings

C. ANSI/ASME B16.24 – Bronze Pipe Flanges and Flanged Fittings

D. ANSI/ASTM B88 – Seamless Copper Water Tube

E. MSS SP-123 – Non Ferrous Threaded and Solder Joint Unions for Use with Copper Water Tube

1.04 SUBMITTALS

A. See Section 23 00 10 – Mechanical General Provisions

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. “R” means required.
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Piping and fitting materials	R			R
Solder	R			

C. Water Samples: Specified in "Cleaning" Article in Part 3 of this section.

D. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.05 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.

C. Comply with NSF 61, "Drinking Water System Components--Health Effects," Sections 1 through 9 for potable-water piping and components.

1.06 PROJECT CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicating:

1. Notify Owner no fewer than seven days in advance of proposed interruption of water service.
2. Do not proceed with interruption of water service without Owner’s written permission.

PART 2 - PRODUCTS

2.01 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.02 COPPER TUBING

A. Soft Copper Tube: ASTM B 88, Types K and L (ASTM B 88M, Types A and B), water tube, annealed temper.

1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping
3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.

B. Hard Copper Tube: ASTM B 88, Types L and M (ASTM B 88M, Types B and C), water tube, drawn temper.

1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.

2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.
3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and- socket, metal-to-metal seating surfaces and solder-joint or threaded ends.

2.03 VALVES

A. Refer to Section 23 05 23 - Valves for bronze and cast-iron, general-duty valves

B. Refer to Section 22 16 00 - Plumbing Specialties for balancing and drain valves

PART 3 - EXECUTION

3.01 INSTALLATION

A. Coordinate the work of other trades.

B. See Section 23 08 00 – Mechanical Commissioning

3.02 EXCAVATION

A. Refer to Division 02 for excavating, trenching and backfilling.

3.03 PIPING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used

B. Flanges may be used on aboveground piping, unless otherwise indicated.

C. Domestic cold water; domestic hot water, and recirculating hot water, and industrial water, above ground:

1. Use Type L hard drawn copper with wrought copper fittings incorporating full solder cup. For sizes 2-in. and larger, joints shall be brazed with 1100 degree F melting point alloy with at least 5 percent silver. For sizes 1-1/2 inch and smaller, may use lead free solder equal to 95/5.
2. Automatic faucets and flush valves shall be piped with copper tube or pipe. (No plastic tubing is allowed).

D. Domestic water below ground: Copper type K with brazed or silver solder joints.

E. Strainers for use in domestic water applications (copper pipe).

1. Strainers shall be based on Watts No. 777 or equal. Provide with a working water pressure (WWP) of 250 psi at 210qF, with a cast bronze body, threaded ends, solid retainer cap and a 20-mesh stainless steel screen (except the 3-in. size must have 3/64 inch perforations).

3.04 VALVE APPLICATIONS

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shut-off Duty: Use bronze ball valves for piping NPS 3 and smaller. Use cast-iron butterfly or gate valves with flanged ends for piping NPS 3-1/2 and larger.

2. Throttling Duty: Use bronze ball or globe valves for piping NPS 2 and smaller. Use cast iron butterfly valves with flanged ends for piping NPS 2-1/2 and larger.
3. Hot-Water-Piping, Balancing Duty: Calibrated balancing valves.
4. Drain Duty: Hose-end drain valves.

3.05 PIPING INSTALLATION

A. Refer to Section 23 05 00 - Basic Mechanical Materials and Methods for basic piping installation.

B. Extend domestic water service piping to exterior water distribution piping in sizes and locations to match service piping.

C. Domestic water piping beneath concrete slabs shall be avoided. Trap primer piping shall be type “L” copper tubing with no joints below slab. Piping penetrations shall be carefully detailed. Insulation through penetrations shall be continuous.

D. Exterior hose bibs shall be provided at new buildings and plazas to wash down walks, loading docks and drives if irrigation system cannot provide this function. Recessed wall box type with loose key stop and vacuum breaker shall be used on buildings.

E. Do not allow piping to contact gypsum board at any point. Provide a minimum ½ inch clearance.

F. Arrange system for complete drainage with ¾ inch hose end gate valves at low points.

G. Domestic water lines in sound-rated construction shall be insulated using Acousto-plumb, Elmdor Trisolator series 400/500 or equal.

3.06 JOINT CONSTRUCTION

A. Refer to Section 23 05 00 - Basic Mechanical Materials and Methods for basic piping joint construction.

B. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

C. Brazed joint: 1100 degree F melting point alloy with minimum 5% silver.

3.07 WATER HAMMER ARRESTERS

A. Water hammer arresters shall be provided on both hot and cold water lines serving fixtures and equipment using flushometer valves or quick-closing valves. One water hammer arrester may serve more than one fixture. These devices must be installed in the upright position. Where utility access has not been provided, access panels shall be provided for access to maintain these devices.

B. At solenoid valves, make-up valves, washers, and flush valves or any other quick closing device, provide a diaphragm type shock absorber.

C. Size and locate in accordance with Plumbing and Drainage Institute Manual WH-201. Show location on shop drawings and PDI size of water hammer arresters required.

3.08 CROSS CONNECTION

A. Cross connection is any connection or arrangement of piping between two otherwise separate piping systems, one of which contains potable water and the other non-potable water or industrial fluids of questionable safety. Cross connection may cause non-potable fluid to enter the potable water system by backflow, back pressure, or back siphonage, and this shall not be allowed.

B. Refer to approved backflow prevention device list in Section 22 16 00 - Plumbing Specialties.

C. Locate reduced pressure backflow prevention devices so that they are accessible for testing and maintenance. Provide for an adequate drainage system near each device. Each device shall be located on a wall approximately 42 inches above the floor with 1'-0"clearance from walls (confirm with the current code). If reduced pressure device is installed more than 5'-0" above floor or grade, then a platform must be provided to test the device.

D. Provide atmospheric vacuum breakers for service sinks.

E. Backflow preventers shall be tested. Test Reports shall be submitted before Substantial Completion.

3.09 VALVE INSTALLATION

A. Install sectional valve close to water main on each branch and riser serving plumbing fixtures or equipment. Use ball valves for piping NPS 3 inches and smaller. Use butterfly or gate valves for piping NPS 3-1/2 inches and larger.

B. Install shutoff valve on each water supply to equipment and on each water supply to plumbing fixtures without supply stops. Use ball valves for piping NPS 3 inches and smaller. Use butterfly or gate valves for piping NPS 3-1/2 inches and larger.

C. Install drain valves for equipment, at base of each water riser, at low points in horizontal piping, and where required to drain water piping.

1. Install hose-end drain valves at low points in water mains, risers, and branches.
2. Install stop-and-waste drain valves where indicated.

D. Install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow.

3.10 HANGER AND SUPPORT INSTALLATION

A. Refer to Section 23 05 48 - Mechanical Sound and Vibration Control for sound and vibration devices

B. Refer to Section 23 05 29 - Hangers and Supports for pipe hanger and support devices. Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Individual, Straight, Horizontal Piping Runs: According to the following:
   a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
3. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Install supports according to Section 23 05 29 - Hangers and Supports

D. Support vertical piping and tubing at base and at each floor.

3.11 FIELD QUALITY CONTROL

A. Inspect domestic water piping as follows:

1. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
2. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
   a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing-in and before setting fixtures.
   b. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
3. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

B. Test domestic water piping as follows:

1. Provide permanent isolation valves to separate new and existing piping during testing.
2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
3. Leave uncovered and unconcealed new, altered, extended, or replaced domestic water piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
4. Cap and subject piping to hydrostatic water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials (minimum of 150 psig). Isolate test source and allow to stand for eight hours. Leaks and loss in test pressure constitute defects that must be repaired.
5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.12 ADJUSTING

A. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

1. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide flow of hot water in each branch.
2. Adjust calibrated balancing valves to flows indicated.
3. Close drain valves, hydrants and hose bibs.
4. Open shutoff valves to proper setting.
5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Check plumbing specialties and verify proper settings, adjustments and operation.

3.13 CLEANING

A. Clean and disinfect service entrance piping and domestic water piping as follows:

1. Purge new piping and parts of existing water piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed, procedure described in either AWWA C651 or AWWA C652 or as described below:
    a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    b. Fill and isolate system according to either of the following:
        1) Fill system or part thereof with water/chlorine solution with at least 50 ppm 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 3 hours.
    c. Flush system with clean, potable water until chlorine is no longer in water coming from system after the standing time.
    d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows contamination.

B. Prepare and submit reports for purging and disinfecting activities.

C. Clean interior of piping system. Remove dirt and debris as work progresses.

3.14 COMMISSIONING

A. Fill water piping. Check components to determine that they are not air bound and that piping is full of water.

B. Perform the following steps before putting into operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.
5. Remove and clean strainer screens. Close drain valves and replace drain plugs.
6. Check plumbing equipment and verify proper settings, adjustments, and operation. Do not operate water heaters before filling with water.

END OF SECTION

SECTION 22 13 16 SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. These Plumbing provisions specified herein apply to all Sections of Division 22.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 22.

1.02 SUMMARY

A. Work included in this section: materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Soil and waste, sanitary drainage and vent piping inside the building

B. Related Section

1. Section 01 91 13 – General Commissioning Requirements
2. Section 22 16 00 – Plumbing Specialties
3. Section 23 00 10 – Mechanical General Provisions
4. Section 23 05 00 – Basic Mechanical Materials and Methods

1.03 REFERENCE STANDARDS

A. ASTM A74 – Standard Specification for Cast Iron Soil Pipe and Fittings

B. ASTM A888 – Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

C. ASTM C564 – Standard for Rubber Gaskets for Cast Iron Soil Pipe and Fittings

D. ASTM C1277 – Standard Specification for Shielded Couplings Joining Hubless Cast Ison Soil Pipe and Fittings

E. ASTM A666 – Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar

F. ANSI/ASME B16.18 – Cast Copper Alloy Solder Joint Pressure Fittings

G. ANSI/ASME B16.22 – Wrought Copper and Copper Alloy Solder Joint Pressure Fittings

H. ANSI/ASME B16.24 – Bronze Pipe Flanges and Flanged Fittings

I. ANSI/ASTM B88 – Seamless Copper Water Tube

J. MSS SP-123 – Non Ferrous Threaded and Solder Joint Unions for Use with Copper Water Tube

K. ASTM D2665 – Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic, Drain, Waste and Vent Pipe and Fittings

L. ASTM D3311 – Standard Specification for Drain, Waste and Vent (DWV) Plastic Fittings Patterns

M. ASTM F409 – Standard Specification for Thermoplastic Accessible and Replaceable Plastic Tube and Tubular Fittings

1.04 SUBMITTALS

A. See Section 23 00 10 – Mechanical General Provisions

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. “R” means required.
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Piping and fitting materials	R			R
Primer, solvent, cement	R			
Solder	R			
Couplings	R			

C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.05 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping; "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.

PART 2 - PRODUCTS

2.01 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

B. Flexible Transition Couplings for Underground Nonpressure Piping: ASTM C 1173 with elastomeric sleeve. Include ends of same sizes as piping to be joined and include corrosion-resistant metal band on each end.

C. Transition Couplings for Underground Pressure Piping: AWWA C219 metal, sleeve-type coupling or other manufactured fitting same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

D. Waste pipes larger than 1¼ inch diameter shall be supported with Elmdor Trisolator series 400/500 or equal, resilient attachments.

E. Waste pipe clamps in vertical runs shall be isolated using Mason SWM or equal, neoprene resilient pads.

F. Copper drain pipe wrapping shall be pipe-wrap tape by Lowry or equal.

2.02 CAST-IRON SOIL PIPING

A. Below Ground Hub-and-Spigot Pipe and Fittings: ASTM A 74, Service class.

1. Gaskets: ASTM C 564, rubber.

B. Above Ground Hubless Pipe and Fittings: ASTM A 888 or CISPI 301.

1. Couplings: ASTM C 1277 assembly of metal housing, corrosion-resistant fasteners, and ASTM C 564 rubber sleeve with integral, center pipe stop.
   a. Heavy-Duty, Type 304, Stainless-Steel Couplings: ASTM A 666, Type 304, stainless-steel shield; stainless-steel bands; and sleeve similar to Husky 4000.
      (1) NPS 1-1/2 to NPS 4: 3-inch wide shield with 4 bands.
      (2) NPS 5 to NPS 10: 4-inch wide shield with 6 bands.

2.03 COPPER TUBING

A. Hard Copper Tube: ASTM B 88, Types L and M (ASTM B 88M, Types B and C), water tube, drawn temper.

1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought- copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end.
3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

2.04 PVC PIPE AND FITTINGS

A. PVC Pipe: ASTM D 2665, Schedule 40, solid-wall drain, waste, and vent

1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.

B. PVC Special Fittings: ASTM F 409, drainage-pattern tube and tubular fittings with ends as required for application.

C. PVC Schedule 40 DWV Foam Core pipe (ASTM F891) is unacceptable.

2.05 ENCASEMENT FOR UNDERGROUND METAL PIPING

A. Description: ASTM A 674 or AWWA C105, high-density, cross-laminated PE film of 0.004-inch minimum thickness.

B. Form: tube.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Coordinate with work of other trades.

B. See Section 23 08 00 - Mechanical Commissioning

3.02 EXCAVATION

A. Refer to Division 02 for excavating, trenching and backfilling.

3.03 PIPING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.

B. Flanges may be used on aboveground pressure piping, unless otherwise indicated.

C. Aboveground, Soil, Waste, and Vent Piping: Use any of the following piping materials for each size range:

1. NPS 1-1/4 and NPS 1-1/2: Copper DWV tube, copper drainage fittings, and soldered joints.
2. NPS 1-1/4 and NPS 1-1/2: PVC pipe, PVC socket fittings, and solvent-cemented joints.
3. NPS 1-1/4 and NPS 1-1/2: Hubless, cast-iron soil piping and the following:
   a. Couplings: Heavy-duty, Type 304, stainless steel.
4. NPS 2 to NPS 4: PVC pipe, PVC socket fittings, and solvent-cemented joints.
5. NPS 2 to NPS 4: Service class, cast-iron soil piping; gaskets; and gasketed joints.
6. NPS 2 to NPS 4: Hubless, cast-iron soil piping and one of the following:
   a. Couplings: Heavy-duty, Type 304, stainless steel similar to Husky 4000.
7. NPS 5 to NPS 6: PVC pipe, PVC socket fittings, and solvent-cemented joints.
8. NPS 5 and NPS 6: Service class, cast-iron soil piping; gaskets; and gasketed joints.
9. NPS 5 and NPS 6: Hubless, cast-iron soil piping and one of the following:
   a. Couplings: Heavy-duty, Type 304, stainless steel similar to Husky 4000.

D. Underground, Soil, Waste, and Vent Piping: Use the following piping materials for each size range:

1. NPS 2 and larger: PVC pipe, PVC socket fittings, and solvent-cemented joints.
2. NPS 2 and larger: Service class, cast-iron soil piping; gaskets; and gasketed joints or Hubless, cast-iron soil piping and one of the following:
   a. Couplings: Heavy-duty, Type 304, stainless steel similar to Husky 4000.

E. Indirect drain piping including cooling coil condensate drain: Use the following piping materials for each size range:

1. NPS 3/4 to NPS 4: Hard copper tube, Type L; wrought copper pressure fittings; and soldered joints.

3.04 PIPING INSTALLATION

A. Refer to Section 23 05 00 - Basic Mechanical Materials and Methods for basic piping installation.

B. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

C. Install cleanout fitting with closure plug inside the building in sanitary force-main piping.

D. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Refer to Section 23 05 00 Basic Mechanical Materials and Methods for sleeves and mechanical sleeve seals.

E. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Refer to Section 23 05 00 Basic Mechanical Materials and Methods for wall penetration systems.

F. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Encase underground piping with PE film according to ASTM A 674 or AWWA C105.

G. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

H. 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.

I. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:

1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
2. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

J. Install engineered soil and waste drainage and vent piping systems in locations indicated and as follows:

1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
2. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.

K. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

L. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

M. Do not allow piping, plumbing or vent stacks to contact gypsum board at any point. Provide a minimum 1½ inch clearance.

3.05 JOINT CONSTRUCTION

A. Refer to Section 23 05 00 - Basic Mechanical Materials and Methods for basic piping joint construction.

B. Cast-Iron, Soil-Piping Joints: Make joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Gasketed Joints: Make with rubber gasket matching class of pipe and fittings.
2. Hubless Joints: Make with rubber gasket and sleeve or clamp.

C. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

D. PVC Nonpressure Piping Joints: Join piping according to ASTM D2665

3.06 VALVE INSTALLATION

A. Refer to Section 23 05 23 - Valves for general-duty valves.

B. Backwater Valves: Install backwater valves in piping subject to sewage backflow.

1. Horizontal Piping: Horizontal backwater valves.
2. Floor Drains: Drain outlet backwater valves, unless drain has integral backwater valve.
3. Install backwater valves in accessible locations.
4. Refer to Section 22 16 00 - Plumbing Specialties for backwater valves.

3.07 HANGER AND SUPPORT INSTALLATION

A. Refer to Section 23 05 29 - Hangers and Supports for pipe hanger and support devices. Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Individual, Straight, Horizontal Piping Runs: According to the following:
   a. 100 Feet 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. Install supports according to Section 23 05 29 - Hangers and Supports

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced 1 size for double-rod hangars, with 3/8-inch minimum rods.

E. Comply with International Plumbing Code or local plumbing codes where more stringent than the requirements of this section.

F. Install hangers for cast-iron soil 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.
4. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

G. Install supports for vertical cast-iron soil piping every 15 feet.

H. Install supports for vertical steel piping every 15 feet.

I. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 72 inches with 3/8-inch rod.
2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
3. NPS 2-1/2: 108 inches with 1/2-inch rod.
4. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.

J. Install supports for vertical copper tubing every 10 feet.

K. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 to NPS 2: 48 inches with 3/8-inch rod.
2. NPS 3: 48 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
4. NPS 6: 48 inches with 3/4-inch rod.

L. Install supports for vertical PVC piping every 48 inches.

M. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.08 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and 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. Refer to Section 22 40 00 - Plumbing Fixtures
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. Refer to Section 22 16 00 - Plumbing Specialties
4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

3.09 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 4 hours 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.

3.10 CLEANING

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.

END OF SECTION

SECTION 22 15 00 COMPRESSED-AIR EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. These Plumbing provisions specified herein apply to all Sections of Division 22.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 22.

1.02 SUMMARY

A. This Section includes equipment and accessories for building compressed-air systems operating at

1. 200 psig and less.

B. Related Sections include the following:

1. Section 22 15 13 – Compressed Air Piping
2. Section 23 00 10 – Mechanical General Provisions
3. Section 23 05 00 – Basic Mechanical Materials and Methods
4. Section 23 05 53 – Mechanical System Identification

1.03 DEFINITIONS

A. Low-Pressure, Compressed-Air Systems: ASME B31.9, "Building Services Piping," for systems operating at pressure of 125 psig or less and at temperature of 200 deg F or less.

1.04 SUBMITTALS

A. Product Data: For each model indicated. Include rated capacities of air compressors, aftercoolers, air dryers, and accessories; shipping, installed, and operating weights; furnished specialties; and accessories. Indicate dimensions, required clearances, methods of assembly of components, and piping and wiring connections.

B. Wiring Diagrams: For each item of equipment with electric power supply. Include ladder-type wiring diagrams for interlock and control wiring required for final installation. Differentiate between factory-installed and field-installed wiring.

C. Coordination Drawings: For compressed-air equipment and piping, including relationship to other services that serve same work areas.

D. Certificates of Shop Inspection and Data Report: As required by ASME Boiler and Pressure Vessel Code.

E. Maintenance Data: For equipment to include in the maintenance manuals specified in Division 23.

1.05 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of compressed-air equipment and accessories and are based on specific types and models indicated. Other products with equal performance characteristics, made by specified manufacturers, may be considered. Refer to Division 1 Section "Substitutions and Product Options".

B. Electrical Component Standard: NFPA 70.

C. Provide listing/approval stamp, label, or other marking on equipment made to specified standards.

D. Listing and Labeling: Provide equipment and accessories specified in this Section that are listed and labeled.

1. Terms "Listed" and "Labeled": As defined in National Electrical Code, Article 100.
2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store equipment and large accessories on factory-installed shipping skids and small accessories in factory-fabricated fiberboard containers.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Pressure-Lubricated, Reciprocating Air Compressors:
   a. Champion
   b. Gardner Denver
   c. Ingersoll-Rand
2. Aftercoolers, Air Cooled:
   a. Arrow Pneumatics, Inc.
   b. Curtis-Toledo, Inc.
   c. Hankison International.
   d. Ingersoll-Rand Co.; Rotary-Reciprocating Compressor Div.
   e. Saylor-Beall Manufacturing Co.
   f. Van Air Systems, Inc.
   g. Zeks Air Drier Corp.
3. Refrigerated Air Dryers:
   a. Champion
   b. Gardner Denver
   c. Ingersoll-Rand

2.02 AIR COMPRESSORS

A. General: Factory-assembled and -tested packaged units; duplex; and with the following capacities, features, and electrical characteristics;

1. Model: Champion HR5D-12
2. Two, 5.0 HP, 208V, 3 phase high efficiency motor driven compressors.
3. 120 Gallon horizontal ASME stamped receiver.
4. 41.4 cfm displacement; 34.6 cfm delivery at 175 psi.

B. Construction of Equipment: ASME B19.1, "Safety Standard for Air Compressor Systems"; or ASME B19.3, "Safety Standard for Compressors for Process Industries," as appropriate.

C. Control Panels: Automatic control station with load control and protection functions. Comply with NEMA ICS 2, "Industrial Controls and Systems: Controllers, Contactors and Overload Relays, Rated Not More than 200 Volts AC or 750 Volts DC"; and UL 508, "Industrial Control Equipment."

1. Mounting and Wiring: Factory installed and connected as an integral part of equipment package.
2. Enclosure: NEMA ICS 6, "Industrial Control and Systems: Enclosures," Type 12 control panel, except where a higher degree of enclosure is specified.
3. Motor Controllers: Full-voltage, combination-magnetic type with undervoltage release feature and motor-circuit-protector-type disconnect and short-circuit protective device.
   a. Control Voltage: 120 V, ac or less, using integral control power transformer.
   b. Motor Overload Protection: Overload relay in each phase.
   c. Starting Devices: Hand-off-automatic selector switch in cover of control panel, plus pilot device for automatic control as indicated.
4. Instrumentation: Include air-receiver pressure gage, discharge-line pressure gage, air-filter maintenance indicator, hour meter, compressor discharge air and coolant temperature gage, and control transformer.

D. Receiver Tanks: ASME Boiler and Pressure Vessel Code, Section VIII, "Pressure Vessels" construction and bear appropriate code symbols, with pressure gage, pressure-reducing valve, and automatic drain.

E. Factory Prepiping: Entire unit, except where otherwise indicated.

2.03 SAFETY VALVES

A. Safety Valves: Poppet type complying with ASME Boiler and Pressure Vessel Code, Section VIII, bear appropriate labeling, and factory sealed after testing.

2.04 RECIPROCATING AIR COMPRESSORS

A. Description: Horizontal tank-mounted, splash lubricated, belt driven, duplex reciprocating air compressors, each with inlet silencer filter, safety valve, discharge pressure gage, pressure regulator, and shutoff valve, low oil sensing switch and low oil pressure shut down switch. Include vibration isolation pads.

B. Receiver Tank Orientation: Horizontal.

2.05 AFTERCOOLERS

A. Aftercoolers, Air-Cooled: Tubular, rated at 250 psig and leak tested at 350-psig minimum air pressure, in capacities indicated. Size units to cool compressed air in compressor-rated capacities to 20 deg F above summertime maximum ambient temperature.

2.06 ACCESSORIES

A. General: Include accessories with working-pressure rating not less than system pressure at location where used, and compatible with equipment and piping system used.

B. Intercoolers: Air-cooled, fixed-bundle, tubular intercoolers, rated at 250psig and leak tested at 350-psig minimum air pressure, in capacities indicated. Size units to cool compressed air in compressor-rated capacities to 20 deg F above summertime maximum ambient temperature.

C. Receivers: ASME stamped; cylindrical, horizontal installation as indicated; galvanized steel; with safety valves in sizes, working pressures, and temperatures indicated, and with drain connection.

1. Pressure Rating: Not less than maximum discharge pressure.

2.07 SPECIALTIES

A. Safety Valves: ASME Boiler and Pressure Vessel Code, Section VIII, "Pressure Vessels" construction, National Board certified, labeled, and factory sealed; constructed of bronze body with poppet safety valve for compressed-air service.

1. Pressure Settings: Higher than discharge pressure and same or lower than receiver pressure rating.

B. Automatic Drain Valves: Corrosion-resistant metal body and internal parts, rated for 200-psig minimum working pressure, capable of automatic discharge of collected condensate.

C. Pressure Regulators: Bronze body, direct acting, spring loaded, manual pressure setting adjustment and rated for 250-psig (1725-kPa) inlet pressure, except where otherwise indicated.

D. Filters: 2-stage, mechanical-separation type, air-line filters in sizes and ratings indicated. Equip with deflector plates; resin-impregnated-ribbon-type filters with edge filtration, 40 micron thick; and drain cock.

E. Coalescing Filters: Capacities and types indicated. Equip with activated carbon capable of removing water and oil aerosols, with color-change dye to indicate when carbon is saturated and warning light to indicate when selected maximum pressure drop has been exceeded.

2.08 REFRIGERATED AIR DRYER, NON-CYCLING

A. General: Factory assembled and tested package unit. Performance data shall be obtained using methods complying fully with CAGI Standard No. ADF100- "Refrigerated Compressed Air Dryers - Methods for Testing and Rating" and National Fluid Power Association (NFPA) Standard NFPA T3.27.2.

B. Basis of Design: Champion CRN-35A1.

Capacity:	scfm	35
	EAT	250 Deg. Fdb
	LAT	50 Deg. F (dewpoint)
	Pressure	175 psi
	Ambient Air	130 Deg. Fdb
	Max. P.D.	5.0 psi (total filter and dryer)
	Motor	0.5HP, 115 VAC, single phase

C. Instrumentation: Include trap, refrigerant analyzes gauge, on-off switch, power "on" light, high inlet temperature light, air outlet pressure gauge, dew point temperature bar graph indicator.

D. Accessories: Include ambient air filter and Type "F" vibration isolators.

PART 3 - EXECUTION

3.01 CONCRETE BASES

A. Install concrete bases of dimensions indicated for air compressors and accessories. Refer to Division 3 Section "Cast-in-Place Concrete" and Section 23 05 00 - Basic Mechanical Materials and Methods.

3.02 EQUIPMENT INSTALLATION

A. Installation of Equipment: Comply with ASME B19.1 or ASME B19.3 as appropriate.

B. Install air compressors, intercoolers, aftercoolers, air-receiver tanks, and dryers on concrete bases. Set and connect units according to manufacturers' written instructions. Install units plumb, level, and firmly anchored in locations indicated. Maintain manufacturers' recommended clearances. Orient so equipment, controls, and devices needing service are accessible.

C. Anchor air compressors, receivers, and other equipment to substrate.

D. Support air compressors using vibration-control devices.

1. Install tank-mounted compressors, more than 5 hp, with concrete inertia base and spring isolators.

E. Install accessories and specialties as indicated. Set and connect units according to manufacturers' written instructions. Install units plumb, level, and firmly anchored in locations indicated. Maintain manufacturers' recommended clearances. Orient so controls needing service are accessible.

3.03 INSTALLATION OF BASIC IDENTIFICATION

A. Install mechanical identification in accordance with Section 23 05 53.

3.04 CONNECTIONS

A. Install piping next to equipment and accessories to allow service and maintenance.

B. Connect air piping to equipment and accessories with unions and shutoff valves. Install with strainers where indicated.

1. Install thermometers on compressor discharge piping, on receiver tanks, and where indicated.
2. Install pressure gages on compressor discharge piping, on receiver tanks, and where indicated.
3. Install safety valves in receiver tanks, in quantity and size to relieve capacity not less than that of connected compressor.
4. Install automatic drain valves on intercoolers, aftercoolers, separators, receivers, dryers, and other locations indicated. Discharge condensate over nearest floor drain.
5. Install accessories as indicated.
6. Ground equipment.
   a. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
7. Arrange for electric-power connections to equipment that requires power. Electric power, wiring, and disconnect switches are specified in Division 26 Sections.

3.05 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Provide services of a factory-authorized service representative to supervise the field assembly of components and installation of equipment, including piping and electrical connections, and to report results in writing.

B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.06 COMMISSIONING

A. Perform the following final checks before startup:

1. Verify that specified tests of piping systems are completed.
2. Check for piping connection leaks.
3. Check for lubricating oil in lubricated-type equipment.
4. Check V belts for proper tension.
5. Check that compressor inlet filters and piping are clear.
6. Check for equipment vibration-control supports and flexible pipe connectors and that equipment is properly attached to substrate.
7. Check safety valves for correct settings. Ensure settings are greater than air-compressor discharge pressure, but not greater than rating of system components.
8. Test operation of equipment safety controls and devices.
9. Drain receiver tanks.
10. Check for adequate room ventilation.

B. Starting Procedures: Follow manufacturer's written instructions. If no instructions are prescribed by manufacturer, proceed as follows:

1. Energize circuits.
2. Start and run equipment through complete sequence of operations.
3. Check for excessive vibration and noise. Correct problems.
4. Check air pressures.
5. Manually operate safety valves.
6. Adjust operating controls, including pressure settings.

C. Operate and adjust operating and safety controls. Replace damaged and malfunctioning controls and equipment discovered by service representative.

3.07 DEMONSTRATION

A. Startup Services: Engage a factory-authorized service representative to perform startup services and to demonstrate and Owner's maintenance personnel as specified below.

1. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance. Refer to Section 23 00 10 – Mechanical General Provisions
2. Review data in the operation and maintenance manuals. Refer to Section 23 00 10 – Mechanical General Provisions

END OF SECTION

SECTION 22 15 13 COMPRESSED-AIR PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. These Plumbing provisions specified herein apply to all Sections of Division 22.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 22.

1.02 SUMMARY

A. This Section includes piping and specialties for building compressed-air systems operating at 200 psig and less.

B. Related Sections include the following:

1. Section 22 15 00 – Compressed Air Equipment
2. Section 23 00 10 – Mechanical General Provisions
3. Section 23 05 00 – Basic Mechanical Materials and Methods
4. Section 23 05 53 – HVAC System Identification

1.03 DEFINITIONS

A. Low-Pressure, Compressed-Air Piping: ASME B31.9, "Building Services Piping," for piping operating at pressure of 125 psig or less and at temperature of 200 deg F or less.

B. PTFE: Polytetrafluoroethylene.

1.04 SUBMITTALS

A. Coordination Drawings: For compressed-air equipment and piping, including relationship to other services that serve same work areas.

1.05 QUALITY ASSURANCE

A. Provide listing/approval stamp, label, or other marking on equipment made to specified standards.

B. Listing and Labeling: Provide equipment and accessories specified in this Section that are listed and labeled.

1. Terms "Listed" and "Labeled": As defined in National Electrical Code, Article 100.
2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Compressed-Air, General-Duty Valves:
   a. Conbraco Industries, Inc.; Apollo Div.
   b. Crane Co.; Valve Div.
   c. Grinnell Corp.
   d. Hammond Valve.
   e. Milwaukee Valve Co., Inc.
   f. Nibco, Inc.
   g. Stockham Valves & Fittings, Inc.
2. Compressed-Air-Service, Locking-Handle, Safety-Exhaust Valves:
   a. Conbraco Industries, Inc.; Apollo Div.
   b. Hammond Valve.
   c. Milwaukee Valve Co., Inc.
   d. Nibco, Inc.
3. Quick Connect/Disconnect Hose Couplings:
   a. Aeroquip Corp.; Industrial Products Group.
   b. Bowes Manufacturing, Inc.
   c. DeVilbiss Air Compressor Products.
   d. Foster Manufacturing Co., Inc.
   e. Milton Industries, Inc.
   f. OBAC Corp.
   g. Parker Hannifin Corp.; Quick Coupling Div.
   h. Schrader, Inc.
   i. Snap-Tite, Inc.
   j. Tuthill Corp.; Hansen Coupling Div.

2.02 PIPING, GENERAL

A. ASME Code Compliance: Provide compressed-air piping components complying with ASME B31.9, "Building Services Piping."

B. ASME Code Compliance: Provide compressed-air piping components complying with the following:

1. Low-Pressure, Compressed-Air Piping: ASME B31.9, "Building Services Piping."

2.03 PIPING

A. Steel Pipe: ASTM A 53, Type E, Electric-Resistance Welded or Type S, Seamless, Grade B, Schedule 40, black or hot dipped, zinc coated.

2.04 PIPE FITTINGS

A. Malleable-Iron Pipe Fittings: ASME B16.3, Class 150, threaded, plain or galvanized.

B. Malleable-Iron Pipe Unions: ASME B16.39, Class 150, threaded.

C. Wrought-Steel Pipe Fittings: ASME B16.9, Schedule 40, butt welding.

D. Forged-Steel Pipe Fittings: ASME B16.11, socket type.

E. Steel Pipe Flanges: ASME B16.5, Classes 150 and 300, carbon steel.

2.05 JOINING MATERIALS

A. Refer to Section 23 05 00 - Basic Mechanical Materials and Methods for joining materials not in this Section.

2.06 VALVES

A. General-Duty Valves: Refer to Section 23 05 23 Valves for compressed-air-service valves not specified in this Section and for valves for other fluids.

B. Special-Duty, Compressed-Air Valves: Include PTFE seats and comply with the following:

1. Ball Valves, 2-Inch NPS and Smaller: MSS SP-110; 2-piece bronze body with blowout-proof stem; regular or full port; chrome-plated, solid-brass or -bronze ball; threaded ends; and 600-psig minimum WOG pressure rating.
2. Butterfly Valves, 2-1/2-Inch NPS and Larger: MSS SP-67; Type I (bubble tight); single-flange (lug-type), cast-iron body with ductile-iron disc, and 200-psig minimum WOG pressure rating.
3. Check Valves, 2-Inch NPS and Smaller: MSS SP-80; Type 4 or nonstandard T-pattern, swing check; Class 125, bronze body with composition-to-metal seat and threaded ends.
4. Check Valves, 2-1/2-Inch NPS and Larger: MSS SP-71, Type II full-waterway or Type IV clear-waterway, cast-iron body with composition-to-metal seat and flanged ends.
5. Globe Valves, 2-Inch NPS and Smaller: MSS SP-80, Class 125, Type 2, bronze body with composition-to-metal seat and threaded ends.

2.07 SPECIALTIES

A. Safety Valves: ASME Boiler and Pressure Vessel Code, Section VIII, "Pressure Vessels" construction, National Board certified, labeled, and factory sealed; constructed of bronze body with poppet safety valve for compressed-air service.

1. Pressure Settings: Higher than discharge pressure and same or lower than receiver pressure rating.
2. Pressure Regulators: Bronze body, direct acting, spring loaded manual pressure-setting adjustment, and rated for 250-psig, except where otherwise indicated.
   a. Type: Diaphragm operated.
3. Pressure Regulators: Aluminum alloy or plastic body, diaphragm operated, direct acting, spring loaded, manual pressure-setting adjustment, and rated for 250 psig inlet pressure, except where otherwise indicated.
4. Filters: 2-stage, mechanical-seperation type, air-line filters in sizes and ratings indicated. Equip with deflector plates; resin-impregnated-ribbon-type filters with edge filtration, 40 micron thick; and drain cock.
5. Coalescing Filters: Capacities and types indicated. Equip with activated carbon capable of removing eater and oil aerosols, with color-change dye to indicate when carbon is saturated and warning light to indicate when selected maximum pressure drop has been exceeded.
6. Automatic Drain Valves: Corrosion-resistant metal body and internal parts, rated for 200-psig minimum working pressure, capable of automatic discharge of collected condensate.

7. Hose, Clamps and Couplings: Provide compatible hose, hose clamps, and hose couplings, suitable for compressed-air service, of nominal diameter, and rated for 300-psig minimum working pressure, except where otherwise indicated.
   a. Quick Connect/Disconnect Hose Couplings: One-way, automatic shutoff, brass body, with O-ring or gasket seal, and stainless steel or nickel-plated steel operating parts. Select socket end with threaded inlet that is considered the fixed end and has one-way valve.
   b. Hose Adapter Couplings: One-piece, brass or stainless-steel fitting, with serrated ends.
   c. Hose: Reinforced, single or double-braid, neoprene-covered hose for compressed air service.
   d. Hose Clamps: Stainless steel, clamps, bands, or wire.

PART 3 - EXECUTION

3.01 PIPING APPLICATIONS

A. ASME Code Compliance: Provide compressed-air piping components complying with ASME B31.9, "Building Services Piping."

B. ASME Code Compliance: Provide compressed-air piping components complying with the following:

1. Low-Pressure, Compressed-Air Piping: ASME B31.9, "Building Services Piping."

C. Install flanges, unions, transition and special fittings, and valves with pressure ratings same or higher than system pressure rating used in applications below, except where otherwise specified.

D. Low-Pressure, Compressed-Air, Distribution Piping: Use the following:

1. 2-Inch NPS and Smaller: Black steel pipe; threaded, malleable-iron fittings; and threaded joints.
2. 2-1/2- to 4-Inch NPS: Black steel pipe; threaded, malleable-iron fittings; and threaded joints.

3.02 VALVE APPLICATIONS

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball or butterfly valves.
2. Throttling Duty: Use globe or butterfly valves.
3. Compressed-Air Supply to Equipment: Locking-handle, safety-exhaust ball valves.
4. Do not use check valves in piping between reciprocating air compressors and air receivers.

3.03 PIPING INSTALLATION, GENERAL

A. Refer to Section 23 05 00 - Basic Mechanical Materials and Methods for basic piping installation.

B. Install air and drain piping with one percent slope downward in direction of airflow.

C. Install eccentric reducers where pipe is reduced in size in direction of airflow, with bottoms of both pipes and reducer flush.

D. Connect branch air piping to mains from top of main. Provide drain leg and drain trap at end of each main, branch, and low point in piping.

E. Install supports and anchors according to Section 23 05 00 - Basic Mechanical Materials and Methods. Do not exceed the following spacing between pipe hangers:

F. Steel Pipe: 12 feet horizontal and 15 feet vertical.

G. Install valves according to Section 23 05 23 – Valves.

H. Install expansion joints and anchors according to Division 15 Section "Basic Mechanical Materials and Methods".

I. Install thermometers and pressure gages according to Section 23 05 16 – Piping Specialties

J. Install plumbing specialties according to Section 22 16 00 - Plumbing Specialties

3.04 JOINT CONSTRUCTION

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

B. Dissimilar Material Piping Joints: Make joints using adapters compatible with both piping materials.

3.05 INSTALLATION OF BASIC IDENTIFICATION

A. Install mechanical identification in accordance with Section 23 05 53.

B. Paint all exposed piping with two coats of specified paint, color shall be selected by the Architect. See Section 09 90 00 – Painting – Non VOC Paint and Section 23 00 10 – Mechanical General Provisions.

3.06 CONNECTIONS

A. Install piping next to equipment and accessories to allow service and maintenance.

B. Connect air piping to equipment and accessories with unions and shutoff valves. Install with strainers where indicated.

C. Install safety valves in receiver tanks, in quantity and size to relieve capacity not less than that of connected compressor.

D. Install automatic drain valves on intercoolers, aftercoolers, separators, receivers, dryers, and other locations indicated. Discharge condensate over nearest floor drain.

E. Install specialties as indicated.

3.07 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Provide services of a factory-authorized service representative to supervise the field assembly of components and piping, and to report results in writing.

B. Test and adjust piping safety controls. Replace damaged and malfunctioning controls.

C. Piping System Tests: Test new piping. Cap and fill compressed-air piping with oil-free, dry air, or gaseous nitrogen to pressure of 50 psig (345 kPa) above system operating pressure, but not less than 150 psig (1035 kPa). Isolate test source and let stand for 4 hours to equalize temperature. Refill system, if required, to test pressure and hold pressure for 2 hours with no drop in pressure.

1. Repair leaks and defects with new materials and retest system until satisfactory results are obtained.

3.08 COMMISSIONING

A. Perform the following final checks before startup:

1. Verify that specified tests of piping are completed.
2. Check for piping connection leaks.
3. Check for lubricating oil in lubricated-type equipment.
4. Check V belts for proper tension.
5. Check that compressor inlet filters and piping are clear.
6. Check for equipment vibration-control supports and flexible pipe connectors and that equipment is properly attached to substrate.
7. Check safety valves for correct settings. Ensure settings are greater than air-compressor discharge pressure, but not greater than rating of system components.
8. Test operation of equipment safety controls and devices.
9. Drain receiver tanks.
10. Check for adequate room ventilation.

B. Starting Procedures: Follow manufacturer's written instructions. If no instructions are prescribed by manufacturer, proceed as follows:

1. Energize circuits.
2. Start and run equipment through complete sequence of operations. 3. Check for excessive vibration and noise. Correct problems.
3. Check air pressures.
4. Manually operate safety valves.
5. Adjust operating controls, including pressure settings.

C. Operate and adjust operating and safety controls. Replace damaged and malfunctioning controls and equipment discovered by service representative.

END OF SECTION

SECTION 22 16 00 PLUMBING SPECIALTIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. These Plumbing provisions specified herein apply to all Sections of Division 22.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 22.

1.02 SUMMARY

A. This Section includes the following plumbing specialties:

1. Balancing valves
2. Strainers
3. Outlet Boxes
4. Water supply outlets
5. Trap seal primer valves
6. Drain valves
7. Miscellaneous piping specialties
8. Sleeve penetration systems
9. Cleanouts
10. Floor drains
11. Thermostatic water mixing valves
12. Domestic hot water recirculating pumps

B. Related Sections include the following:

1. Section 23 00 10 – Mechanical General Provisions
2. Section 23 05 00 – Basic Mechanical Materials and Methods
3. Section 23 05 16 – Piping Specialties

1.03 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing piping systems with following minimum working-pressure ratings, unless otherwise indicated:

1. Domestic Water Piping: 150 psig
2. Sanitary Waste and Vent Piping: 10-foot head of water
3. Storm Drainage Piping: 10-foot head of water

1.04 SUBMITTALS

A. Product Data: Include rated capacities and shipping, installed, and operating weights. Indicate materials, finishes, dimensions, required clearances, and methods of assembly of components; and piping and wiring connections for the following:

1. Balancing valves and strainers.
2. Thermostatic water mixing valves.
3. Water hammer arresters, air vents, and trap seal primer valves and systems.
4. Drain valves, hose bibbs and hydrants.
5. Outlet boxes and washer-supply outlets.
6. Cleanouts, floor drains, and open receptors.

7. Vent caps, vent terminals, and roof flashing assemblies.
8. Sleeve penetration systems.
9. Domestic hot water recirculating pumps.

B. Shop Drawings: Diagram power, signal, and control wiring

C. Field test reports

D. Maintenance Data: For plumbing specialties to include in maintenance manuals. Include the following:

1. Thermostatic water mixing valves
2. Trap seal primer valves and systems
3. Hose hydrants
4. Domestic hot water recirculating pumps

E. Refer to Section 23 00 10 – Mechanical General Provisions for additional submittal requirements

1.05 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of plumbing specialties and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

B. Plumbing specialties shall bear label, stamp, or other markings of specified testing agency.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for piping materials and installation.

E. NSF Compliance:

1. Comply with NSF 61, "Drinking Water System Components--Health Effects, Sections 1 through 9," for potable domestic water plumbing specialties.

PART 2 - PRODUCTS

2.01 BALANCING VALVES

A. Calibrated Balancing Valves: Adjustable, with two readout ports and memory setting indicator. Include manufacturer’s standard hoses, fittings, valves, differential pressure meter, and carrying case.

1. Manufacturers:
   a. Armstrong Pumps, Inc.
   b. ITT Industries; Bell & Gossett
   c. Watts Industries, Inc; Water Products Div.
2. NPS 2 and Smaller: Bronze, Y-pattern body with adjustment knob and threaded ends.

2.02 STRAINERS

A. Strainers: Y-pattern, unless otherwise indicated, and full size of connecting piping. Include ASTM A666, Type 304, stainless steel screens with 3/34-inch round perforations, unless otherwise indicated.

1. Pressure rating: 125 psig minimum steam working pressure, unless otherwise indicated.
2. NPS 2 and smaller: Bronze body, with female threaded ends.
3. NPS 2-1/2 and Larger: Cast-iron body, with interior AWWA C550 or FDA-approved, epoxy coating and flanged ends.

2.03 OUTLET BOXES

A. Manufacturers

1. Guy Gray Manufacturing Co., Inc.
2. Acorn Engineering Company
3. Zurn Industries, Inc.

B. General: Recessed-mounting outlet boxes with supply fittings complying with ASME A112.18.1M. Include box with faceplate, services indicated for equipment connections and wood-blocking reinforcement. Boxes shall be metallic

C. Washing Machine Outlet Boxes: Guy Gray stainless steel washing machine outlet box with quarter turn valves

D. Icemaker Outlet Boxes: Guy Gray stainless steel ice maker box

2.04 HOSE BIBBS

a. Refer to Section 22 40 00 – Plumbing Fixtures

2.05 TRAP SEAL PRIMER VALVES

A. Trap Seal Primer System: Factory-fabricated, ASSE 1044:

1. Manufacturers (or equal):
   a. Precision Plumbing Products, Inc.
   b. Sloan
   c. Zurn
2. Fixture Flush Pipe-Fed Type
   a. One-piece, chrome-plated, vacuum breaker trap primer flush connection with integral water deflector
   b. Cast-brass
   c. NPS 3/8 minimum, elbow and flexible connector to wall
   d. Wall flanges and fittings to connect to NPS 1/2 pipe

2.06 DRAIN VALVES

A. Hose-End Drain Valves: MSS SP-110, NPS 3/4 ball valve, rated for 400-psig minimum CWP. Include two-piece, copper-alloy body with standard port, chrome-plated brass ball, replaceable seats and seals, blowout-proof stem, and vinyl-covered steel handle.

1. Inlet: Threaded or solder joint.
2. Outlet: Short-threaded nipple with ASME B1.20.7, garden-hose threads and cap.

B. Stop-and-Waste Drain Valves: MSS SP-110, ball valve, rated for 200-psig minimum CWP or MSS SP-80, Class 125, gate valve; ASTM B 62 bronze body, with NPS 1/8 side drain outlet and cap.

2.07 MISCELLANEOUS PIPING SPECIALTIES

A. Water Hammer Arresters: ASSE 1010 or PDI-WH 201, metal-bellows type with pressurized metal cushioning chamber. Sizes indicated are based on ASSE 1010 or PDI-WH 201, Sizes A through F.

1. Manufacturers:
   a. Josam Co.
   b. Smith, Jay R. Mfg. Co.
   c. Zurn Industries, Inc.; Specification Drainage Operation.
   d. Or equal

B. Optional Water Hammer Arresters: ASSE 1010 or PDI-WH 201, piston type with pressurized metal-tube cushioning chamber. Sizes indicated are based on ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

1. Manufacturers (or equal):
   a. Josam Co.
   b. Precision Plumbing Products, Inc.
   c. Watts Industries, Inc.; Drainage Products Div.
   d. Zurn Industries, Inc.; Wilkins Div.

C. Air Vents: Float type for automatic air venting.

1. Bolted Construction: Bronze body with replaceable, corrosion-resistant metal float and stainless-steel mechanism and seat; threaded NPS 1/2 minimum inlet; 125-psig minimum pressure rating at 140 deg F; and threaded vent outlet.
2. Welded Construction: Stainless-steel body with corrosion-resistant metal float, stainless-steel mechanism and seat, threaded NPS 3/8 minimum inlet, 150-psig minimum pressure rating, and threaded vent outlet.

D. Open Drains: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting, joined with ASTM C 564, rubber gaskets.

E. Deep-Seal Traps: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap seal primer valve connection.

1. NPS 2: 4-inch- minimum water seal.
2. NPS 2-1/2 and Larger: 5-inch- minimum water seal.

F. DST-1: Deep Seal Traps (with Open Funnel): Same as “Deep Seal Trap” specified above except that a bronze funnel is required. (Smith Figure 3822 or equal).

G. Floor-Drain Inlet Fittings: Cast iron, with threaded inlet and threaded or spigot outlet, and trap seal primer valve connection.

H. Fixed Air-Gap Fittings: Manufactured cast-iron or bronze drainage fitting with semi-open top with threads or device to secure drainage inlet piping in top and bottom spigot or threaded outlet larger than top inlet. Include design complying with ASME A112.1.2 that will provide fixed air gap between installed inlet and outlet piping.

I. Stack Flashing Fittings: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.

J. Vent Caps: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and set-screws to secure to vent pipe.

K. Vent Terminals: Commercially manufactured, shop- or field-fabricated, frost-proof assembly constructed of galvanized steel, copper, or lead-coated copper. Size to provide 1-inch (25-mm) enclosed air space between outside of pipe and inside of flashing collar extension, with counterflashing.

L. Expansion Joints: ASME A112.21.2M, assembly with cast-iron body with bronze sleeve, packing gland, and packing; of size and end types corresponding to connected piping.

2.08 SLEEVE PENETRATION SYSTEMS

A. Manufacturers:

1. ProSet Systems, Inc.
2. Or equal.

B. Description: UL 1479, through-penetration firestop assembly consisting of sleeve and stack fitting with firestopping plug.

1. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
2. Stack Fitting: ASTM A 48 (ASTM A 48M), gray-iron, hubless-pattern, wye-branch stack fitting with neoprene O-ring at base and gray-iron plug in thermal-release harness in branch. Include PVC protective cap for plug.
   a. Special Coating: Include corrosion-resistant interior coating on fittings for plastic chemical waste and vent stacks.

2.09 FLASHING MATERIALS (COORDINATE WITH ROOFING SPECIFICATIONS)

2.10 CLEANOUTS

A. Service: Sanitary, soil and waste piping

B. Manufacturers;

1. Zurn
2. J.R. Smith
3. Josam
4. Cresline
5. Or equal

C. Cleanouts shall be the same size as pipe except that cleanouts larger than 4 inches are not required. Install cleanouts and/or test tees at the foot of all soil, waste and drain stacks; and on each building drain outside of building. Cleanouts shall be installed every 50 feet or less on all horizontal drain lines.

D. At ends of horizontal lines in unfinished areas: Wye fitting with cast brass plugs, threaded

E. At base of vertical lines in unfinished areas and hard piped downspouts. Wye fitting with cast brass plugs, threaded

F. Cleanouts shall be as follows:

1. Vertical Lines Concealed: Josam 58600-COT-20.
2. Vertical Lines Exposed: Josam 58910.
3. Horizontal Lines Exposed and/or Above Accessible Ceilings: Josam 58900-20.
4. Horizontal Lines Concealed Under Floors with Tile, Vinyl, Terrazzo and/or Concrete Finish: Josam 555000Z-2.
5. Horizontal Lines Concealed Under Floors with Carpet Finish: Josam 55000Z-2-14.
6. Cleanouts for PVC piping shall be equal to Cresline DW75A.

G. Cleanouts to Grade (exterior cleanout): Josam 58900, cast iron floor cleanout with round heavy duty cover. Locate cleanout set in concrete yard box with cast iron cover marked “sewer”, Brooks 3CI, Christy or equal large enough for two-way clean out assemblies.

H. Cleanouts for PVC piping shall be equal to Cresline DW75A.

2.11 FLOOR DRAINS

A. Manufacturers:

1. J.R. Smith
2. Zurn
3. Wade
4. Josam

B. See Plumbing Fixture Schedule in the Construction Documents.

C. Provide trap primers to all floor drains, unless otherwise indicated.

2.12 DOMESTIC HOT WATER RECIRCULATION PUMPS

A. Manufacturers:

1. Bell & Gossett
2. Taco
3. Grundfos
4. Or equal

B. Description: Furnish and install domestic hot water recirculation pumps of the size and capacity shown in the Construction Documents.

C. Pump Construction:

1. Housing: Bronze
2. Impeller: Bronze, closed type
3. Shaft: Stainless Steel
4. Mechanical Seal: Stainless Steel
5. Motor: Open dripproof type with sleeve bearings and built-in automatic thermal overload protection, 1725 RPM

D. Provide and install strap-on aquastat to hot water recirculation line to control pump.

2.13 THERMOSTATIC WATER MIXING VALVES

A. Manufacturers:

1. Leonard Valve Company.
2. Symmons Industries, Inc.
3. T & S Brass and Bronze Works, Inc.

B. General: ASSE 1017, manually adjustable, thermostatic water mixing valve with bronze body. Include che3ck stop and union on hot- and cold-water-supply inlets, adjustable temperature setting, and thermometer.

C. Manifolded, Thermostatic Water Mixing-Valve Assemblies: Factory-fabricated unit consisting of parallel arrangement of thermostatic water mixing valves.

1. Arrangement: Single, thermostatic water mixing valve with flow-control valve, pressure regulator, and inlet and outlet pressure gages. Include outlet thermometer, factory- or field-installed inlet and outlet valves, and other indicated options.
2. Include piping, valves, and unions.
3. Piping Component Finish: Rough bronze.
4. MV-1: Leonard TM-26-LF-E-RF-BDT.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Refer to Section 23 05 00 - Basic Mechanical Materials and Methods for piping joining materials, joint construction, and basic installation requirements.

B. Examine roughing-in of water distribution piping to verify actual locations of connections before plumbing specialty or pump installation.

C. Install 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.

D. Install expansion joints on vertical risers, stacks, and conductors if indicated.

E. 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.

F. Install cleanout deck plates with top flush with finished floor, for floor cleanouts for piping below floors.

G. Install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall, for cleanouts located in concealed piping.

H. Install flashing flange and clamping device with each stack and cleanout passing through floors with waterproof membrane.

I. Install vent flashing sleeves on stacks passing through roof. Secure over stack flashing according to manufacturer's written instructions.

J. Install floor drains at locations shown on architectural drawings. 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.

K. Fasten wall-hanging plumbing specialties securely to supports attached to building substrate if supports are specified and to building wall construction if no support is indicated.

L. Fasten recessed-type plumbing specialties to reinforcement built into walls.

M. Install individual shutoff valve in each water supply to plumbing specialties. Use ball, gate, or globe valve if specific valve is not indicated. Install shutoff valves in accessible locations. Refer to Section 23 05 23 - Valves for general-duty ball, butterfly, check, gate, and globe valves.

N. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

O. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.02 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Connect plumbing specialties to piping specified in other Division 22 Sections.

D. Ground equipment.

E. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

F. Connect plumbing specialties and devices that require power according to Division 26 Sections.

3.03 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each thermostatic water mixing valve, trap seal primer system and domestic hot water recirculating pump.

1. Text: 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.
2. Refer to Section 23 00 10 – Mechanical General Provisions and Section 23 05 53 - Mechanical Systems Identification for nameplates and signs.

3.04 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled trap seal primer systems and their installation, including piping and electrical connections. Report results in writing.

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.05 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

3.06 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner’s maintenance personnel to adjust, operate, and maintain, pumps, and mixing valves. Refer to Section 23 00 10 – Mechanical General Provisions.

END OF SECTION

SECTION 22 34 00 FUEL-FIRED, COMMERCIAL WATER 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. These Plumbing provisions specified herein apply to all Sections of Division 22.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 22.

1.02 SUMMARY

A. This Section includes the following for domestic water systems:

1. Tankless, gas water heaters.
2. Compression tanks.
3. Accessories.

1.03 SUBMITTALS

A. See Section 01 33 23 Shop Drawings, Product Data and Samples.See Section 23 00 10 – Mechanical General Provisions

B. See Section 23 05 00 – Basic Mechanical Materials and Methods

C. Product Data: For each type and size of water heater. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.

D. Shop Drawings: Detail water heater assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power, signal, and control systems. Differentiate between manufacturer-installed and field-installed wiring.

E. Product Certificates: Signed by manufacturers of water heaters certifying that products furnished comply with requirements.

F. Maintenance Data: For water heaters to include in maintenance manuals specified in Division 22.

G. Warranties: Special warranties specified in this Section.

1.04 QUALITY ASSURANCE

A. Source Limitations: Obtain same type of water heaters through one source from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. ANSI Compliance: Provide gas water heaters that comply with ANSI standards for gas water heaters and related products and that bear AGA certification label.

D. ASHRAE Standards: Comply with performance efficiencies prescribed for the following:

1. ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings," for commercial water heaters.

E. ASME Compliance:

1. Where ASME-code construction is indicated, fabricate and label commercial water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
2. Where ASME-code construction is indicated, fabricate and label commercial, finned-tube water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.

F. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9" for all components that will be in contact with potable water.

1.05 WARRANTY

A General Warranty: Special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Warranty: Written warranty, executed by manufacturer agreeing to repair or replace components of water heaters that fail in materials or workmanship within specified warranty period.

1. Failures include rusty water or heating surfaces due to lime scale build-up.
2. Warranty Period: From date of acceptance by the Owner.
   a. Burner Assemblies: 1 Year complete parts, labor and freight; additional four (4) years parts.
   b. Heat Exchanger: Five (5) years warranty.
3. Heater shall have a five (5) year non-prorated limited warranty against leaks or production of rusty water, including a three (3) year non-prorated limited warranty covering failure of heating surfaces due to lime scale build-up. Warranty shall include a one year cost free service policy including labor and freight for service due to factory defect. The manufacturer’s written warranty shall be part of the submittals.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 TANKLESS, GAS WATER HEATERS

A. Description: AGA certified; tankless, temperature controlled, continuous flow, water heaters for natural-gas fuel.

1. Manufacturers:
   a. Rinnai Corporation
   b. Takagi
   c. Rheem

B. Construction: Without hot-water storage.

1. Working-Pressure Rating: 150 psig (1035 kPa).
2. Tappings: ASME B1.20.1, pipe thread.
3. Interior Finish: Materials complying with NSF 61, barrier materials for potable-water tank linings.
4. Jacket: Aluminum or steel, with enameled finish, or plastic.

C. Burner: Direct vent, forced combustion for natural-gas fuel.

1. Temperature Control: Adjustable remote thermostat.
2. Safety Control: Flame failure, boiling protection, remaining flame (OHS),thermal fuse, automatic frost protection, combustion fan rpm check, overcurrent and automatic unit temperature control default to 100 deg F. (anti-scald).
3. Automatic Ignition: ANSI Z21.20, automatic battery-sparked gas-ignition system and components.

D. Capacities are scheduled on the drawings.

2.03 COMPRESSION TANKS

A. Description: Steel, pressure-rated tank, ASME-constructed with welded joints and factory-installed, butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.

1. Manufacturers:
   a. Amtrol, Inc.
   b. Smith: A.O. Smith; Aqua-Air Div.
   c. Wessels
   d. Elbi

B. Construction: 150-psig (1035-kPa) working-pressure rating.

C. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1, pipe thread.

D. Tank Interior Finish: Materials and thicknesses complying with NSF 61, barrier materials for potable-water tank linings. Extend finish into and through tank fittings and outlets.

E. Air-Charging Valve: Factory installed.

2.04 WATER HEATER ACCESSORIES

A. Gas Shutoff Valves: ANSI Z21.15, manually operated. Furnish for installation in piping.

B. Gas Pressure Regulators: ANSI Z21.18, appliance type, factory or field installed. Include pressure rating, capacity, and pressure differential required for water heater and gas supply.

C. Vent System: Provide complete concentric combination combustion air intake and exhaust vent piping system including, but not limited to the following: vertical discharge adaptor, vertical concentric piping, vent pipe clamps, condensate collector, roof flashing assembly, roof disharge terminal and fittings.

D. Water Heater Mounting Brackets: Water heater manufacturer's factory-fabricated steel bracket for wall mounting and capable of supporting water heater and water.

E. Piping Manifold Kits: Water heater manufacturer's factory-fabricated inlet and outlet piping arrangement for multiple-unit installation. Include piping and valves for field assembly that is capable of isolating each water heater and of providing balanced flow through each water heater.

F. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1-2010.

G. Controls: Provide complete operating system with multiple unit controllers, controllers to select and change hot water supply temperature and non-polarized two-core cable. Controller shall have capability to rotate lead water heater to equalize multiple water heater operation time.

H. Aquastat: Provide aquastat as required to control water heater operation and recirculation pump. Provide aquastat per manufacturer’s recommendations.

PART 3 - EXECUTION

3.01 WATER HEATER INSTALLATION

A. Install water heater, 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.

B. Anchor water heaters to substrate.

C. Install and connect gas water heaters according to NFPA 54.

1. Install appliance, gas pressure regulators on gas-burner inlets of water heaters without pressure regulators.
2. Install vent piping from gas-train pressure regulators and valves to outside of building where required. Terminate vent piping with brass-screened vent cap fitting. Do not combine vents except with approval of authorities having jurisdiction.

D. Install combination temperature and pressure relief valves in water piping for 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.

E. Install water heater drain piping as indirect waste to spill into open drains or over floor drains. Install hose-end drain valves at low points in water piping for water heaters that do not have tank drains. Refer to Division 22 Section "Plumbing Specialties" for drain valves.

F. Install thermometers on water heater and storage tank inlet and outlet piping. Refer to Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.

G. Assemble and install inlet and outlet piping manifold kits for multiple water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each water heater. Include shutoff valve and thermometer in each water heater inlet and outlet, and throttling valve in each water heater outlet. Refer to Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty valves and to Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.

H. Arrange for insulation on equipment and piping not furnished with factory-applied insulation. Fill water heaters with water.

I. Charge compression tanks with air.

3.02 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.Install piping adjacent to machine to allow service and maintenance.Connect hot- and cold-water piping with shutoff valves and unions.

B. Connect gas piping to gas burner with drip leg, tee, shutoff valve, and union; minimum size same as inlet connection.

C. Make connections with dielectric fittings where piping is made of dissimilar metal.

D. Gas, Water Heater Vent Connections: Connect to vent system. Include draft hoods and diverters where required. Use vents same size as or larger than water heater outlets, but not smaller than indicated unless smaller vent size has been calculated according to NFPA 54. Comply with gas utility requirements for sizing.

E. Electrical Connections: Power wiring and disconnect switches are specified in Division 26 Sections. Arrange wiring to allow unit service.

F. Ground equipment.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.03 FIELD QUALITY CONTROL

A. Engage a factory-authorized service representative to perform startup service.

B. In addition to manufacturer’s written installation and startup checks, perform the following:

1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment and retest until satisfactory results are achieved.
2. Verify that piping system tests are complete.
3. Check for piping connection leaks.
4. Check for clear relief valve inlets, outlets, and drain piping.
5. Test operation of safety controls, relief valves, and devices.
6. Energize electric circuits.
7. Adjust operating controls.
8. Adjust hot-water-outlet temperature settings. Do not set above 135 deg F unless piping system application requires higher temperature.

3.04 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain water heaters.

1. Train Owner's maintenance personnel on procedures for starting and stopping troubleshooting, servicing, and maintaining equipment. Refer to Division 22 Section "Plumbing General Provisions".
2. Review date in maintenance manuals. Refer to Division 22 Section "Plumbing General Provisions".
3. Schedule training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION

SECTION 22 40 00 PLUMBING FIXTURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. These Plumbing provisions specified herein apply to all Sections of Division 22.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 22.

1.02 WORK INCLUDED

A. This Section includes plumbing fixtures and related components.

1.03 RELATED WORK AND REQUIREMENTS

A. Requirements of General Conditions, Division 1

B. Section 22 16 00 - Plumbing Specialties

C. Section 23 00 10 – Mechanical General Provisions

1.04 DEFINITIONS

A. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.

B. Fitting: Device that controls flow of water into or out of plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.

1.05 SUBMITTALS

A. See Section 01 33 23 - Shop Drawings, Product Data and Samples

B. See Section 23 00 10 – Mechanical General Provisions

C. Product Data: Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports and indicate materials and finishes, dimensions, construction details, and flow-control rates for each type of fixture indicated. All product data for plumbing fixtures shall be submitted to the Owner for review and approval.

D. Shop Drawings: Diagram power, signal, and control wiring and differentiate between manufacturer installed and field-installed wiring.

E. Maintenance Data: For plumbing fixtures to include in maintenance manuals specified in Division 01.

1.06 QUALITY ASSURANCE

A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.

1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act".

D. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.

E. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

F. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

G. Comply with the following applicable standards and other requirements specified for plumbing fixtures:

1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
2. Hand Sinks: NSF 2 construction.
3. Porcelain-Enameled, Formed-Steel Fixtures: ASME A112.19.4M.
4. Stainless-Steel Fixtures Other Than Service Sinks: ASME A112.19.3M.
5. Vitreous-China Fixtures: ASME A112.19.2M.
6. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.
7. Water-Closet, Flushometer Tank Trim: ASSE 1037.

H. Comply with the following applicable standards and other requirements specified for sink faucets:

1. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.
2. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
3. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
4. Faucet Hose: ASTM D 3901.
5. Faucets: ASME A112.18.1M.
6. Hose-Connection Vacuum Breakers: ASSE 1011.
7. Hose-Coupling Threads: ASME B1.20.7.
8. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
9. NSF Materials: NSF 61.
10. Pipe Threads: ASME B1.20.1.
11. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
12. Supply and Drain Fittings: ASME A112.18.1M.

I. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:

1. Atmospheric Vacuum Breakers: ASSE 1001.
2. Brass and Copper Supplies: ASME A112.18.1M.

3. Manual-Operation Flushometers: ASSE 1037.
4. Plastic Tubular Fittings and Piping: ASTM F 409.
5. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.
6. Tubular Brass Drainage Fittings and Piping: ASME A112.18.1M.

J. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Disposers: ASSE 1008 and UL 430.
2. Floor Drains: ASME A112.21.1M.
3. Grab Bars: ASTM F 446.
4. Hose-Coupling Threads: ASME B1.20.7.
5. Hot-Water Dispensers: ASSE 1023 and UL 499.
6. Off-Floor Fixture Supports: ASME A112.6.1M.
7. Pipe Threads: ASME B1.20.1.
8. Plastic Toilet Seats: ANSI Z124.5.
9. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.07 COORDINATION

A. Coordinate roughing-in and final plumbing fixture locations, and verify that fixtures can be installed to comply with original design and referenced standards.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General:

1. Provide fixtures and trim complete for proper installation as described in the manufacturer's catalog with the modifications as shown on Plumbing Fixture Schedule in the plans or specifications.
2. All fixtures, specified to be of vitreous ware, shall be of a quality known commercially as "twice fired" vitreous chinaware of the best quality, nonabsorbent, burned so that the whole mass is thoroughly fused and vitrified producing a material white in color, which when fractured will show a homogeneous mass, close-grained and free from pores. The glazed and vitreous china fixtures shall be white, thoroughly fused and united to the body, without discoloration, chips, or flaws and shall be free from cracks. Warped or otherwise imperfect fixtures will not be acceptable.
3. Factory grind back and bases of fixtures smooth.
4. Enamelware to be white cast iron with acid-resisting enamel.
5. Unless otherwise specified, water closets to have a waste passage to pass a 2-1/2 inch ball minimum. Bolt water closets to flanges with a 1-inch thick rubber foam gasket.
6. Fixture trim and exposed metal items shall be polished chrome-plated unless otherwise noted, and pipes passing through walls shall have polished chrome-plated escutcheon plates. All stainless steel shall be satin brushed (US32D) finish unless noted otherwise.
7. Fixtures shall be free from imperfections, true as to line, angles, curves, and color; smooth, watertight and practically noiseless in operation.
8. Exposed Pipe, Trim Including Fittings, Traps, Escutcheons, Valves, Valve Handles, and Accessories: Above and Below Fixtures:
   a. Polished chrome plated CP brass.
   b. Set-screw cast brass escutcheons for piping.
   c. Traps: Cast brass with cleanout plugs.

d. Covering tubes not permitted.
e. Provide Hudee stainless steel rims, as applicable, for non-selfrimming counter mounted fixtures.

9. Supply Fixtures With:
   a. Renewable seats or replaceable internal units.
   b. Compositional washers.

2.02 MANUFACTURERS

A. Manufacturers for fixtures and trim:

1. Fixtures (vitreous china): Toto, Zurn, Kohler, American-Standard
2. Sinks (stainless steel): Just, Elkay, Kohler, American Standard
3. Floor and roof drains, carriers, etc.: Zurn, J.R. Smith, Josam
4. Sink and lavatory trim: Zurn, Kohler, Delta
5. Electric water coolers: Haws, Elkay, or Equal
6. Safety eyewash and shower: Haws, Encon Safety Products or equal
7. Flush Valves: Water closets manual flush type and urinals shall be battery sensor-operated flush type. Sensor operated urinal flush valves shall have manual over-ride button.

2.03 FLUSH VALVE PLUMBING FIXTURES

A. Provide vacuum breakers and angle control-stop valves for each flush valve. Vacuum breakers shall conform to ASSE 1001. Exposed to view and pressure containing components of flush valves, vacuum breaker, angle control-stop valve, tail pieces, slip nuts, escutcheon plates, and wall plates shall be chromium-plated copper alloy or polished stainless steel. Water flushing volume of the flush valve shall not exceed the gallons per flush required below, and is factory set as required by the fixture. Mount flush valves not less than 11 inches above neither the fixture nor more than 44 inches above the floor for ADA accessible fixtures. For ADA accessible water closets, controls for flush valves shall be located on the wide side of the toilet area.

B. Water Closets (WC): See plumbing fixture schedule on Drawings

C. Urinals (U): See plumbing fixture schedule on Drawings

2.04 LAVATORIES AND SINKS

A. Lavatories (L): See plumbing fixture schedule on Drawings

B. Mop Basin (MB): See plumbing fixture schedule on Drawings

2.05 ELECTRIC WATER COOLERS

A. Electric Drinking Fountain (EDF): See plumbing fixture schedule on Drawings

2.06 SHOWERS

A. SHOWERS (SH): See plumbing fixture schedule on Drawings

2.07 EMERGENCY SHOWER AND EYE WASH

A. (ES/EW): See plumbing fixture schedule on Drawings

2.08 PLUMBING FIXTURE FAUCETS, TRIM AND FITTINGS

A. ASME A112.18.1M for plumbing fixture faucets. The finish of plumbing fixture faucets, trim, valves, and fittings exposed to view shall be chromium-plate or polished stainless steel except as modified herein. Bolts, nuts, and screws shall be copper alloy or stainless steel. Provide ball valves or 4 turn angle valve connections in each supply to each faucet; chromium-plated finish is not required if not exposed to view. Supply risers shall be chrome plated copper flex riser style smooth surface. Faucets shall be the washerless type and shall have threaded type end connections, coupling nuts, or union connections. Provide washers and lock nuts to secure faucets to lavatories and sinks.

B. Traps: Provide P-traps for each plumbing fixture that do not have integral traps. Provide 1.5 inch brass adjustable P-traps, 16 gauge tubing with slip nuts and gaskets; chromium-plated finish is required if exposed.

C. Continuous Waste: Tubular brass, 0.045-inch wall thickness, with slip-joint inlet and size to match equipment.

D. Indirect Waste: Tubular brass, 0.045-inch wall thickness, with slip-joint inlet and size to match equipment.

E. FHB-1 Freezeproof Hose Bibb: Nonfreeze concealed-outlet wall hydrants, ASSE 1019, self-drainable with flush-mounting box with cover, integral nonremovable hose-connection vacuum breaker, cast bronze casing and operating rod to match wall thickness, concealed outlet, and wall clamp. ASME A112.21.3M, key-operation hydrant with pressure rating of 125 psig. Inlet NPS 3/4 threaded or solder joint. Outlet ASME B1.20.7, garden hose threads. Operating keys, one with each key-operation hydrant.

1. Classification: Type A, for automatic draining with hose removed or Type B, for automatic draining with hose removed or with hose attached and nozzle closed.
2. Box and Cover Finish: polished nickel bronze.
3. Manufacturer: Woodford B65, Josam, Watts, Zurn

2.09 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Guard: Manufactured, plastic covering or enclosure for hot- and cold-water supplies and trap and drain piping and complying with ADA requirements.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine roughing-in for water soil and for waste piping systems and supports to verify actual locations and sizes of piping connections and that locations and types of supports match those indicated, before plumbing fixture installation. Use manufacturer's roughing-in data if roughing-in data are not indicated.

B. Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 APPLICATIONS

A. Include supports for plumbing fixtures according to the following:

1. Heavy-Duty Chair Carriers: For accessible lavatories and other fixtures where indicated.

B. Include fitting insulation kits for accessible fixtures according to the following:

1. Lavatories: Cover Hot-and cold-water supplies, stops and handles, drain, trap, and waste to wall.
2. Fixtures with Offset Drain: Cover hot-and cold-water supplies, offset drain, trap, and waste to wall.
3. Other Fixtures: Cover exposed fittings below fixture.

3.03 FIXTURE INSTALLATION

A. Assemble fixtures, trim, fittings, and other components according to manufacturers' written instructions.

B. For wall-hanging fixtures, install off-floor supports affixed to building substrate.

1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.

C. Install back-outlet, wall-hanging fixtures onto waste fitting seals and attach to supports.

D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate. Closet flanges shall be anchored to the floor per manufacturer’s recommendations.

E. Install wall-hanging fixtures with tubular waste piping attached to supports.

F. Install counter-mounting fixtures in and attached to casework.

G. Install fixtures level and plumb according to manufacturers' written instructions and roughing-in drawings.

H. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

1. Exception: Use ball, gate, or globe valve if stops are not specified with fixture.
2. Refer to Section 23 05 23 - Valves for general-duty valves.

I. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

J. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.

K. Install toilet seats on water closets.

L. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

M. Install water-supply, flow-control fittings with specified flow rates in fixture supplies at stop valves.

N. Install faucet, flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

O. Install traps on fixture outlets.

1. Exception: Omit trap on fixtures with integral traps.
2. Exception: Omit trap on indirect wastes, unless otherwise indicated.

P. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Refer to Section 23 05 00 - Basic Mechanical Materials and Methods for escutcheons.

Q. Seal joints between fixtures and walls, floors, and counters using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Refer to Division 7 Section "Joint Sealants" for sealant and installation requirements.

3.04 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 and Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect water supplies from water distribution piping to fixtures.

C. Connect drain piping from fixtures to drainage piping.

D. Supply and Waste Connections to Plumbing Fixtures: Connect fixtures with water supplies, stops, risers, traps, and waste piping. Use size fittings required to match fixtures. Connect to plumbing piping.

E. Supply and Waste Connections to Fixtures and Equipment Specified in Other Sections: Connect fixtures and equipment with water supplies, stops, risers, traps, and waste piping specified. Use size fittings required to match fixtures and equipment. Connect to plumbing piping.

F. Ground equipment.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

G. Arrange for electric-power connections to fixtures and devices that require power. Electric power is specified under Division 26.

3.05 FIELD QUALITY CONTROL

A. Verify that installed fixtures are categories and types specified for locations where installed.

B. Check that fixtures are complete with trim, faucets, fittings, and other specified components.
C. Inspect installed fixtures for damage. Replace damaged fixtures and components.

D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

E. Install fresh batteries in sensor-operated mechanisms.

3.06 ADJUSTING

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

B. Adjust water pressure at faucets, and flushometer valves to produce proper flow and stream.

C. Replace washers and seals of leaking and dripping faucets and stops.

3.07 CLEANING

A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:

1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
2. Remove sediment and debris from drains.

3.08 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 23 00 10 MECHANICAL GENERAL PROVISIONS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. These heating, ventilating and air conditioning (HVAC) provisions specified herein apply to all Sections of Division 23.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 23.

1.02 DIVISION OF WORK

A. This section delineates the division of work between Divisions.

B. Consult all other Sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable installation. This section is provided to assist the Contractor in coordination of work scope but shall not be construed to limit Contractor's scope of work encompassed by the contract documents.

C. Coordination with other Trades: The following table is intended to assist the Contractors in coordinating the scope of work between Division 23 (Indicated as 23 in table) and other Divisions as indicated. However, the General Contractor is ultimately responsible for coordination among his subcontractors regardless of what is listed in this Section.

INTERFACE/RESPONSIBILITY MATRIX						
System		Division under which the following is specified				Remarks
		Equipment	Installation	Power Wiring [1]	Control & Interlock Wiring [1]	
A. FIRE SPRINKLER SYSTEM						
1.	Flow switches	21	21	26	26	
2.	Valve monitors	21	21	26	26	
3.	Post indicating valves	21	21	26	26	
B. FIRE & LIFE SAFETY SYSTEMS						
1.	Fire alarm and smoke control systems	26	26	26	26	
2.	Duct mounted & in-direct mounted smoke detectors	26	23	26	26/ 23	[2]
C. MECHANICAL EQUIPMENT						
1.	Variable refrigerant flow system (including all control panels, control devices and communication devices)	23	23	26	23	[3]
2.	Energy recovery ventilator	23	23	26	23	

INTERFACE/RESPONSIBILITY MATRIX						
	System	Division under which the following is specified				Remarks
		Equipment	Installation	Power Wiring [1]	Control & Interlock Wiring [1]	
3.	Packaged terminal heat pump	23	23	26	23	
4.	Fans	23	23	26	23	
5.	Infrared heaters	23	23	26	23	
6.	Unit heaters	23	23	26	23	
7.	Motors, 3 phase	23	23	26	-	
8.	Motor starters, 3 phase	23	23	26	23	[4]
9.	Motors, 1 phase	23	23	26	23	[5]
10.	Other powered equipment	23	23	26	23	
11.	Disconnects	26/23	26/23	26	26	[6]
D. PLUMBING SYSTEMS						
1.	DHW heater venting and combustion air	23	23	-	-	
2.	Condensate drains including traps, primers	22	22	-	-	[7]
3.	Condensate pumps	23	23	23	-	
4.	Natural gas connections, pressure reducing station, gages	22	22	-	-	[8]
5.	Recirculation pumps or heat tape	22	22	26	23	
6.	Pipe gauges, thermometers, test plugs	22	22	-	-	
7.	Sensor wells, meters and other pipe-mounted control devices	23	22	23	23	
E. HVAC SHEET METAL						
1.	Duct mounted sensors	23	23	23	23	
3.	Control dampers	23	23	23	23	[9]
4.	Control damper actuators	23	23	23	23	[9],[10]
F. MISCELLANEOUS						
1.	Trenching, backfilling, boring, soil compaction, saw-cutting, patching and paving for underground piping	31	31	-	-	
2.	Roofing, including cant strips and counterflashing at the sides of roof curbs	7	7	-	-	
3.	Thermal and acoustical insulation in and on partitions and ceilings	7	7	-	-	
4.	Louvers	23	8	-	-	
5.	Combination louver/damper	23	23	23	23	
6.	Concrete housekeeping pads, curbs, pedestals etc. for equipment	3	3	-	-	[11]
7.	Equipment, ductwork, and piping steel supports and frames	23	23	-	-	
8.	Painting of exposed piping, HVAC equipment, etc.	23	23	-	-	
9.	Paining of exposed plumbing piping,	22	22			

INTERFACE/RESPONSIBILITY MATRIX

	System	Division under which the following is specified				Remarks
		Equipment	Installation	Power Wiring [1]	Control & Interlock Wiring [1]	
	plumbing equipment, etc.					
10.	Fire-stopping around pipe and duct penetrations in floor and walls	23	23	-	-	
11.	Framing of walls and ceilings to accept air outlets, fire dampers, etc.	9	9	-	-	[12]
12.	Ceiling and wall access doors	23	8	-	-	[13]

NUMBERED REMARKS::

[1] Wiring includes raceway, fittings, wire, boxes and related items, all voltages

[2] Wiring of interlock of duct smoke detectors to shut off supply fans upon detection of smoke is specified under Division 23 HVAC. All other smoke control/fire alarm related control wiring is specified under Division 26 Electrical.

[3] Variable refrigerant flow (VRF) equipment, control devices, control panels, etc. by VRF manufacturer. Installation and wiring of all equipment, control devices, control panels, system programming and commissioning, etc. specified under Division 23 HVAC. VRF vendor to provide all necessary technical assistance to Division 23 Contractor in system setup, programming and commissioning.

[4] Integral starter control devices such as HOA switches, 120V control transformers and time delay relays (from high to low speed) for two speed motors specified under Division 26 Electrical.

[5] Single phase 120V motors with integral motor overload protection specified under Division 23 HVAC. Line voltage control device such as thermostat or switch specified under Division 23 HVAC; wiring and conduit between control device and motor specified under Division 26 Electrical.

[6] Disconnects are specified under Division 23 HVAC where specifically called for in equipment schedules or specifications to be factory installed with equipment. Otherwise all disconnects are specified under Division 26 Electrical.

[7] Coordinate piping from condensate pans to the sewer system including trap and final connections is specified under Division 22 Plumbing. Piping from auxiliary drain pans where provided at air handling equipment in furred spaces is specified under Division 23 HVAC.

[8] Pressure reducing valves to deliver gas at the pressure required by mechanical equipment, including final connections and shut-off cock, is specified under Division 22 Plumbing. All other gas control and regulating devices provided under the Section providing the gas-fired equipment. Venting of gas regulating devices and other equipment gas-train devices where required is specified under Division 22 Plumbing.

[9] Duct access doors required for access to control devices where required specified under Division 23 HVAC.

[10] Actuators for motorized dampers supplied with fans or hood where scheduled on HVAC drawings are specified under Division 23 HVAC, mounted and wired.

[11] Shop drawings showing dimensions of all curbs, bases, etc. specified under Division 23 HVAC.

[12] Additional T-bar or spline and cut ceiling tile as required to accept air outlets is specified under Division 9.

[13] Dimensioning of access doors to mechanical equipment and coordination with Architect and Division 8 specified under Division 23.

D. HVAC/Electrical Design Coordination

1. The power ratings of motors and other HVAC equipment and the electrical characteristics of electrical systems serving them, as specified herein and indicated on the Drawings, have been established as minimums which will allow that equipment to satisfactorily function while producing the required capacities. These power ratings include a safety factor deemed appropriate to accommodate common differences between design parameters and field construction practices. Under no circumstances shall equipment with power ratings less than those indicated on the Drawings or specified herein be provided.
2. Contractor shall coordinate the electrical requirements of the HVAC equipment actually furnished on this Project and provide the electrical systems required by that equipment. This coordination effort shall be completed prior to the installation of either the HVAC equipment or the electrical systems serving that equipment. Electrical system revisions required to coordinate with the HVAC equipment actually furnished shall be provided at no additional cost to the Owner.

E. Related Work Specified Elsewhere

1. Utilities five feet beyond building line unless noted otherwise: See Division 33 Utilities
2. Undercutting of doors and door louvers: See Division 8 Openings.
3. Painting (except as specifically indicated): See Division 9 Finishes
4. Fire resistant enclosures around ducts and at fire dampers such as at the bottoms of shafts. See Division 9 Finishes.
5. Electric power, interlock and control wiring, except as specified herein.
6. Installation of starters, contactors, thermal overload switches, and remote push buttons, except as specified herein.
7. Fire alarm initiating devices, control modules, and monitoring modules.
8. Louvers and screens, except as specified herein.
9. Concrete equipment pads.

1.03 REFERENCE STANDARDS

A. Reference to codes, standards, specifications and recommendation of technical societies, trade organizations and governmental agencies shall mean that latest edition of such publications adopted and published prior to submittal of the bid. Such codes or standards shall be considered a part of this Specification as though fully repeated herein.

B. Work shall be performed in accordance with all applicable requirements of the latest edition of all governing codes, rules and regulations including but not limited to the following minimum standards, whether statutory or not.

C. Requirements of Regulatory Agencies

1. In accordance with the requirement of Division 1 General Requirements.
2. Nothing in contract documents shall be construed to permit work not conforming to current and applicable laws, ordinances, rules and regulations.
3. Where contract documents exceed requirements of applicable laws, ordinances, rules and regulations, comply with documents establishing the more stringent requirement.

4. It is not the intent of contract documents to repeat requirements of codes except where necessary for completeness or clarity.
5. Comply with the Safety Orders issued by OSHA and any other safety, health or environmental regulations of the State of Mississippi and any districts having jurisdictional authority. Where an omission or conflict appears between OSHA requirements and the Drawings and Specifications, OSHA requirements shall take precedence.
6. Applicable codes as listed below, in addition to others specified in individual sections.
   a. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) – Standard 90.1-2010 "Energy Standard for Buildings Except Low-Rise Residential Buildings".
   b. International Building Code (IPC) – 2012.
   c. International Mechanical Code (IMC) – 2012.
   d. International Plumbing Code (IPC) - 2012.
   e. NFPA 1 – 2012, Fire Code
   f. NFPA 70 - 2008, National Electric Code
   g. NFPA 90A - 2009, Installation of Air Conditioning and Ventilating Systems

D. Published specifications, standards, tests or recommended method of trade, industry or governmental organizations as listed below apply to all work in Division 23 HVAC, in addition to other standards which may be specified in individual sections.

E. All base material shall meet ASTM and ANSI standards.

F. All Gas Fired Devices: Comply with standards and bear label of AGA.

G. All Pressure Vessels, Relief Valves, Safety Relief Valves and Safety Valves: Comply with standards, ASME stamped.

H. All Electrical Devices and Wiring

1. Conform to standards of NEC
2. All devices UL or ETL listed and identified

1.04 QUALITY ASSURANCE

A. Supply all equipment and accessories in compliance with the applicable standards listed in Paragraph 1.3C and with all applicable national, state and local codes.

B. All equipment and accessories shall be new and the product of a manufacturer regularly engaged in its manufacturer.

C. All items of a given type shall be the products of same manufacturer.

D. Workmanship, material and equipment shall be in accordance with Specifications and Drawings and in some instances the requirements exceed those required by codes and standards. Where not exceeded, the codes and standards shall be considered as absolute minimum requirements.

1.05 SUBMITTALS

A. No work may begin on any segment of this Project until the related submittals have been reviewed for conformance with the design intent and the Contractor has responded to all comments to the satisfaction of the Owner.

B. Submit drawings, product data, samples and certificates of compliance required as hereinafter specified. See also Division 01 – Shop Drawings, Product Data and Samples. Conditions in this Section take precedence over conditions in above referenced Section.

C. Submit no later than 35-days after signing of Contract, or as otherwise indicated by Architect. Submit a schedule indicating the proposed submission date of each submittal specified herein. Schedule shall anticipate the submittal review time, the possible need for resubmittals, and the time required for fabrication, shipping and integration into the construction sequence. Architect will advise of any conflicts in reviewing submittals that the proposed schedule presents.

1. Complete schedule of submittals for equipment and layout shop drawings. Allow 15-working days for review, unless Architect agrees to accelerated schedule.
2. List of all proposed substitutions: See Paragraph 1.7
3. Designate in schedule dates for submission and dates that reviewed shop drawings, product data and samples will be needed.
4. Provide submittals promptly in accordance with schedule and in such sequence as to cause no delay in work or in work of any other division.

D. Submit drawings, product data, samples and certificates of compliance required hereinafter specified.

1. See also Division1 Shop Drawings, Product Data and Samples. Conditions in this Section take precedence over conditions in above referenced Section.
2. Provide submittals promptly in accordance with schedule and in such sequence as to cause no delay in work or in work of any other division.
3. Submittals for each specification section shall be submitted in a single package. However, it is not required (nor desired) for all products to be submitted concurrently. Rather, submittals may be staggered based on schedule and required equipment release dates.
4. Allow 15-working days for review, unless the Architect agrees to accelerated schedule.
5. For substitutions, list any features or characteristics that are not strictly in compliance with specifications. If none are listed with the submittal, Contractor is guaranteeing that substituted product is functionally equivalent to the specified product in accordance with Paragraph 1.7.
6. Submittal reviews by the Architect are intended to assist the Contractor in complying with the design intent and requirements of the drawings and specifications. Reviews do not relieve the Contractor from compliance with these requirements and comments or lack thereof do not constitute approval of changes in these requirements.

E. Submission and Resubmission Procedure

1. Each submittal shall have a unique serial number that includes the associated specification section followed by a number for each sub-part of the submittal for that specification section, such as “SUBMITTAL 23 xx xx-01”.
2. Each resubmittal shall have the original unique serial number plus revision number such as “SUBMITTAL 23 xx xx-01 REVISION 1”.
3. Submit in format specified below. SUBMISSIONS MADE IN WRONG FORMAT WILL BE RETURNED WITHOUT ACTION.
   a. Product Submittals: One copy in word-searchable electronic format. Submit each specification section in a separate file named with unique name and number described above.

b. Shop Drawings:
   1) One copy in electronic format .dwg, .dwf, or .pdf
   2) Two and only two copies on paper; any additional copies will not be returned without review

4. Architect will return a memo or mark-up of submittal with comments and connections noted where required.
5. Make corrections
   a. Revise initial submittal to resolve review comments and corrections.
   b. Indicate any changes that have been made other than those requested.
   c. Clearly identify resubmittal by original submittal number and revision number.
6. Resubmit revised submittals until no exceptions are taken.
7. Once submittals are accepted and stamped with no exceptions taken, provide
   a. Complete submittal of all accepted products in a single electronic file for each specification section.
   b. Photocopies for coordination with other trades, if and as required by the Contractor or Architect. Photocopies will serve as submittal for record and coordination.

F. Product Data Submittals

1. Contents
   a. Manufacturer's name and model number
   b. All information required to completely describe materials and equipment and to indicate compliance with drawings and specifications, including, but not limited to:
      1) Schedule when more than one of each item is covered by submittal
      2) Physical data, as applicable
         a) Dimensions
         b) Weight
         c) Finishes and colors
         d) Dimensional shop drawings
      3) Performance data, as applicable
         a) Rated capacities
         b) Performance curve
         c) Operating temperature and pressure
         d) Efficiency
      4) Flow and wiring diagrams as applicable
      5) Description of system operation
   c. All other pertinent information requested in individual sections
2. Format
   a. See Division 1 Shop Drawings, Product Data and Samples
   b. Identify clearly if submittal is substitution: Refer to Paragraph 1.8
   c. Reference specification Division, Section, Title, Paragraph and Page number or drawing number as applicable
   d. Use same nomenclature, legend, symbols and abbreviations on submittal material as used in contract documents

G. Layout Shop Drawings (Coordination Drawings)

1. Drawings shall be developed in format compatible with AutoCAD version 2010 or later.

2. Shop fabrication, coordination and installation drawings by the Contractor, are for the Contractor's use and shall be the Contractor's responsibility. These Drawings indicate where the Contractor intends to install the material and equipment as required by the Contract Documents. Do not submit shop fabrication documents unless requested. Use of contract documents or electronic files of contract documents for shop drawings is not sufficient.
3. Prepare and submit Shop Drawings for all Work deviating from that indicated on Contract Drawings. Clearly indicate deviations.
4. Review is not intended to verify dimensions or quantities, or to coordinate items shown on these Drawings. Review is for general conformance with design concept of the Project and general compliance with the information given in the Contract Documents. Contractor is responsible for dimensions, which shall be confirmed and correlated at the Jobsite, for fabrication processes and techniques or construction, for coordination of Work with that of all other trades and the satisfactory performance of Work.
5. Prepare and submit layout drawings, sections and details for following areas, minimum 1/4 inch scale:
    a. Mechanical equipment rooms
6. Prepare layout shop drawings for all areas; minimum 1/4 inch scale.
7. Layout drawings, as a requirement of Division 23 HVAC, shall indicate, superimposed, Work of all Sections involved in congested area, including ductwork, piping, electrical work, ceiling work, etc. Include all mechanical rooms. Identification of space problems without solutions is not acceptable.
8. Individual coordinated trade layout drawings are to be prepared for all deviations from design documents.
9. Contractor is to assure that each trade has coordinated work with other trades, prior to submittal where submittal is required.
    a. Include stamp on each submittal indicating that layout shop drawing has been coordinated:
    b. No layout shop drawing will be reviewed without stamped and signed coordinated assurance by Contractor.
10. All changes shall be clearly marked on each submitted layout drawing.
11. Drawings shall show work of all trades including but not limited to:
    a. Ductwork
    b. Piping: All Trades, including Fire Sprinklers and electrical installations
    c. Mechanical Equipment
        1) For fire and smoke dampers, tag each damper with a unique tag, starting with the tag on the drawings but adding a 4 digit number: xyzz where
            a) x= AC or AH unit that serves the damper
            b) y= floor
            c) zz= unique consecutive number
    d. Electrical Equipment
    e. Main Electrical conduits and bus ducts
    f. Equipment supports and suspension devices
    g. Structural and architectural constraints
    h. Show location of
        1) Valves: manual and automatic
        2) Piping specialties
        3) Dampers: fire/smoke, automatic and manual volume, etc.
        4) Access doors
        5) Control and electrical panels
        6) Others as required for clear coordination

12. Drawings shall indicate coordination with work specified in other Divisions which must be coordinated with work specified under Division 23 Mechanical, including, but not limited to:
    a. Irrigation equipment and piping
    b. Elevator equipment
    c. Building vacuum cleaning systems
    d. Pneumatic tube systems
    e. Cable trays
    f. Computer equipment
    g. Others as required
13. Submission of drawings
    a. See Division 1 – Shop Drawings, Product Data and Samples
    b. Submit to other trades for review of space allocated to all trades
    c. Revise drawings to compensate for requirements of existing conditions and conditions created by other trades
    d. Ensure that each trade has coordinated work with other trades
    e. Submit with stamps of General and all other applicable Contractors, initialed and signed certifying
        1) Review of submittal
        2) Verification of products, field measurements and field construction criteria
        3) Coordination of information in submittal with requirements of work of this Division and other divisions of Contract Documents
    f. No layout shop drawing will be reviewed without stamped and signed coordination assurance by the Contractor

H. Samples: Submit as required in each specification section

1.06 COMPLETION REQUIREMENTS

A. Procedure

1. Until the documents required in this section are submitted and approved, the system will not be considered “accepted”
2. Before requesting acceptance of work, submit one set of Completion Documents for review and approval of Architect
3. After review, furnish quantity of sets indicated below to Owner
4. Format
    a. See Paragraph 1.6H for required format of Completion Documents
    b. Paper copies; assemble in chronological order following alpha-numeric system used in specification, in heavy three-ring binder
    c. Where electronic copies are called for in Paragraph 1.5H, comply with the following:
        1) Provide in word-searchable electronic format; acceptable formats are MS Word, Adobe Acrobat (pdf) and HTML; submit other formats for review and approval prior to submission; scanned paper documents not acceptable
        2) For submittals, provide separate file for each type of equipment
        3) For Test & Balance report, provide separate files for each air handling system
        4) Record drawings shall be in original format

B. Operating and Maintenance (O&M) Manual: See O&M Manual requirement herein

C. Record Drawings

1. Keep up-to-date during progress of job one set of Mechanical Drawings indicating the Record installation. In addition to changes made during course of Work, show following by dimension from readily obtained base lines
   a. Fully illustrate all revisions made by all crafts in course of work
   b. Include all field changes, adjustments, variances, substitutions and deletions, including all Change Orders
   c. Exact location, type and function of concealed valves, dampers, controllers, piping, air vents and piping drains
   d. Exact size, invert elevations and location of underground and under floor piping and ducts
      1) Progress drawing set shall be available for inspection by Architect weekly
      2) Update engineering design drawings and shop drawings to reflect revisions and additional data listed above at completion of Project
   e. Original engineering design drawings will be provided to Contactor in electronic format compatible with AutoCAD version 2010 or later
   f. Both shop and engineering design drawings shall be in format compatible with AutoCAD version 2010 or later
   g. Drawings required to be updated if revisions were made
      1) Floor plans
      2) Shop drawings required by Paragraph 1.5G
      3) Sections
      4) Riser diagrams

D. Test and Balance Reports: See Section 23 05 93 – Testing, Adjusting and Balancing

E. Training Materials: See Training Materials requirements herein

F. Miscellaneous Certificates

1. Pressure and Leakage Test documentation/certificates
2. Training/Instruction completion certificates
3. Fire Marshal and Fire Department approvals of system, as required
4. Final inspection certificate signed by governing authorities
5. Warranty period, including start and end period
6. Field test report, including as applicable
7. Start up documents with date and name of technician
8. Piping pressure tests
9. Duct leakage and pressure tests
10. Drain pan drainage tests
11. Certificates of sterilization/chlorination of plumbing systems
12. Others as specified herein and in other Division 23 – Mechanical sections

G. Format of Completion Documents

1. Provide the type and quantity of media listed in table below
2. Optical media shall be readable on a personal computer:

	Document	Paper (Binder or bound)	Electronic	
			Read only optical disk	Loaded Onto Operator Workstation
1	O&M Manuals	3	1	-
2	Record Drawings	2 Full size 2 Half size	1	-
3	Original issue EMCS software & manuals	1	1	-
4	Control sequences	1	1	-
5	Test and Balance Report	5	1	-
6	Warranty documents	1	-	-
7	Training materials	1 per trainee	1	-

1.07 DESCRIPTION OF BID DOCUMENTS

A. The Contractor shall be responsible for becoming thoroughly acquainted with all Contract Document contents that affect his work under this contract. Work required under this section includes, but is not limited to, all material, equipment transportation, services and labor required to complete the entire mechanical system as required by the Contract Documents.

B. The Specifications and the associated Drawings are complimentary and any portion of the work described in one shall be provided as if described in both.

C. Specifications

1. Specifications, in general, describe quality and character of materials and equipment.
2. Specifications are of simplified form and include incomplete sentences.
3. Words or phrases such as “The Contractor shall,” “shall be,” “furnish,” “provide,” “a,” “an,” “the,” and “all” have often been omitted from specifications for brevity.

D. Drawings

1. Drawings are diagrammatic in nature and, unless explicitly dimensioned, indicate approximate locations of apparatus, equipment, ductwork and piping. Changes in the location, and offsets, of same which are not shown on the Drawings but are necessary in order to accommodate building conditions and coordination with the work of other trades, shall be made during the preparation of coordination drawings and prior to initial installation, without additional cost to the Owner. Contractor shall install all system components in such a manner as to conform to the structure, avoid obstructions, preserve headroom, keep openings and passageways clear and maintain required servicing clearances without further instructions or additional cost to the Owner.
2. Scaled and figured dimensions are approximate and are for estimating purposes only. Indicated dimensions are limiting dimensions where noted. Duct and piping elevations are indicated for initial coordination; final requirements shall be determined by the Contractor after final coordination with other trades.
3. Before proceeding with work, check and verify all dimensions in field.

4. Assume all responsibility for fitting of materials and equipment to other parts of equipment and structure.
5. Make adjustments that may be necessary or requested in order to resolve space problems, preserve headroom and avoid architectural openings, structural members and work of other trades.
6. It is intended that all mechanical, plumbing and fire protection devices, piping, etc. be located symmetrically with all architectural elements. Refer to Architectural, Structural, Plumbing, Fire Protection, Mechanical and Electrical Specifications and Drawings in completing the required coordination.
7. The Contractor shall fully inform himself regarding any and all peculiarities and limitations of the spaces available for the installation of all work and materials furnished and installed under this Contract. He shall exercise due and particular caution to determine that all parts of his work are made readily accessible.
8. The Contractor shall study all drawings and specifications to determine any conflict with all applicable ordinances and statutes. Any discrepancies shall be reported to the Owner and any changes shall be shown on the as-built drawings with the additional work performed at no cost to the Owner.
9. The submittal of his bid shall indicate the Contractor has examined the site, drawings and specifications and has included all required allowances in his bid. No allowance shall be made for any error or omission resulting from the Contractor's failure to visit job site and to review drawings and specifications. The Contractor's bid shall include costs for all required drawings and changes as outlined above at no cost to the Owner.
10. Provide access to equipment and apparatus requiring operation, service or maintenance throughout the life of the system.

E. Do not use equipment exceeding dimensions indicated on drawings or equipment or arrangements that reduce required clearances or exceed specified maximum dimensions.

F. If any part of Specifications or Drawings appears unclear or contradictory, apply to Architect for an interpretation and decision prior to as early as possible.

1 Do not proceed with work without the decision of the Architect.

1.08 DEFINITIONS

A. In addition to those defined in Division 01 Specification Section 01 42 00 – Reference, the following additional definitions shall apply. Definitions of term used in Division 23 HVAC may differ from those given in general and supplementary conditions and take precedence over them.

B. "Provide": to furnish, supply, install and connect up complete and ready safe and regular operation of particular work referred to unless specifically noted.

C. "Supply": to purchase, procure, acquire and deliver complete with related accessories.

D. "Work": includes labor, materials, apparatus, controls, equipment services and all related accessories necessary for the proper and complete installation of complete systems.

E. "Piping": includes pipe, tube, fittings, flanges, valves, controls, strainers, hangers, supports, unions, traps, drains, insulation and all related accessories.

F. "Wiring": includes raceway, fittings, wire, boxes and all related accessories.

G. "Concealed": not in view, installed in masonry or other construction, within furred spaces, double partitions, hung ceiling, trenches, crawl spaces, or enclosures.

H. "Exposed": in view, not installed underground or "concealed" as defined above. Exposed piping, conduit, or ductwork is that which can be seen when the building is complete without opening or removing access doors or panels or accessible ceiling components.

I. "Control or Actuated Devices": includes automatic sensing and switching devices such as thermostats, pressure, float, flow, electro-pneumatic switches and electrodes controlling operation of equipment.

J. "Indicated," "shown" or "noted": as indicated, shown or noted on drawings or specifications.

K. "Reviewed," "approved," or "directed", as reviewed, approved or directed by or to Owner.

L. "Motor Controllers": starter, variable speed drives and other devices controlling the operation of motors.

1.09 PROJECT CONDITIONS

A. Examine site related work and surfaces before starting work of any Section.

1 In case of conflict, the most stringent takes precedence.
2 For purposes of clarity and legibility, Drawings are essentially diagrammatic to extent that many offsets, bends, unions, special fittings, exact locations of items are not indicated, unless specifically dimensioned. Especially note a number of required duct and pipe offsets to coordinate with structure and not shown. Coordinate dimensioned conditions, including invert elevations, with other trades prior to installation by any trade.
3 Exact routing of piping, ductwork, etc. shall be governed by structural conditions and other obstructions. Not all offsets in ductwork or piping are shown on the Drawings. Determine which item to offset or relocate. Maintain required slope in piping. Make use of data in Contract Documents. In addition, Architect reserves right, at no additional cost to the Owner, to make any reasonable change in location of mechanical items, exposed at ceiling or on walls, to group them into orderly relationships or increase their utility. Verify Owner's requirements in this regard prior to rough-in.
4 Take dimensions, location of doors, partitions, similar physical features from Architectural Drawings. Verify at Site under this Division. Consult Architectural Drawings for exact location of outlets to center with Architectural features, panels, etc., at the appropriate location shown on Mechanical Drawings.
5 Mounting heights of brackets, outlets, etc., as required.
6 Report to Architect, in writing, conditions which will prevent proper provision of this work.
7 Beginning work of any Section without reporting unsuitable conditions to Architect constitutes acceptance of conditions by Contractor.
8 Perform any required removal, repair or replacement of this work caused by unsuitable conditions at no additional cost to the Owner.

B. Coordination

1 Work out all “tight” conditions involving Work specified under this Division and work in other Divisions in advance of installation, if necessary, and before Work proceeds in these areas, prepare supplementary Drawings under this Division for review showing all Work in congested area. Provide supplementary Drawings, additional Work necessary to overcome congested conditions, at no additional cost to the Owner.

2 Conflicts: Difference or disputes concerning coordination, interference or extent of Work between sections shall be decided as follows:

a. Install mechanical and electrical systems in the following order of preference (those trades listed below another must reroute to resolve the conflict):

1) Drain piping required by code to be sloped
2) Supply air and exhaust air ductwork connected to fans
3) Electrical conduit 4 inches and larger
4) Domestic water piping
5) Fire sprinkler piping
6) Electrical conduit smaller than 4 inches
7) Transfer ducts and other ductwork not connected to fans
8) Control system piping and wiring

b. Continued disputes shall be decided by Contractor and Contractor’s decision, if consistent with Contract Document requirements, shall be final.

3 Supervision: Personally or through an authorized and competent representative, constantly supervise the work from beginning to completion and, within reason, keep the same foreman and workmen on the Project throughout the Project duration.

4 Provide templates, information and instructions to other Divisions to properly locate hides and openings to be cut or provided.

5 The drawings govern in matters of quantity, and the specifications govern in matters of quality. In the event of conflict within the drawings involving quantities, or within the specifications involving quantities, or within the specifications involving quality, the greater quantity and higher quality shall apply. Such discrepancies shall be noted and clarified in the Bid. No additional allowances will be made because of errors, ambiguities, or omissions that reasonably should have been discovered during the preparation of the Bid.

C. Equipment Rough-in

1 Rough-in locations shown on Mechanical Drawings for equipment furnished by the Owner and for equipment furnished under other Divisions are approximate only. Obtain exact rough-in locations from following sources.

a. From Shop Drawings for equipment provided under this contract
b. From Architect for Owner furnished-Contractor installed equipment
c. From existing equipment where such equipment is relocated under this Contract

2 Verify mechanical characteristics of equipment before starting rough-in. Where conflict exists between equipment and rough-in shown on Drawings obtain clarification from Architect and provide as directed by the Architect at no additional cost to the Owner.

3 Make final connections

1.10 CLEARANCE FROM ELECTRICAL EQUIPMENT

A. Piping, equipment or ductwork

1 Prohibited, except as noted in:
a. Electric rooms and closets over equipment, as restricted by NEC.
b. Electrical switchboard room
2 Prohibited, except as noted, over or within 5 feet of:
a. Switchboards
b. Motor control centers
c. Bus ducts
d. Electrical panels
e. Starters

B. Electrical Working Space: Dimensions of the working space shall be a minimum depth of 42 inches horizontally, the width of the equipment or 30 inches whichever is greater, and the height of the equipment or 78 inches, whichever is greater. Minimum depth shall be increased to 60 inches for equipment rated over 600 V.

1.11 REVIEW OF CONSTRUCTION

A. Work may be reviewed at any time by representatives of the Owner and/or Architect.

B. Advise Owner that work is ready for review at the following times

1. Prior to backfilling buried work.
2. Prior to concealment of work in walls and above ceilings.
3. When all requirements of Contract have been completed.
4. When testing will be performed.

C. Do not backfill or conceal work without Architect’s consent.

1.12 PERMITS

A. Obtain all permits, certificates of inspections, patent rights and licenses that are required for the performing of this work by all laws, ordinances, rules and regulations or orders of any officer and/or body. Provide all notices necessary in connection therewith, and pay all fees relating thereto and all costs and expenses incurred on account thereof. No work shall be covered before inspection by the jurisdiction authorities and observation by the Architect.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Identify materials, equipment by manufacturer's name, nameplate data. Remove unidentified materials, equipment from Site.

B. Equipment specified by manufacturer's number shall include all accessories, controls, etc., listed in catalog as standard with equipment. Furnish optional or additional accessories as specified.

C. Where no specific make of material or equipment is mentioned, any first class product of reputable manufacturer may be used, provided it conforms to requirements of system and meets with acceptance.

D. Provide an authorized representative to constantly supervise work of this Division, check all materials prior to installation for conformance with Drawings, Specifications, reviewed Submittals and reviewed Shop Drawings.

E. Conform to conditions shown and specified. Coordinate with other trades for best possible assembly of combined Work. Relocate equipment when necessitated by failures to coordinate Work or to advise Architect of conflicts in writing.

F. Material and Equipment-General Requirements

1. New
2. Approved for use by State Fire Marshal and local building inspection department when applicable
3. Testing agency labeled or with other identification wherever standards have been established
4. Architect reserves right to reject items not in accordance with Specification either before or after installation
5. Comprised to render complete and operable systems; provide additional items needed to complete installation to realized design
6. Compatible with space allocated; modifications necessary to adjust items to space limitations at Contractor's expense
7. Installed fully operating and without objectionable noise or vibration
8. Design of mechanical systems is generally based on product of the first named manufacturers cited. Where systems for product installed necessitate modification of systems shown on drawings, Contractor is responsible for installation of systems appropriate to product installed.

G. Electrical Requirements

1. Electrical Work performed under Division 23 – Mechanical shall conform to requirements of Division 26 Electrical
2. Provide weatherproof devices and installation for out-of-doors work

2.2 PAINTING

A. Finish painting (other than factory applied) of mechanical equipment and associated piping and ductwork shall be as specified in Division 09 “Painting” Section(s). Provide touch up painting of prefinished mechanical products.

1 All equipment, ductwork, piping conduit and associated supports, attachments, hardware and connectors exposed to the weather shall be properly coated, painted or otherwise protected from corrosion caused by the elements (sun, wind, rain, snow, ice, etc.).

B. Surfaces shall be left clean, debris shall be removed, and equipment shall be furnished in prime coat finish ready for finish coats.

1 Piping, Ductwork and Equipment: Clean exterior of piping, ductwork and equipment removing rust, plaster and dirt by wire brushing. Remove grease, oil and similar materials by wiping with clean rags and suitable solvents.
2 Motors, Pumps and Other Items with Factory Finish: Remove grease and oil and leave surfaces clean and polished.

C. Cleaning operations may be supplemented by more detailed instructions in various other Sections of this Specification.

D. Paint for high temperature piping and equipment shall be high temperature resistant, designed for the temperatures at which the system will operate.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify that conditions are satisfactory for the installation of materials and equipment. Notify Architect if conditions are not satisfactory and do not commence work until conditions have been corrected.

3.2 INSTALLATION

A. Install materials and equipment in compliance with governing codes.

B. Equipment

1. Assemble equipment which is required to be field assembled under the direct supervision of the manufacturers' agent
2. Prior to the final acceptance submit letters from the manufacturers that equipment has been assembled under the direct supervision of the manufacturers' agent
3. Accurately set and level equipment with supports neatly placed and properly fastened
4. Properly fasten equipment in place with bolts to prevent movement
5. Coordinate the installation of equipment with openings in structure
6. Coordinate and fully dimension steel supports for mechanical equipment where shown on drawings with installing contractor
7. Provide all roof curbs for roof mounted fans, flues, piping and duct penetrations, etc.
8. Concrete
   a. Concrete work, include forming, steel bar reinforcing, cast-in-place concrete, finishing and grouting is specified under Division 3 Concrete
   b. Coordinate and fully dimension concrete housekeeping pads and curbs with installing contractor; dimensions shall be as required for structural requirements, see Section 23 05 48 – Mechanical Sound and Vibration Control
   c. Coordinate inertia base fill with installing contractor

C. Electrical

1. See Division 26 Electrical
2. Install electrical devices with code required clearances and access
3. Assist the electrical contractor in the proper connecting of all electrical wiring and equipment required for mechanical equipment

D. Sleeves, Chases and Concrete Inserts

1. Provide all required sleeves, chases, concrete inserts, anchor bolts, etc.
2. Sleeves, chases are prohibited in structural members, except where shown or as directed by Architect in writing
3. Embed no piping in concrete or masonry

E. Restoration of Damage

1. Repair or replace, as directed by Architect, materials and parts of premises which become damaged
2. Remove replaced parts from premises at no additional cost to the Owner

F. Review architectural drawings and coordinate with Architect and other contractors to be sure that all architectural shafts, plenums, rated duct enclosures etc. required for mechanical systems are properly located and dimensioned.

G. Openings

1. Coordinate and fully dimension all openings in walls, floors, roofs and structural elements required for mechanical work
2. Provide all required fire-stopping around pipe, duct and other penetrations required for mechanical work in rated partitions where required by code
3. Fire damper openings: Contractor shall provided damper UL installation requirements to contractor installing partitions to ensure construction complies with listing
4. Air outlet openings
   a. Contractor shall coordinate exact locations of air outlets in floors, walls and ceilings with contractor installing partition
   b. Contractor shall coordinate additional T-bar or spline required to accept air outlets with contractor providing and installing ceiling and associated materials

3.3 PROTECTION OF EQUIPMENT AND MATERIALS DURING CONSTRUCTION

A. Provide protective covers, skids, plugs or caps to protect equipment and materials from damage or deterioration during construction.

B. Store equipment and material under cover, and off the ground or floors exposed to rain.

C. For outdoor storage, protective covers of 10 mil thick black sheet plastic shall be fitted over equipment and materials. Covers shall be reinforced to withstand wind and precipitation. Set equipment and material on skids or platforms of height to avoid damage or deterioration from spattering and ground water.

D. Protect coils against damage by installing temporary closure panels over exposed coil faces. Panels shall be minimum 24 gauge sheet metal or 0.375" plywood.

E. Completely cover motors and other moving machinery to protect from dirt and water during construction

F. Close open ends of fans, air valves, terminal units, energy recovery units, air handling units, and ductwork with temporary closures of sheet plastic taped in place.

G. Plug ends of pipes when work is stopped to prevent debris from entering the pipes.

H. Provide dust and debris protection for ductwork, coils, fans, equipment, motors, and bearings operated during construction up to date of substantial completion.

I. Cover open ends of exhaust and return ducts with temporary filter media while fan systems are operating.

J. Material, equipment or apparatus damaged because of improper storage or protection will be rejected

1. Remove from site and provide new, duplicate, material, equipment or apparatus in replacement of that rejected
2. Any porous materials, such as duct liner, insulation or flexible ductwork that becomes wet; for example, due to rain shall be replaced; drying is not sufficient (due to possible microbial contamination)

K. Perform Work in manner precluding unnecessary fire hazard

3.4 ADJUSTMENT

A. Preliminary Operation

1. Operate any portion of installation for Owner's convenience if so requested by Architect. Such operation does not constitute acceptance of Work as complete but does constitute beneficial use, see Paragraph 1.19B. Cost of utilities, such as gas and electrical power, will be borne by the Owner if operation is requested by Owner.

B. Startup Service

1. Prior to startup, ensure that systems are ready, including checking the following: Proper equipment rotation, proper wiring, auxiliary connections, lubrications, venting fan balance, controls and installed and properly set relief and safety valves. See pre-function tests in Division 23 – Mechanical.
2. Start and operate all systems
3. Provide services of factory trained technicians for startup of major equipment and systems including boilers, chillers, fire pumps, etc.
4. Adjusting: See Section 23 05 93 – Testing, Adjusting and Balancing

C. Noise

1. Cooperate in reducing any objectionable noise or vibration caused by mechanical systems to the extent of adjustments to specified and installed equipment and appurtenances
2. Completely correct noise problems caused by failure to make installation in accordance with Contract Documents, including labor and materials required as a result of such failure, at no additional cost to the Owner

3.5 CLEANING

A. Thoroughly clean equipment, fans, pumps, motors, piping and other materials under this Division free from all rust, scale and all other dirt before any covering or painting is done, or the systems put in operation; leave in condition satisfactory to Architect.

B. At all times keep the premises free from accumulation of waste material and debris caused by his employees. At the completion of the Project, and at other times as Architect may direct, remove refuse from within and around the building. All tools, scaffolding and surplus materials shall also be removed, leaving the Site of his Work clean.

C. Completely cover all plumbing fixtures and all motors and other moving machinery to prevent entry of dirt and water during construction

D. Effectively cap all openings into ducts and pipes to keep moisture and foreign matter out during construction

E. Clean and polish identification plates

F. Clean equipment, ductwork, insulation, piping, conduit, and room surfaces from dust and dirt and maintain in a clean condition from date of substantial completion until final completion of work and corrective work.

3.6 PAINTING

A. Painting

1. Piping exposed to outdoors and where indicated elsewhere
    a. One coat primer
    b. Two coat alkyd oil paint, UV resistant for PVC piping, color as indicated
    c. Not required for copper, galvanized steel, or insulated piping
2. Steel hangers and supports exposed to outdoors
    a. One coat primer
    b. Not required for galvanized steel
3. Interior of ductwork and duct accessories, including insulation stick pins, at air outlets as far back as visible from occupied spaces
    a. Flat black
4. Marred surfaces of factory painted equipment
    a. Spot coat to match adjacent coat
5. Insulation exposed to sunlight: See Section 23 07 00 – Mechanical Insulation

B. Execution

1. Protect flooring and equipment with drip cloths
2. Paint and materials stored in location where directed
3. Oily rags and waste removed from building every night
4. Wire brush and clean off all oil, dirt and grease areas to be painted before paint if applied
5. Workmanship
    a. No painting or finishing shall be done with
        1) Dust laden air
        2) Unsuitable weather conditions
        3) Space temperature below 60 degrees Fahrenheit
    b. Pipes painted containing no heat and remain cold until paint is dried

c. Paint spread with uniform and proper film thickness showing no runs, sags, crawls or other defects
d. Finished surfaces shall be uniform in sheen, color and texture
e. All coats thoroughly dry before succeeding coats are applied, minimum 24 hours between coats
f. Priming undercoat of slightly different color for inspection purposes

6. Piping continuously painted in all exposed areas

C. Paint

1. High gloss medium or long alkyd paint
2. Best grade for its purpose
3. Deliver in original sealed containers
4. Apply in accordance with manufacturers instructions

D. Colors

1. Colors as directed by Architect unless specified herein.
2. Interior of ductwork as far back as visible from outside: flat black
3. Uncoated hangers, supports, rods and insets: dip in zinc chromate primer

E. Factory finish

1. Ceiling and wall mounted air outlets in acoustical tile ceilings: Baked white enamel
2. Aluminum air outlets that are not to be painted: anodized
3. Exposed fan coil units: baked enamel
4. Unit ventilators and unit heaters: baked enamel
5. Fans, pumps, compressors, tanks and like items
6. Air handlers, pumps, water heaters and like items where exposed

F. Marred surfaces of prime coated equipment and piping: spot prime coat to match adjacent coat

G. Properly prepare Work under this Division to be finish painted under Division 09 Painting

H. Provide moisture resistant paint for exterior painting and heat resisting paint for hot piping, equipment and materials

I. For the following, provide factory prime coat. Also, provide factory finish painting on each if not specified in Painting Division

1. Other air outlets

J. Paint all equipment out-of-doors and equipment supports with two coats of weather resistant enamel

K. Protect all finished surfaces of fixtures with heavy paper pasted thereon, or by other means, throughout the period of construction

L. Refinish Work supplied with final finish under this Division if damaged under this Division to satisfaction of Architect

3.7 EQUIPMENT AND INSTALLATION REQUIREMENTS

A. Air systems shall operate without aerodynamic noise generated from the faulty installation of ductwork or any component of the air distribution system.

B. Equipment shall be installed and connected as specified herein or indicated on the Drawings in accordance with the manufacturers' instructions and recommendations for this Project. Furnish and install auxiliary piping, water seals, valves, and electrical connections recommended by the manufacturer for operation.

C. Provide roughing, fittings, accessories, and connecting piping, and make final connections to all equipment. Coordinate carefully with equipment vendor prior to starting rough-in work.

D. Field-installed equipment controls or sensor wiring shall be installed in conduit. Low voltage control and sensor wiring shall be installed in conduits separate from line voltage control wiring and power wiring.

E. Where water connection sizes at equipment vary from the pipe size indicated on the Drawings, provide appropriate reducers/increasers directly adjacent to the pipe-equipment unions. Unless otherwise specified herein or indicated on the Drawings, the size of the valves and accessories dedicated to the equipment shall not be less than the pipe size to which they are connected.

F. Install all work so that parts requiring periodic inspection, operation, maintenance and repair are readily accessible and with the manufacturer’s minimum required clearances provided. Minor deviations from the drawings may be made to accomplish this, but changes of substantial magnitude shall not be made without written approval.

1 Group concealed valves, controls and equipment requiring access, so as to be freely accessible through access doors.

3.8 EXCAVATION AND BACKFILLING

A. In accordance with the requirements of Division 31 for excavating, trenching, and backfilling.

B. Provide barricades, signs, lanterns, shoring, sheeting and pumping as part of Work in this Division as required to ensure safe conditions. Comply with OSHA requirements

C. Dig trenches straight, true to line and grade with sides and bottoms smoothed of any rock points

1 Excavate 6 inches below grade of pipe
2 Fill with sand properly packed
3 Support pipe for entire length on packed sand
4 Shape or pack bottom of trenches for pipe, duct fittings, hubs, couplings, etc., using templates to fit outside periphery of lower third of piping and ductwork
5 Provide piping outside building with 36-inch minimum cover from top of pipe to finished grade
6 Minimum width 16 inches

D. Dispose of all surplus excavation material and seepage water as directed by the Architect

E. Backfill

1 After piping has been installed, tested and approved, backfill all excavation, tamp and compact by compressed air tampers
2 Backfill to 6-inches above crown of pipe with unwashed sand, with remainder of trench back-filled and mechanically tamped in 6-inch maximum layers of selected excavated materials, free from organic matter, rocks, etc. Provide 90-percent compaction in accordance with ASTM D 1557-58T; 95-percent compaction for trenches below building slabs.

F. In any asphalt or concrete paved areas, backfill only to subgrade level

G. When piping is installed, prior to backfilling, advise Architect; do not backfill without acceptances of Architect

H. Replace to original condition all paving, curbs, gutters, walks, etc., which become disturbed by trenching

3.9 OPERATION AND MAINTENANCE MANUALS

A. These operation and maintenance manual requirements supplement operation and maintenance manual documentation requirements of other Sections of these specifications.

B. Operation and maintenance documentation, in hardback 3-ring loose-leaf binders except full size drawings and CDs, shall cover the HVAC and building automation systems. Documentation shall include an operations and maintenance documentation directory, emergency information, operating manual, maintenance manual, test reports, and construction documents.

C. Initial Submittal: The operation and maintenance documentation package shall be submitted as one comprehensive package to the Owner 1 month before systems start-up, and shall be updated, revised and completed at completion of construction.

D. Final Submittal: Provide four (4) complete manuals.

1. Correct or modify each manual to comply with Architect's comments. Submit Final manuals shall be submitted 15 working days prior to demonstration and training of Owner's personnel. Manuals are to be used in training sessions by Owner's personnel.

E. Compile and coordinate the documentation for equipment and systems installed. 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. Documentation shall be typewritten and shall contain, at a minimum, the following information.

1. Introduction:
   a. Project name, contractors' and subcontractors' names, addresses, telephone numbers, email addresses and facsimile numbers. Indicate the portion of the work for which each subcontractor was responsible.
   b. List of Documents
   c. List of systems
   d. List of equipment
   e. Table of Contents.

2. Operations and Maintenance Documentation Directory:
   a. Explanation of the identification system used, including lists of systems, equipment, and component identifiers and names. Use the same system, subsystem and equipment designation as used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."
3. Manual Organization: Unless otherwise indicated, organize each manual and 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:
   a. Title page
   b. Table of contents
   c. Manual contents
4. Manual Title Page: Enclose title page in transparent plastic sleeve. Include the following information:
   a. Project name, contractors' and subcontractors' names, addresses, telephone numbers, email addresses and facsimile numbers. Indicate the portion of the work for which each subcontractor was responsible.
   b. Subject matter included in manual
   c. Name and address of Project
   d. Name and address of Owner
   e. Date of submittal
   f. Name, address, telephone number, fax number and email address of Contractor
   g. Name and address of Architect and other Architects
   h. Cross-reference to related systems in other operation and maintenance manuals.
5. Manual 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.
   a. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table for all volumes in each volume of the set.
6. 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.
   a. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2 x 11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
      1) If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
      2) Identify each binder on front and spine, with printed title "OPERATION AND MAINTNANCE MANUAL," Project title or name, project number and subject matter contents. Indicate volume number for multiple-volume sets and six-digit Section number on bottom of spine.

b. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the system on each divider, cross-referenced to Specification Section number and title of Project Manual.
c. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
d. Supplementary Text: Prepared on 8-1/2 x 11-inch, 20-lb/sq.ft. white bond paper.
e. Drawings: Attached reinforced, punched binder tabs on drawings and bind with text.
    1) If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
    2) If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual or reduced drawings. DO NOT USE BINDER POCKETS. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents and drawing locations.
f. Provide color photographs instead of drawings where necessary to demonstrate unusual or complex installations.

3.10 MAINTENANCE

A. Equipment operated prior to the date of substantial completion shall be maintained in accordance with manufacturer's recommendations.

B. Prepare and submit a lubrication chart listing for each piece of equipment:

1. Points requiring lubrication.
2. Recommendations for a single manufacturer's lubricants with brand name and designation.
3. Frequency of lubrication required.

C. Lubricate each item of apparatus requiring lubrication prior to start-up in accordance with the manufacturer's recommendations.

3.11 DEMONSTRATION AND TRAINING FOR MECHANCIAL SYSTEMS AND EQUIPMENT

A. Submittals

1. Instruction Program: Submit to the Architect copies of instructional program outline for demonstration and training, including a schedule of proposed dates, times, length of instruction and instructors' names for each training module. Include learning objective and outline for each training.
    a. At completion of training, submit two (2) complete training manuals for Owner's use.
2. Qualification Data: Include lists of completed projects with project names and addresses, names and addresses of Architects and Owner and other information specified.
3. Attendance Record: For each training module, submit list of participants and length of instruction time.
4. Evaluations: For each participant and each training module, submit results and documentation of performance-based test.

5. Demonstration and Training DVD's: Submit two copies of each DVD within seven (7) days of recording.
   a. Format: Provide high quality color DVDs
   b. Identification: On each DVD, provide an applied label with the following information:
      1) Name of project
      2) Name and address of photographer
      3) Name of Engineer
      4) Name of Contractor
      5) Date DVD was recorded
      6) Description of vantage point, indicating location, direction (by compass point) and elevation or construction story
   c. Transcript: Prepared on 8-1/2 x 11" (A4) paper, punched and bound in heavy-duty, 3-ring, vinyl-covered binders. Mark appropriate identification on front and spine of each binder. Include a cover sheet with the same label information as the corresponding DVD. Include name of Project and date of DVD on each page.

B. Quality Assurance

1. Instructor Qualifications: A factory-authorized service representative experienced in operation and maintenance procedures and training.
2. Photographer Qualifications: An individual of established reputation who has been regularly engaged as a professional video photographer for not less than five years.
3. Pre-instruction Conference: Review methods and procedures related to demonstration and training including, but not limited to the following:
   a. Inspect and discuss locations and other facilities required for instruction.
   b. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment and facilities needed to avoid delays.
   c. Review required content of instruction.
   d. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

C. Coordination

1. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations.
2. Coordinate instructors, including providing notification of dates, times, length of instruction and course content.
3. 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.

D. Instruction Program

1. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections and as follows:
   a. Gas-fired heating equipment.
   b. Refrigeration system including VRF and split systems.
   c. HVAC system including air-handling equipment, unit heaters, power ventilators, heat exchangers, piping specialties, etc.
   d. VRF control system

e. Programmable thermostats
f. All control end-devices and sensors

2. Training Modules (Basis of System Design, Operational Requirements and Criteria): Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participants are expected to master. For each module, include instruction for the following (this will be provided through the Architect):
   a. System, subsystem and equipment descriptions
   b. Performance and design criteria
   c. Operating standards
   d. Regulatory requirements
   e. Equipment function
   f. Operating characteristics
   g. Limiting conditions
   h. Performance curves
3. Training Modules (Documentation): Review the following items in detail:
   a. Operations manuals
   b. Maintenance manuals
   c. Project record documents
   d. Warranties and bonds
   e. Maintenance service agreements and similar continuing commitments
4. Adjustments: Include the following:
   a. Alignments
   b. Checking adjustments
   c. Noise and vibration adjustments
   d. Economy and efficiency adjustments

E. Instruction

1. Facilitator: The Architect will serve as facilitator to assist the Contractor in preparation of instruction program and training modules, to coordinate instructors and to coordinate between Contractor and Owner for number of participants, instruction times and location.
2. Engage qualified instructors to instruct Owner's personnel to adjust, operate and maintain systems, subsystems and equipment not part of a system.
   a. Architect will furnish an instructor to describe basis of system design, operational requirements, criteria and regulatory requirements.
   b. Owner will furnish an instructor to describe Owner's operational philosophy.
   c. Owner will furnish Contractor with names and positions of participants.
3. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
   a. Schedule training with Owner, through Architect, with at least forty-five (45) days advance notice.
4. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a written performance-based test.
5. Demonstration and Training DVD: Record each training module separately. Include classroom instructions and demonstrations, board diagrams and other visual aids, but not student practice.
   a. At beginning of each training module, record each chart containing learning objective and lesson outline.
6. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

F. Demonstration and Training DVDs

1. Demonstration and Training DVDs: Record instruction of Owner's personnel in the operation and maintenance of equipment and systems. Edit DVDs to remove non-instructional conversation. Photographer shall select vantage points to best show equipment, systems and procedures demonstrated.

END OF SECTION

SECTION 23 05 00 BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. These mechanical provisions specified herein apply to all Sections of Division 22 and Division 23.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 23.

1.02 SUMMARY

A. This Section includes the following basic mechanical materials and methods to complement other Division 23.

1. Temporary operation of mechanical equipment
2. Piping materials and installation instructions common to most piping systems
3. Concrete base construction requirements
4. Sleeves
5. Escutcheons
6. Mechanical sleeve seals
7. Wall and ceiling access panels
8. Nonshrink grout for equipment installations
9. Field-fabricated metal equipment supports
10. Installation requirements common to equipment specification sections

B. Pipe and pipe fitting materials are specified in Division 23 piping system Sections.

1.03 DEFINITIONS

A. Refer to Section 23 00 10 – Mechanical General Provisions

1.04 SUBMITTALS

A. Product Data: For dielectric fittings, flexible connectors, mechanical sleeve seals, escutcheons and access panels.

1.05 QUALITY ASSURANCE

A. Equipment Selection: Equipment of higher electrical characteristics, physical dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. Additional costs shall be paid by this Contractor for these increases. If minimum energy ratings or efficiencies of equipment are specified, equipment must meet design and commissioning requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and prevent entrance of dirt, debris, and moisture.

B. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, if stored inside.

C. Protect flanges, fittings, and piping specialties from moisture and dirt. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.07 SEQUENCING AND SCHEDULING

A. Coordinate mechanical equipment installation with other building components.

B. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.

C. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components, as they are constructed.

D. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning before closing in building.

E. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.

F. Coordinate requirements for access panels and doors if mechanical items requiring access are concealed behind finished surfaces.

G. Coordinate installation of identifying devices after completing covering and painting, if devices are applied to surfaces. Install identifying devices before installing acoustical ceilings and similar concealment.

1.08 TEMPORARY OPERATION OF MECHANICAL EQUIPMENT

A. The Contractor shall notify the Professional in writing fourteen (14) days in advance to request temporary operation of the building HVAC systems.

B. The Professional will schedule a site-visit to observe the site conditions to ensure all the items described below have been met prior to temporary operation.

C. The Contractor shall submit in writing an operation and maintenance plan for temporary use of the building HVAC systems. At a minimum the O&M plan shall address:

1. Equipment, system, and filter maintenance
2. Temporary filter installation locations
3. Daily, weekly, monthly, etc. cleaning procedures to ensure indoor cleanliness.
4. Describe in detail how the system will be controlled and indoor conditions monitored. Procedures for shutting down equipment or isolation of areas where dust, dirt, or

D. At a minimum the following building components and activities shall be completed prior to operation of the building HVAC systems

1. Dust or particulate generating construction activities completed.
2. All dirt, dust, and debris have been removed from the Mechanical Room.

3. Piping insulation is fully completed and all seams, openings, etc. have been sealed.
4. All HVAC system equipment utilized for temporary heating and cooling shall have been started up per specifications. All startup and warranty information (including checklists) shall be completed and submitted to the Professional.
5. All temporary air filters in place of types and installed in locations specified in 23 40 00 Air Cleaning Devices. All return air distribution devices and openings shall be covered and protected with filter material specified in 23 40 00 Air Cleaning Devices. All temporary filters shall be continually monitored and replaced periodically when required.

E. Upon completion of the Professional's site visit, review of site conditions and temporary operation plan, the Professional reserves the right to refuse temporary startup and operation if site conditions and plan do not meet specifications. No additional time will be given to the Contractor due to unapproved startup and temporary operation conditions.

F. The building indoor environmental conditions shall be continuously maintained within the following limits:

1. Maximum indoor temperature: 85 Deg. F dry bulb
2. Minimum indoor temperature: 60 Deg. F dry bulb
3. Maximum indoor relative humidity: 80 percent RH

G. Temperature and humidity dataloggers shall be installed throughout the facility to record indoor condition data. Datalogger quantity and locations shall be approved by Professional. Data from dataloggers shall be submitted to the Professional every two weeks for review. Data shall be submitted in .csv format or other format agreed upon by Professional.

H. Contractor shall have either spedified or temporary controls in place and fully operational to maintain the specified indoor environmental conditions above. Contractor shall provide all required temporary building services for temporary operation at no additional cost to the Using Agency.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Mechanical Sleeve Seals:
   a. Calpico, Inc.
   b. Metraflex Co.
   c. Thunderline/Link-Seal
2. Access Panels:
   a. Williams Brothers
   b. Acudor
   c. J.R. Smith

2.02 PIPE AND PIPE FITTINGS

A. Refer to individual Division 23 piping Sections for pipe and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.03 JOINING MATERIALS

A. Refer to individual Division 23 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness, unless thickness or specific material is indicated.
   a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
   b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

E. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

F. Solder Filler Metals: ASTM B 32.

1. Alloy Sn95 or Alloy Sn94: Approximately 95 percent tin and 5 percent silver, with 0.10 percent lead content.
2. Alloy E: Approximately 95 percent tin and 5 percent copper, with 0.10 percent maximum lead content.
3. Alloy HA: Tin-antimony-silver-copper zinc, with 0.10 percent maximum lead content.
4. Alloy HB: Tin-antimony-silver-copper nickel, with 0.10 percent maximum lead content.

G. Brazing Filler Metals: AWS A5.8.

1. BCuP Series: Copper-phosphorus alloys.
2. BAg1: Silver alloy.

H. Solvent Cements: PVC Piping; ASTM D 2564. Include primer according to ASTM F 656.

I. Plastic Pipe Seals: ASTM F 477, elastomeric gasket

J. Couplings: Iron-body sleeve assembly, fabricated to match OD of plain-end, pressure pipes.

1. Sleeve: ASTM A 126, Class B, gray iron.
2. Followers: ASTM A 47 (ASTM A 47M) malleable iron or ASTM A 536 ductile iron.
3. Gaskets: Rubber.
4. Bolts and Nuts: AWWA C111.
5. Finish: Enamel paint.

2.06 MECHANICAL SLEEVE SEALS

A. Description: Modular design, with interlocking rubber links shaped to continuously fill annular space between pipe and sleeve. Include connecting bolts and pressure plates.

1. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Stainless steel. Include two for each sealing element.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.07 PIPING SPECIALTIES

A. Sleeves: Sleeves shall be standard weight steel pipe except sleeves for concealed piping through floors not in structural members, and through interior drywall construction may be formed from 24 gauge galvanized sheet metal lapped and pop riveted.

1. Sleeves through grade slabs, basement or exterior wall shall be steel or cast iron pipe with water stop flange, set flush with finished surfaces and an expansion seal (see Mechanical Sleeve Seal herein.)
2. Sleeves in wet or potentially wet floors, exterior walls or spaces such as mechanical equipment rooms or sprinklered areas other than those requiring fire stopping, shall be Schedule 40 galvanized steel pipe with water stop flange and with the top of the sleeve projecting 2-inches above the finished floor or beyond the inside wall surface and expansion seal installed.

B. Escutcheons: Manufactured wall, ceiling, and floor plates; deep-pattern type if required to conceal protruding fittings and sleeves.

1. ID: Closely fit around pipe, tube, and insulation of insulated piping
2. Completely cover opening
3. Cast Brass: One piece, with set screw.
   a. Finish: Polished chrome-plate.
4. Cast Brass: Split casting, with concealed hinge and set screw.
   a. Finish: Polished chrome-plate.
5. Cast-Iron Floor Plate: One-piece casting.

2.08 GROUT

A. Nonshrink, Nonmetallic Grout: ASTM C 1107, Grade B

1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psig, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

2.09 ACCESS PANELS

A. Access panels shall be provided for all concealed valves, controls, dampers, and other mechanical equipment and devices where occasional access for adjustment or repairs will be necessary. Panels shall have cam and cylinder lock with two keys. All locks shall be keyed alike. Label panels as in accordance with Section 23 05 53 – Mechanical System Identification.

B. Size of panels to be large enough to permit servicing or replacement of devices, controls, valves, etc.; minimum size to be 18"x18". Submit schedule with submittal package indicating location and size.

C. General:

1. Fabricate units of all welded steel construction.
2. The frame and panel assembly for fire rated access panels shall be manufactured under the Factory Inspection Service of Underwriters Laboratories, Inc., and shall bear a label reading: "Frame and Fire Door Assembly, Rating 1-1/2 Hr. (B), Temperature Rise 30 Minutes, 250ºF, Maximum".
3. Access panels used in toilets, kitchens, and other areas expected to experience high relative humidity are to be constructed of stainless steel.

D. Flush Panel Access Panels: Model WB-GP.

1. Frame and door shall be of one piece unit body construction and 14 gauge steel. Body shall be 18 gauge steel with a return edge around door opening.
2. Flange shall be 1-3/4” wide.
3. Hinges shall be concealed, piano type, opening to 175 degrees. Number of hinges will vary with size of door.
4. Locks shall be flush, key operated cylinder lock. Number of locks will vary with size of door.
5. Finishes shall be factory applied with a rust inhibiting phosphated undercoat; finish to be chemically bonded oven baked white enamel.
6. For installation in masonry openings, units shall be furnished with flexible metal anchor straps welded to the body.

E. Flush Access Panel for Drywall or Plaster: Model WB-DW and WB-PL:

1. Body and flange shall be 16 gauge steel. Door shall be 14 gauge steel.
2. Hinges shall be concealed, piano type, opening to 175 degrees. Number of hinges will vary with size of door.
3. Locks shall be flush, key operated cylinder lock. Number of locks will vary with size of door.
4. Finish shall be factory applied oven baked grey enamel with rust inhibiting phosphated undercoat.

5. Plaster models shall have 2-1/2” of 24 gauge galvanized expanded wing casting surrounding door.
6. Drywall models shall have a 1-1/8” perforated drywall bead on all four sides.

F. Fire Rated “B” Label Access Panel: Model WB-FR

1. Frame and door shall be of one piece unit body construction and 14 gage steel. Door shall be sandwich type filled with 2 inches thick thermafiber felt insulation and back enclosure of 22 gage steel. Body shall be 16 gage steel.
2. Flange shall be 1-3/4 inches wide.
3. Hinge shall be continuous steel piano type mounted on long side of doors, opening to 180 degrees and equipped with a spring mechanism for automatic closure.
4. Lock assembly shall be self-latching with key operated cylinder lock and shall have a mechanism to release the latch bolt from the inside.
5. Finish shall be factory applied oven baked grey enamel with rust inhibiting phosphated undercoat.
6. For installation in masonry openings, units may be furnished with flexible metal anchor straps welded to the body.

PART 3 - EXECUTION

3.01 PIPING SYSTEMS - COMMON REQUIREMENTS

A. General: Install piping as described below, unless piping Sections specify otherwise. Individual Division 23 piping Sections specify unique piping installation requirements.

B. General Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated, unless deviations to layout are approved on Coordination Drawings.

C. Install piping at indicated slope.

D. Install components with pressure rating equal to or greater than system operating pressure.

E. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.

F. Install piping free of sags and bends.

G. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.

H. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.

I. Install piping to allow application of insulation plus 1-inch clearance around insulation.

J. Locate groups of pipes parallel to each other, spaced to permit valve servicing.

K. Install fittings for changes in direction and branch connections.

L. Install couplings according to manufacturer's written instructions.

M. Verify final equipment locations for roughing-in.

N. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

O. Install sleeves for pipes passing through concrete and masonry walls, and concrete floor and roof decks.

1. Cut sleeves to length for mounting flush with both surfaces.
   a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
2. Build sleeves into new walls and slabs as work progresses.
3. Install sleeves large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
   a. Steel Pipe Sleeves: For pipes smaller than 6". Steel, Sheet-Metal Sleeves: For pipes 6 inches and larger, penetrating gypsum-board partitions.
4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants. Refer to Division 7 Section "Sealants" for materials.
5. Use Type S, Grade NS, Class 25, Use O, neutral-curing silicone sealant, unless otherwise indicated.

P. Aboveground, Exterior-Wall, Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches in diameter and larger.
3. Assemble and install mechanical sleeve seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.

Q. Verify final equipment locations for roughing-in.

R. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

S. Install pipe escutcheons for pipe penetrations of concrete and masonry walls, wall board partitions, and suspended ceilings according to the following:

1. Uninsulated Piping Wall Escutcheons: Cast brass, chrome plated, with set screw.
2. Uninsulated Piping Floor Plates in Utility Areas: Cast-iron floor plates.
3. Insulated Piping: Cast brass; with concealed hinge, spring clips, and chrome-plated finish.
4. Piping in Utility Areas: Cast brass, with set-screw or spring clips.

T. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping specification Sections:

1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
3. Soldered Joints: Construct joints according to AWS's "Soldering Manual," Chapter "The Soldering of Pipe and Tube."
   Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
4. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   a. Note internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
   b. Apply appropriate tape or thread compound to external pipe threads, unless dry seal threading is specified.
   c. Align threads at point of assembly.
   d. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
   e. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
5. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.
6. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join pipe and fittings according to the following:
   a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
   b. PVC Nonpressure Piping: ASTM D2855.

U. Piping Connections: Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping 2-inch and smaller, adjacent to each valve and at final connection to each piece of equipment with 2-inch or smaller threaded pipe connection.
2. Install flanges, in piping 2-1/2-inch and larger, adjacent to flanged valves and at final connection to each piece of equipment with flanged pipe connection.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling, unions, and nipple fittings to connect piping materials of dissimilar metals.

3.02 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to provide maximum possible headroom, if mounting heights are not indicated.

B. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to Professional.

C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

D. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

E. Install equipment giving right of way to piping installed at required slope.

F. Install flexible connectors on equipment side of shutoff valves, horizontally and parallel to equipment shafts if possible.

3.03 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer’s written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit. Edges to be chamfered.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement.

3.04 ERECTION OF METAL SUPPORTS AND ANCHORAGE

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

B. Field Welding: Comply with AWS D1.1, "Structural Welding Code--Steel."

3.06 GROUTING

A. Install nonmetallic, nonshrink, grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's written instructions.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placing of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases to provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout according to manufacturer's written instructions.

END OF SECTION

SECTION 23 05 13 MOTORS AND CONTROLLERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. These heating, ventilating and air conditioning (HVAC) provisions specified herein apply to all Sections of Division 23.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 23.

1.02 SUMMARY

A. Work included in this section: materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Motors
2. Motor controllers where provided as part of mechanical equipment

B. Related Sections

1. Section 23 00 10 – Mechanical General Provisions
2. Section 23 00 50 – Basic Mechanical Materials and Methods

1.03 REFERENCE STANDARDS

A. ABMA 9 – Load Ratings and Fatigue Life for Ball Bearings

B. ABMA 11 – Load Ratings and Fatigue Life for Roller Bearings

C. ANSI/IEEE 112 – Test Procedure for Polyphase Induction Motors and Generators

D. ANSI/NEMA MG 1 – Motors and Generators

E. ANSI/NFPA 70 – National Electrical Code

F. Underwriters laboratories – UL508C

1.04 DEFINITIONS

A. ECM: Electrically Commutated Motor

1.05 SUBMITTALS

A. See Section 23 00 10 – Mechanical General Provisions

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. “R” means required.
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Motors	R	R		R
Belts and Drives		R		
Variable Speed Drives	R	R		R
Motor Controllers/Starters	R	R		R

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Motors

1. General Electric
2. Lincoln Electric Co.
3. Baldor

B. Motor controllers/starters

1. Cerus
2. GE
3. Square D

2.2 MOTORS

A. General

1. In accordance with NEMA, IEEE, and ANSI C50 standards
2. Capacity
   a. Minimum horsepower indicated
   b. To operate driven devices under all conditions without overload
3. Squirrel-cage induction type, NEMA Type "B: insulation class, continuous duty
4. Speed
   a. 1750 RPM, unless otherwise indicated
   b. See schedules on drawings for other speeds
5. NEMA KVA locked rotor CODE LETTER: "G" or better
6. Service factor: 1.15
7. Type unless otherwise scheduled on Drawings
   a. Voltage: As scheduled on Drawings. Contractor shall verify actual site voltage prior to procurement.
   b. 1/2 horsepower and smaller
      (1) Single-phase phase, 60 hertz
      (2) With built-in auto-reset thermal overload protection

   c. 3/4 horsepower and larger
      (1) Three-phase, 60 hertz
      (2) Motors 50 horsepower and over: Reduced voltage start, suitable for star-delta starting or as scheduled on Drawings
   d. Electrically Commutated Motor (ECM)
      (1) Where scheduled on Drawings or equipment Specifications
      (2) Equal to GE ECM version 2.2 or greater
      (3) Programmed with fan curve for “constant airflow”

8. Bearings, unless otherwise scheduled on Drawings or equipment Specifications
    a. Provide motors with double shielded, grease lubricated, ball bearings, with grease pockets on each side for regreasing in service. Provide inlet and outlet grease connections in motor housings for each bearing. Provide factory sealed permanently lubricated ball bearings on roof mounted equipment. Similar bearing may be provided on fractional horsepower motors. Provide sleeve bearings where so specified.
    b. Ball type, unless otherwise noted
    c. Sealed, permanently lubricated, unless otherwise noted or not available in motor size

B. Enclosure

1. Open drip-proof (ODP)
    a. Provide ODP motors unless otherwise indicated
2. Totally enclosed (TEFC)
    a. Motors outside the building or otherwise exposed to the weather
    b. Non-ventilated: under 1/2 horsepower
    c. Fan-cooled: 1/2 horsepower and larger
3. See schedules on drawings for other enclosures

C. Belt-connected motors

1. Foundation slide base
2. Shaft as required for aligning pulleys

D. Motors 1 horsepower and larger shall be NEMA Premium labeled and have guaranteed efficiencies equal to or exceeding NEMA Table 12-6D.

E. Multi-speed motors

1. Two speed motors shall be single winding 1800/900 rpm unless otherwise specified or indicated
2. Provide 1800/1200 rpm multi-speed motors of separate winding, variable torque type, unless otherwise specified or indicated.

F. Motors driven by variable frequency drives

1. Shall meet the requirements of NEMA MG-1 part 31.40.4.2
2. Where used for pumps or fans shall be capable of operating at 10 percent speed indefinitely

G. Electrically Commutated Motors (ECMs)

1. Brushless DC type with electronic commutation from 115 volt or 277 volt single phase power to a DC signal
2. Speed controllable from a minimum of 20% or less to 100% of full speed
3. Minimum 80% efficiency at all speeds
4. Provide one of the following as indicated on Drawings or Specifications
    a. Where scheduled only: Potentiometer dial mounted on the exterior of the motor housing
    b. Unless otherwise noted: 0-10 VDC control signal input and 0-10 VDC speed feedback output with pre-wired contacts. Motor shall shut off when speed signal is below minimum.

2.3 MOTOR CONTROLLERS/STARTERS

A. General:

1. Manual reset, Class 20, thermal type overload protection for each phase, in accordance with NEMA ICS 2-2000 (R2005).
2. NEMA 3R enclosures for exterior application.
3. Equipment furnished with factory-installed starters shall also be equipped with individual motor disconnect and thermal magnetic circuit breakers or fuses as specified herein with lugs sized to receive a feeder as indicated on the Electrical Drawings.
4. 120 V secondary control power transformer with fused primary and secondary circuit in the enclosure.
5. Unused auxiliary contacts (installed on each contactor): 1 normally open, and 1 normally closed.

B. Motor starters shall be provided with provisions for interfacing with the Energy Management and Control System (EMCS) or other control and interlocking requirements.

1. For all magnetic starters, a minimum of one set of field reversible auxiliary contacts shall be provided with the starter.

C. For 3-phase motors, unless otherwise specified herein:

1. Combination magnetic type and thermal magnetic circuit breaker with:
   a. Circuit breakers having minimum AIC rating as specified in Division 26.
   b. External operating handle capable of being locked in the off or open position.
   c. Hand-off-automatic switch, except those manually controlled.
   d. Starters for motors 50 hp and larger shall be solid-state, reduced-voltage type.

D. For 1-phase, unless otherwise specified herein:

1. Manual starting switch with thermal overload protection and pilot light.
2. Magnetic across-the-line starters with overload protection and Hand-Off-Automatic switch, except for manually controlled equipment.

E. Provide control transformers for equipment with voltage above 240 volts, or as required for complete, operable systems.

F. Coordinate with DIVISION 26: ELECTRICAL

G. Refer to individual equipment sections for factory-provided controllers

1. Installed on equipment by manufacturer
2. Supplied with equipment by manufacturer for field installation

PART 3 - EXECUTION

3.1 INSTALLATION

A. See Section 23 05 48– Mechanical Sound and Vibration Control

B. Coordinate with work of other trades

C. Install in accordance with manufacturer’s written installation instructions

D. Drives for packaged equipment shall be mounted and wired by equipment manufacturer

E. Mounting and power wiring of field mounted motor controllers is specified under Division 26 Electrical:

1. Where wall space is not available for mounting motor controllers, provide mounting struts securely mounted to the floor, roof, or adjacent structure

F. Set overload devices to suit motors provided in accordance with NEC

3.2 INSPECTION

A. Verify that adequate clearance between motor, controllers and adjacent walls or equipment is available to permit maintenance and repairs.

B. Check that motor and controller are properly supported and allows for proper alignment and tension adjustments as necessary for application.

3.3 PRE-OPERATING CHECKS

A. Before operating motors and controllers

1. Check for proper and sufficient lubrication
2. Check for correct rotation
3. Confirm alignment and re-align if required
4. Check for proper adjustment of vibration isolation.

3.4 STARTUP, TESTING, AND ADJUSTING

A. Start and test motors and controllers in accordance with manufacturers written installation instructions.

B. After starting motors

1. Check for high bearing temperatures
2. Check for motor overload by taking ampere reading at maximum operating conditions, with all valves open and individual motor running
3. Check for objectionable noise or vibration; correct as needed at no additional cost to the Using Agency

C. Motor Controllers/Starters

1. Provide starters, push buttons, thermal overload switches, and contactors for equipment covered in Division 23 unless otherwise specified herein. Installation of starters, push buttons, and thermal overload switches, not factory installed, is specified under Division 23.
2. Provide 120 V secondary control power transformers for control circuits where equipment is served at 208 V or higher.

D. See Section 23 05 93– Testing, Adjusting, and Balancing

3.5 TRAINING

A. See Section 23 00 10 – Mechanical General Provisions

END OF SECTION

SECTION 23 05 16 PIPING SPECIALTIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. These heating, ventilating and air conditioning (HVAC) provisions specified herein apply to all Sections of Division 23.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 23.

1.02 SUMMARY

A. Section Includes: Materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Thermometers
2. Pressure gauges
3. Test plugs

B. Related Sections

1. Section 23 00 10 – Mechanical General Provisions
2. Section 23 05 00 – Basic Mechanical Materials and Methods

1.03 SUBMITTALS

A. See Section 23 00 10 – Mechanical General Provisions

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. “R” means required.
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Thermometers	R	R		
Pressure gages	R	R		
Test plugs	R			

PART 2 - PRODUCTS

MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Thermometers

1. Weksler
2. Ashcroft
3. Trevice

E. Pressure gauges

1. Weksler
2. Dresser Industries, Ashcroft
3. Weiss Instruments, Inc.

F. Pressure-temperature test plugs

1. Peterson Engineering Company
2. Taco, Inc.
3. Or equal

2.02 THERMOMETERS

A. Digital, self-powered

1. Display: Minimum 3/8 inch LCD digits, swivel mount for 360 Deg. viewing adjustment
2. Range: 0 to 300 Deg. F
3. Sensor: Glass passivated thermistor
4. Accuracy: 1 percent of reading or 1 Deg. F, whichever is greater
5. Resolution: 0.1 Deg. F between 0 and 200 Deg. F
6. Recalibration: Internal potentiometer
7. Lux Rating: 10 Lux (one foot-candle)
8. Waterproof cover for outdoor installations
9. Ambient Operating Range:
   a. Temperature: -30/140 Deg. F
   b. Humidity: 0 percent RH to non-condensing
10. Power: Self-powered via integral photovoltaic cells
11. Weiss DVU or equal

B. Stem Length for Nominal Pipe Sizes

1. Below 4 inch: 3-1/2 inch stem, elbow mounted
2. 4-8 inch: 3-1/2 inch stem
3. 10-14 inch: 6 inch stem

2.03 PRESSURE GAUGES

A. Pipe or equipment mounted type

1. Diameter: 4 1/2 inch, except as noted
2. Case: black finished cast aluminum with flangeless back
3. Threaded black cast aluminum ring with gasketed glass face
4. Type 316 stainless steel spring tube
5. Stainless steel precision movement: Micrometer adjustment on needle
6. Accuracy: 0.5 of 1 percent full scale range
7. With calibration adjustment
8. Quarter turn stop cock: Materials compatible with service

9. Pressure snubbers
    a. Filter type
    b. For liquid, air and gas
10. Weksler Type AA44 or equal

B. Pressure gauge ranges in pounds per square inch gage

1. Chilled water pump: 0-200
2. Heating water pump: 0-160
3. Condensate pump set: 0-60
4. Diesel oil pump: 0-160
5. Emergency generator jacket water pump: 0-50
6. City water connection, connection to equipment: 0-100
7. Pressure gauges indicated on drawings or in specifications not indicated above to be submitted with appropriate range for review

2.04 PRESSURE/TEMPERATURE TEST PLUG

A. Solid brass with valve core

B. Valve core: Nordel

C. Fitted with a color coded and marked cap with gasket

D. Suitable for 500 pounds per square inch gage and 275ºF for water systems

E. Pete's Plug: No. 110/100XL with yellow cap or equal

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install items in accordance with manufacturer's instructions.

3.02 INSTRUMENTATION

A. Install sensors and sensor wells to piping using thread o-lets welded or soldered to pipe, or other approved means. For piping smaller than 1.5 times well depth, wells shall be installed in the end of an elbow, or tee used in place of an elbow, to minimize obstruction

3.03 THERMOMETERS

A. Install thermometers for easy readability (height, distance, view angle) from floor, except thermometers at ceiling coils: Use remote mounted dial thermometers when mercury or spirit thermometers are not easily readable due to distance or position in piping.

B. Locate where shown on drawings.

3.04 PRESSURE GAUGES

A. Provide gauges where shown on drawings.

B. Install gauges on non-vibrating backing.

C. Provide instrument cocks for isolation and removal of gauge at each pressure connection point.

D. Install gauges for easy readability (height, distance, view angle) from floor, except gauges at ceiling coils

E. At pumps, install a single pressure gauge only piped to pump taps at the inlet and outlet of pump. Using two gauges or connecting to piping rather than pump taps is not acceptable.

3.05 PRESSURE-TEMPERATURE TEST PLUGS

A. Provide pressure/temperature test plugs where shown on drawings.

B. Install at all equipment, coil and heat exchanger connections. Install at each VAV terminal unit.

C. Also locate at all temperature/pressure wells for calibration, see Section 23 09 00 – Energy Management & Control Systems

3.06 INSPECTION

A. Verify that adequate clearance between piping specialties and adjacent walls or equipment is available to permit maintenance and repairs.

3.07 TESTING AND ADJUSTING

A. Test thermometers, pressure gauges and water meters for accurate indication with known calibrated master; calibrate or replace if not within 5 percent of reading.

B. Test air vent points to insure all air has been vented.

C. Test other piping specialties for proper operation.

END OF SECTION

SECTION 23 05 23 VALVES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. These heating, ventilating and air conditioning (HVAC) provisions specified herein apply to all Sections of Division 23.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 23.

1.02 SUMMARY

A. Work Included in This Section: Materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Service valves in plumbing systems (other than gas and fire sprinkler)
2. Balancing valves
3. Check valves
4. Safety and relief valves
5. Vent and gas cocks

B. Related Sections

1. Section 23 00 10 – Mechanical General Provisions
2. Section 23 05 00 – Basic Mechanical Materials and Methods
3. Section 22 11 16 – Domestic Water Piping

1.03 QUALITY ASSURANCE

A. Provide valves with manufacturer's name and pressure rating clearly marked on outside of body.

1.04 VALVES

A. See Section 23 00 10 – Mechanical General Provisions

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. “R” means required.
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Valves, all types	R	R		R
Manual and automatic air vents	R	R		

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Gate, ball, globe, and check valves

1. Nibco Inc.
2. Crane Company
3. Grinnell

C. Gate valves – buried

1. Mueller Company
2. Clow Corporation
3. Fairbanks Valve Company

D. Balancing valves

1. ITT Bell and Gossett
2. Mueller Steam Specialty
3. Watts

E. Safety and relief valves

1. Consolidated
2. Kunkle Valve Company
3. J.E. Lonergan Company

F. Relief valves, water type

1. ITT Bell and Gossett
2. Cash-Acme
3. Watts Regulator Company

2.02 GENERAL

A. Where possible, provide valves of same manufacturer for all Mechanical Sections per products in this Section.

B. For copper tubing provide solder-joint valves, flare fittings, or IPS-to-copper adaptor, sized for use with tubing and respective valve.

C. For flanged valves, provide streamline companion flanges, ANSI B16.5, 1988 150 class pounds per square inch

1. 255 pounds per square inch water on gage (WOG) at 150 degree Fahrenheit
2. 225 pounds per square inch water on gage (WOG) at 250 degree Fahrenheit unless indicated otherwise

D. Provide valves rated not less than 125 pounds per square inch steam working pressure, unless indicated otherwise.

E. Provide valve materials suitable for service and temperature of respective systems, especially with respect to discs, plugs, balls, linings, gaskets, and lubricants of globe valves, plug cocks, ball valves, etc.

F. Provide chain-operated hand wheels, rustproof chain and chain guide for following valves

1. Valves 8 feet or more above operating floor or platform
2. As noted

2.03 GATE VALVES

A. General

1. 2 inches and smaller a. Bronze
    a. Class 125 (125 psi steam, 200 psi water)
    b. Solid wedge
    c. Union bonnet
    d. Inside screw
    e. Rising stem
    f. Equal to Nibco
        (1) Threaded: T-124
        (2) Soldered: S-134
2. 2-1/2 inches and Larger
    a. Iron body
    b. Bronze trim
    c. Class 125 (125 psi steam, 200 psi water)
    d. Solid wedge
    e. Outside screw and yolk (OS&Y)
    f. Flanged
    g. Equal to Nibco:
        (1) 125 pounds per square inch: F617-0
        (2) 250 pounds per square inch: F-667-0

B. Gate Valves Hose

1. Cast Bronze
2. 200 pounds per square inch water working pressure
3. Rising stem
4. Polished chrome plated
5. Satin chrome
6. Rough bronze
7. Polished bronze
8. NFPA approved
9. Cap chained to valve body
10. With escutcheon
11. Hose threads per requirements of Fire Authority having jurisdiction
12. Equal to Potter-Roemer
    a. 2-1/2 x 2-1/2 = 4315
    b. 2-1/2 x 3 = 4335

C. Gate Valves - Direct Buried

1. AWWA C500
2. Federal Specification WW-V-586, Type II, Class1
3. Cast iron

4. Pressure ratings: 2-12 inches - 200 pounds per square inch working, 400 pounds per square inch test; 14 inch and larger - 150 pounds per square inch working, 300 pounds per square inch test
5. Double disc, parallel seat
6. Non-rising stem
7. Joint ends to match piping
8. Equal to Clow Series F-5062 through F-5085

D. Valve Indicator Posts

1. U.L. listed
2. Two piece
3. Non-rising stem
4. Equal to Nibco NIP-1AJ

E. Lockshield Gate Valves: Same as gate valves, except key operated

2.04 BALL VALVES

A. 2 inches and smaller

1. Bronze
2. 316 SS trim
3. Two piece body
4. Standard port
5. 600 pounds per square inch water on gage (WOG) at 100 degree F, 125 pounds per square inch saturated steam
6. Equal to Nibco
   a. Threaded - T-580-70
   b. Soldered - S-580-70

B. 2-1/2 inches and larger: Not used

2.05 BALANCING VALVES

A. Calibrated Balancing Valves

1. Combination balancing and shut-off valves
2. Calibrated name plate and adjustable memory stop
3. Capped read-out valves
4. Pre-formed insulation
5. One differential pressure read-out meter for all valves in system
6. 2 inches and smaller
   a. Brass body
   b. Threaded or soldered ends
   c. Teflon seats
   d. 250 pounds per square inch at 250 degrees Fahrenheit
7. 2-1/2 inches and larger
   a. Ductile or cast iron body
   b. Flanged
   c. 175 pounds per square inch at 250 degrees Fahrenheit
8. Devices using venture type flow meter not acceptable (due to propensity for clogging and ease of putting valve with limited flow range in wrong direction)
9. Devices using Pitot tube or Annubar type flow meter not acceptable (due to propensity for clogging)

10. Devices using other than ball or butterfly valves shall not be used for coil isolation – a separate ball valve or butterfly valve shall be added for isolation (to ensure positive shut-off and to allow 90˚ open-close with memory stop).
11. Bell & Gossett type CB, or equal.

B. Combination shut-off, balancing, and check valve: Not allowed

2.06 CHECK VALVES

A. Check Valves, General Service

1. 2 inches and smaller

a. Swing check
b. Class 125 (125 psi steam, 200 psi water)
c. Regrinding bronze disc
d. Screw-in cap
e. Threaded body
f. Equal to Nibco
(1) Threaded - T-413-Y
(2) Soldered - S-413-Y

2. 2-1/2 inches and larger
a. Swing Check
b. Class 125 (125 psi steam, 200 psi water)
c. Regrinding bronze disc
d. Bolted cap
e. Flanged body
f. Equal to Nibco F-918-8

2.07 SAFETY AND RELIEF VALVES

A. Use “pressure relief valves” for unheated liquids

B. Use “safety relief valves” for heated liquids

C. ASME rated direct spring-loaded type

1. Lever operated
2. Non adjustable factory set discharge pressure

D. Constructed, rated and stamped in accordance with ASME

1. Relief valves: for unheated liquids
2. Safety relief valves: for heated liquids
3. Safety valves for gases and vapors: Including air and steam

E. Set pressures and ratings

1. Suitable and rated for system pressure and temperature: For safety relief valves, minimum temperature rating: saturated steam temperature corresponding to pressure 10 percent higher than valve set pressure
2. Set pressure as indicated on Drawings: Not to exceed pressure rating of protected equipment

F. Valves to open, under test, at set pressure with following tolerance

1. Set pressure up to 70 pounds per square inch gage: plus or minus 2 pounds per square inch
2. Set pressure, above 70 pounds per square inch gage: plus or minus 3 percent

G. Capacities

1. Valves shall have capacity to relieve maximum possible generated energy while maintaining pressure in protected equipment at no more than 10 percent above vessel working pressure.
2. Greater than make-up pressure reducing valve capacity
3. Equipment relief valve capacity to exceed rating of connected equipment
4. Provide multiple valves if required for capacity even though only one valve may be shown on Drawings

H. Maintain pressure in protected equipment at not more than following

1. Low pressure Boilers: 5 pounds per square inch above boiler working pressure
2. High pressure Boilers: 6 percent above boiler working pressure
3. Unfired Pressure Vessels: 10 percent above vessel working pressure

I. Provide multiple valves if required for capacity even though only one valve may be shown on Drawings: Factory manifold

J. Safety and Relief Valves: Similar to Consolidated

K. Relief Valves, Water: Equal to Watts

2.08 VENT COCKS

A. Bronze body, 1/4 inch size

B. Lever handle

C. 125 pounds per square inch steam working pressure

D. Equal to Weiss LC-14

PART 3 - EXECUTION

3.01 INSTALLATION

A. Coordinate with work of other trades

B. Install valves in accordance with manufacturer’s written installation instructions

C. Provide valves as shown on drawings, and provide shutoff valves around all equipment whether shown with valves on drawings or not.

D. Provide all valves (except control valves), strainers, and check valves of same size as the pipes in which they are installed unless otherwise indicated

E. Pressure rating of valves same as piping in which installed

F. Install valves with stems upright or horizontal, not inverted

G. Install valves with cast directional arrows in direction of flow

H. Support line valves at the valve in addition to regularly spaced pipe supports shown and specified

I. Check valves

1. Install swing checks and gravity closing lift checks in horizontal position.

J. Provide blow-down ball valves and hose adaptors at strainers, air separators, tanks, pipe traps, equipment drains, etc. of same size as strainer blow-off connection

K. Provide drain valves at main shut-off valves, low points of piping and apparatus

L. Provide extended valve stems to clear insulation on insulated valves.

M. Locate wheel handles to clear obstructions with hand

N. Install valves only in accessible locations

O. Wherever possible, install valves accessible from floor level. Provide guided chain operators on valves over 7 feet above floor in equipment areas. Extend chains to within 6 feet 6 inches of floor.

P. Locate equipment shut-off valves to be accessible without climbing over equipment

Q. Provide operating handles for all valves and cocks without integral operators, unless otherwise noted. Provide adequate clearance for easy operation

R. Provide discharge pipe to atmosphere from all relief and safety valves, sized with area equal to sum of outlet areas of all valves connected thereto, unless indicated larger. Extend to over code compliant drain receptacle with airgap.

S. Provide ball valves to isolate shock absorbers

T. Provide open-ended line valves with plugs or blind flanges

3.02 VALVE APPLICATIONS

A. Valves shall be limited to the applications listed below. Where this section disagrees with drawings, obtain clarification from Professional and provide as directed by the Professional at no additional cost to the Using Agency.

B. Gate Valves

1. Shut-off: water (use ball valves where possible, Professional shall approve use of gate valves aboveground)

C. Ball valves

1. Throttling and shut-off: water
2. Use in domestic water piping 2-1/2 inches and smaller interchangeably in place of gate, globe and angle valves

3.03 FIELD QUALITY CONTROL

A. Test valve bonnets for tightness. Test operate valves from closed-to-open-to-closed position while valve is under test pressure.

B. Test automatic valves including solenoid valves, expansion valves, water regulating valves, pressure reducing valves, pressure relief valves, safety valves and temperature and pressure relief valves for proper operation at settings indicated.

C. Insure that valves are field checked for packing and lubricant and that disc is for service intended. Replace leaking packing at no additional cost to the Using Agency. Service valves which do not operate smoothly and properly with suitable lubricant before placing in operation at no additional cost to the Using Agency.

3.04 INSPECTION & COMPLETION

A. Verify that adequate clearance between valves and adjacent walls or equipment is available to permit maintenance and repairs.

B. Verify valve set for normal operation.

C. Valves tags, see Section 23 05 53 – Mechanical Identification

D. See Section 23 05 93 – Testing, Adjusting and Balancing

END OF SECTION

SECTION 23 05 29 HANGERS AND SUPPORTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. These heating, ventilating and air conditioning (HVAC) provisions specified herein apply to all Sections of Division 23.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 23.

1.02 SUMMARY

A. Work included in this section: materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Pipe and duct hangers, supports and associated anchors
2. Thermal hanger shields for insulated piping

B. Related Sections include the following:

1. Section 23 00 10 – Mechanical General Provisions
2. Section 23 05 48 – Mechanical Sound and Vibration Control
3. Division 21 – Fire Protection Work
4. Division 22 – Plumbing Work

1.03 REFERENCE STANDARDS

A. American Society of Mechanical Engineers: ASME Section VIII – Boiler and Pressure Vessel Code – Pressure Vessels

B. Pipe Supports: ANSI B31.1, Power Piping

C. Duct Hangers: SMACNA Duct Manuals

1.04 DEFINITIONS

A. MSS: Manufacturers Standardization Society for the Valve and Fittings Industry.

B. Terminology: As defined in MSS SP-90, “Guidelines on Terminology for Pipe Hangers and Supports”.

1.05 PERFORMANCE REQUIREMENTS

A. Design channel support systems for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

B. Design heavy-duty steel trapezes for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

1.06 SUBMITTALS

A. See Section 23 00 10 – Mechanical General Provisions

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. "R" means required.
2. "R2" means required only for products and equipment differing for the specified manufacturer and model and for "or equals" where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Pipe hangers and supports	R			R
Structural attachments	R			R
Pipe protection and thermal hanger shields	R			
Expansion shields	R			

1.07 QUALITY ASSURANCE

A. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications".

PART 2 - PRODUCTS

2.01 GENERAL

A. Terminology used below is as defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports." Pipe hangars and supports shall comply with MSS SP-58 requirements for materials, design and manufacturer, MSS SP-69 requirements for selection and design and MSS SP-89 requirements for fabrication and installation. All hangers shall be furnished and installed complete with rods and supports proportioned to the size of piping or equipment to be supported.

2.02 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Hangers, Inserts and Supports

1. Fee and Mason
2. B-Line Systems, Inc.
3. ITT Grinnell Corporation
4. Unistrut

C. Pipe Protection and Thermal Hanger Shields

1. Pipe Shields, Inc.
2. Elcen Metal Products Company
3. Midland-Ross Corp.: Superstrut

D. Expansion Shields

1. ITT Phillips Drill Co.: Red Head
2. Hilti Fastening Systems
3. Omark Industries, Inc.

E. Pipe Stand Supports

1. B-Line Systems, Inc.
2. Grinnell Corp.
3. PHD Manufacturing, Inc.

F. Powder-Actuated Fastener Systems:

1. Hilti, Inc.
2. ITW Ramset/Red Head.
3. Masterset Fastening Systems, Inc.

G. Insulation Protectors:

1. B-Line Systems, Inc.
2. ITT Grinnell Corporation
3. PHD Manufacturing, Inc.

H. Miscellaneous Devices

1. Kopty
2. Wejit
3. Or equal (add one more)

2.03 PIPE HANGERS AND SUPPORTS

A. Model numbers are Superstrut, unless otherwise indicated

B. Provide electro-chromate, galvanized or factory painted finish; no plain, "black" hangers allowed

C. Dielectric Isolators: All uninsulated copper tubing systems; Superstrut isolators or equal, Cush-A-Strip or Cush-A-Clamp on all pipe clamps; for individual hangers, use felt lined hangers

D. Individual Pipe Hangers

1. Cold pipe all sizes: Clevis hanger, No. C710
2. Hot pipe sizes up to 4 in: Clevis hanger, No. C710
3. Hot pipe sizes above 6 in: Adjustable steel yoke and cast iron roll No. C729

E. Multiple or Trapeze Hangers

1. Factory channel
   a. 12 gage thick steel
   b. Single or double section
   c. Electro-chromate finish
   d. Strutnuts: Series A-100 or CM-100
   e. Straps: Series 702
   f. Other accessories
   g. No. A-1200 or A-1202
2. Hot pipe sizes 6 in and larger: cast iron roll and stand; C728 or CR728

F. Wall Supports

1. Pipe sizes up to 3 in: Steel bracket No. C738
2. Pipe sizes 4 in and larger: Welded steel bracket C-735
3. Hot pipe sizes 6 inches and larger
   a. Welded steel bracket No. C739
   b. Adjustable steel yoke and cast iron roller No.C729

G. Vertical Support

1. Riser clamp Series C-720

H. Floor Support:

1. Hot pipe sizes up to 4 in; cold pipe, all sizes
   a. Adjustable cast iron saddle No. R786
   b. Locknut nipple
   c. Floor flange
2. Hot pipe sizes 6 in and larger: Adjustable cast iron roll and stand No. R-730-C

I. Thermal Hanger Shields

1. 360 degree high density insert
   a. 100 psi waterproofed calcium silicate, asbestos-free, K=0.38, encased in a 360-degree galvanized sheet metal shield, ASTM A653
   b. See Section 23 07 00 Mechanical Insulation
   c. Same thickness as adjoining pipe insulation
2. 360 degree galvanized sheet metal shield
   a. Shield length and gauges

Pipe Size	Shield Length	Minimum Gauge
1/2-1 1/2	4	26
2 - 6	6	20
8 - 10	9	16

3. Insert to extend one inch beyond metal shield ends on chilled water piping
4. Use double layer shield on bearing surface for
   a. Roller hangers
   b. Support spacing exceeding 10 feet
5. Pipe Shields Incorporated or equal

J. Pipe Isolators

1. Hanger with felt padding
2. Tolco Fig. 3F felt lined hangers or equal

K. Insulated Pipe Supports

1. Pipe supported on rod hangers - use Models A1000, A2000, A3000, 4000 and A9000
2. Pipe supported on flat surfaces - use Models A1000, A2000, A5000, A6000, A7000, A7200 and A7400 Series
3. Pipe supported on pipe rolls - use Models A3000, A4000, A5000, A6000, A8000, A8200 and A8400 Series
4. Model designations are Pipe Shields, Inc. or equal; use only models designed for service for which supports are to be used

L. Anchors and Guides: Provide anchors and guides where indicated on the Drawings and as required. Structural inserts shall be high density calcium silicate compressive strength 600 pounds per square inch. Guide slide pads shall be Teflon. Ensure that slide accommodates pipe movement over full range of service and out-of-service temperatures. Guides shall be Pipe Shields, Inc. Model #B3000 or equal. Anchors shall be Pipe Shields, Inc. Model #C4000 or equal. See Section 23 07 00 – Mechanical Insulation.

M. Insulated Pipe Strap

1. 1/2 in to 1 in plumbing piping in wood frame construction
2. Felt insulated
3. Nailable pipe straps; In lieu of other hangers and dielectric isolators
4. Kopty or equal

N. Escutcheons: See Section 23 05 00 – Basic Mechanical Materials and Methods

O. Flashing and Sleeves

1. Flashings
   a. See Division 07 – Thermal and Moisture Protection
   b. Flash and counter flash watertight all pipe and duct penetrations of roofs and exterior walls
   c. Flash pipes through roofs with ITWBuildex Dektite
   d. Flash vents through roofs with
      (1) Minimum 24 gage soldered roof jack for flat surface roofs
      (2) Minimum 4 pound lead soldered roof jack for roofs other than flat surface roofs
      (3) Vandal caps
      (4) Provide counter-flashing sleeves and storm collars
      (5) Caulk counter-flashing and storm collar weather tight
      (6) Other flashings shall be minimum 24-gage galvanized sheet metal
2. Sleeves
   a. Through exterior concrete walls below grade and floor slabs on grade
      (1) Schedule 40, galvanized steel pipe sleeves
      (2) Seal annular space between pipe and sleeve water tight with one of the following
         a) Thunderline Link-Seals
         b) Calpico Pipe Linx
         c) Oakum sealed in with mastic
         d) Provide membrane clamps at penetrations of membranes
         e) Or equal
   b. Other concrete walls, floors and roofs
      (1) Adjustable telescopic metal sleeves
      (2) Tightly pack annular space between pipe and sleeve with fiberglass. Seal both sides with mastic
   c. For insulated piping, sleeve diameter shall not be less than diameter of insulation
   d. Terminate sleeves flush with walls, and ceiling
   e. For exposed vertical pipe, extend sleeves 1 inch above finished floor except where escutcheons are required
   f. Packing through fire rated partitions on of following
      (1) 3M Penetration Sealing Systems (PSS 7909) and 3M Fire Barrier Caulk and Putty
      (2) Dow-Corning LTV Silicone foam
      (3) Or equal
3. Separate piping through walls, other than concrete walls, from contact with wall construction materials; use non-hardening caulking
4. Install insulation on piping in walls which require insulation at time of installation

2.04 DUCT HANGERS AND SUPPORTS

A. See Section 23 31 13 – Ducts.

2.05 DUCT AND PIPE SUPPORT AT ROOF LEVEL.

A. The Contractor shall coordinate pipe work and ductwork to provide access to all equipment. The services at roof level indicated on our details provide the minimum clearance required for pipe work and ductwork for maintenance of the roof. The plans indicate higher elevations where necessary for access. Where pipe work and ductwork cross over at the same point, the pipe work shall run underneath the ductwork. The Contractor may propose a combined structure, for approval, to support the pipes and ducts at roof level. The contractor shall provide calculations by a certified licensed engineer in the state of Mississippi once the conceptual support has been approved. The main path of egress shall be maintained clear at 7'-6".

2.06 STRUCTURAL ATTACHMENTS

A. Model Numbers are Superstrut, unless otherwise indicated

B. Anchor Bolts: Size as specified for hanger rods

C. Concrete Inserts

1. Malleable iron
2. Place reinforcing steel through insert as recommended by manufacturer for recommended loads
3. No. 452 or equal

D. Beam Clamps

1. All with U-568 safety strap
2. All with locknuts on
   a. Set Screw
   b. Hanger rod
3. Bottom flange attachment
   a. Loading 150 pound and less: U-563
   b. Loading 150 pound to 300 pound: U-562
   c. Loading more than 300 pound: U-560
4. Top flange attachment
   a. Permitted only when bottom flange attachment cannot be used
   b. Loading 400 pound and less: M-777
   c. Loading more than 400 pound: M-778

E. Welded Beam Attachments: No. C-780 or equal

F. Side Beam Brackets: No. 542 or equal

G. Hanger Rods

1. ASTM A575 Hot rolled steel
2. ANSI B1.1 Unified Inch Screw Treads
3. Threaded both ends, threaded one end, or continuous threaded

H. Hanger Rod Fixtures

1. Turnbuckles: No. F-112 or equal
2. Linked Eye Rod
   a. Rod swivel
   b. No. E-131 or equal
3. Clevis: No. F-111 or equal

I. Powder or Gas Actuated Anchors (Powder Actuated Anchors-Not Allowed)

1. Not allowed on initial building construction; allowed only for revisions made after initial construction and with approval of Using Agency
2. Hardened steel stud with threaded shank; size of shank to match hanger rod size
3. Use only with non-shock loads
4. Maximum load safety factors:
   a. Maximum anchor load: 100 pounds
   b. Static loads - 5
   c. Vibratory loads - 8-10
5. For concrete and steel; not to be used for light weight concrete, brick or concrete block
6. 10% testing rate required, testing by contractor
7. Omark Drivit or equal

J. Expansion Shields

1. Carbon-steel anchors, zinc coated
2. Stainless steel for corrosive atmospheres
3. For normal concrete use
   a. Self-drilling anchor
   b. Sleeve anchor
   c. Stud anchor
4. For thin concrete use: wedge anchor
5. For brick or concrete block use: sleeve anchor
6. Maximum load safety factors
   a. Static loads - 4
   b. Vibratory loads - 8 - 10
   c. Shock loads - 8 - 10
7. Size to suit hanger rods
8. ITT Phillips Red Head or equal

K. Steel Deck Inserts

1. Factory stud with
   a. Clip
   b. Spring
   c. Coupling
2. ITT Phillips Red-Head or equal

L. Miscellaneous Metal

1. Steel plate, shapes and bars: ASTM A36
2. Steel pipe columns: ASTM A53, Schedule 40, black
3. Bolts and nuts: regular hexagon-head type, ASTM A307, Grade A
4. Lag bolts: square head type, Fed. Spec. FF-B-561
5. Plain washers: round, carbon steel, Fed. Spec. FF-W.92

2.07 MISCELLANEOUS MATERIALS

A. Powder-Actuated Drive-Pin Fasteners: Powder-actuated-type, drive-pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

C. Structural Steel: ASTM A36/A36M, steel plates, shapes, and bars, black and galvanized.

D. Concrete: Normal weight concrete (145 pcf) using Type I Portland Cement, 1" maximum size coarse aggregate to provide a minimum 28 day compressive strength of 3000 psi.

E. Grout: ASTM C1107, Grade B, factory-mixed and -packaged, nonshrink and nonmetallic, dry, hydraulic-cement grout.

1. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
2. Properties: Nonstaining, noncorrosive, and nongaseous.
3. Design Mix: 7000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.01 PIPE HANGERS, SUPPORTS AND GUIDES

A. Specific hanger requirements are specified in Sections specifying equipment and systems.

1. Assure adequate support for pipe and contents
2. Provide adjustable hangers for all pipes complete with inserts, adjusters, bolts, nuts, swivels, all-thread rods, etc., except where specified otherwise
3. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping and do not support piping from other piping.
4. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping
5. Install all cast iron piping in accordance with Cast Iron Soil Pipe Industry (CISPI) Standards
6. Support all piping within 2 feet of each change of direction on both sides of fitting
7. Thermal hanger shields shall be provided at hangers and supports where piping is insulated
8. Prevent vibration or swaying
9. Provide for expansion and contraction
10. Supports of wire, rope, wood, chain, strap perforated bar or any other makeshift device not permitted
11. Comply with applicable requirements at ANSI B31.1 and B31.2 for piping
12. Support piping independently so that equipment is not stressed by piping weight of expansion
13. See Section 23 05 48 – Mechanical Sound and Vibration Control for mechanical sound and vibration control
14. See Section 23 05 48 – Mechanical Sound and Vibration Control for hangers, guides, anchors and supports requiring vibration isolation units
15. Hangers and supports shall have minimum safety factor of five (5), based on ultimate tensile or compressive strength, as applicable, of material used; base calculations on equipment’s heaviest operating weight and pipes full of water

16. Install additional supports or braces if, during normal operation, piping should sway, crawl or vibrate. Piping shall be immobile
17. Install thrust blocks as required to prevent sway

B. Horizontal piping, except as noted

1. Adjustable clevis type and rod; all services at or below 250 degrees F
2. Rollers or slide bases: not required
3. Trapeze hangers; guide individual pipes on trapezes with 1/4 inch U-bolt or Superstrut 702 pipe clamp
   a. Install thermal hanger shield at each support point
4. Galvanized sheet metal shields between hangers and PVC piping
5. Threaded steel rods
   a. 2 in vertical adjustment with 2 nuts each end for positioning and locking
   b. Size to 12 in inside pipe size (IPS)

Pipe, IPS	Rod
to 2 inch	3/8 inch
2-1/2 inch and 3 inch	1/2 inch
4 inch	5/8 inch
6 inch and 8 inch	3/4 inch
10 inch and 12 inch	7/8 inch
14 inch and 18 inch	1 inch
20 inch and 30 inch	1-1/4 inch

   c. Size above 12 inch IPS and multiple pipe standards: safety factor of 5 on ultimate strength on area
   d. For double rod hangers: 1 size smaller than above

C. Vertical piping

1. Base support
   a. Base elbow or welded equivalent
   b. Bearing plate on structural support
2. Guides
   a. At every third floor but not to exceed
      (1) 25 feet for piping to 2 inch
      (2) 36 feet for piping 2-1/2 inch to 12 inch
      (3) 50 feet for piping 14 inch and larger
   b. Or as otherwise designed by the Vibration Isolation vendor; coordinate with Section 23 05 48 – Mechanical Sound and Vibration Control
3. Top support
   a. Special hanger or saddle in horizontal connection
   b. Provisions for expansion
4. Intermediate supports: steel pipe clamp at floor
   a. Bolted and welded to pipe
   b. Extension ends bearing on structural steel or bearing plates
5. For multiple pipes: coordinate guides, bearing plates and accessory steel

D. Horizontal insulated piping

1. Install saddles for rollers or slide bases
2. Install thermal hanger shields for all other types of supports
3. See Section 23 07 00 – Mechanical Insulation for insulation connection to shields

E. Vertical insulated piping

1. Install thermal hanger shields at guides
2. See Section 23 07 00 – Mechanical Insulation for insulation connection to shields

F. Install Pipe Isolators between hangers and piping for all uninsulated copper tubing.

G. Spring Supports for Piping: See Section 23 05 48 – Mechanical Sound and Vibration Control.

H. Miscellaneous Steel: Provide miscellaneous steel members, beams, brackets, etc., for support of work in this division unless specifically included in other divisions.

I. Roof pipe supports shall be installed per manufacturer's recommendations in coordination with the roofing system and company holding the roof warranty.

3.02 PIPE SUPPORT SPACING

A. Maximum spacing for horizontal piping

Type of Pipe	Size	MAXIMUM SPACING
Steel	1-1/2 inch and smaller	7 feet
	2 inch and larger	10 feet
Copper	3/4 inch and smaller	5 feet
	1- 1-1/4 inch	6 feet
	1-1/2 - 3 inch	8 feet
	4 inch and larger	10 feet
Plastic	3/4 inch and smaller	3 feet

B. Spacing Notes: Additional supports at

1. Changes in direction
2. Branch piping and runouts over 5 feet
3. Concentrated loads due to valves, strainers and other similar items
4. At valves 4 inch and larger in horizontal piping, support piping on each side of valve

C. Parallel piping on trapezes: Maximum spacing to be that of pipe requiring closest spacing.

3.03 ATTACHMENT TO STRUCTURE

A. Concrete

1. Use inserts for suspending hangers from reinforced concrete slabs, walls and sides of reinforced concrete beams wherever practicable
2. Set inserts in position in advance of concrete work
3. Provide reinforcement rod in concrete for inserts carrying
   a. Pipe over 4 inch
   b. Ducts over 60 inches wide
4. Where concrete slabs form finished ceiling, finish inserts flush with slab surface
5. Where inserts are omitted, install hangers with expansion shields
6. Through-deck support
   a. Drill through concrete slab from below
   b. Provide rod with recessed square steel plate and nut above slab

7. Where permitted by Using Agency and only for revisions made after initial construction, powder actuated anchors or expansion shields may be used in lieu of inserts
   a. In bottom of thick slabs
   b. In thin slab construction, only in sides of beams
8. Pre-Cast Concrete
   a. Use pre-set inserts
   b. Where inserts are not available, field drill through beam or joists at locations as directed by Professional
   c. Through bolt side beam bracket to beam or joist
9. Poured-In-Place Concrete
   a. With metal form or underdeck
   b. Before concrete is poured
      (1) Field drill hole through metal deck
      (2) Provide bearing plate, nut and locknut on rod; or install factory-made steel deck inserts specified hereinbefore
   c. After concrete is poured
      (1) Install hangers with expansion shields

B. Steel Beam Anchors

1. Beam or channel clamps
2. Do not cut or weld to structural steel without permission of structural engineer

C. Steel Deck Anchors

1. Concrete filled: as specified above
2. Decking without concrete
   a. Through rod Support
      (1) Weld to square plate, 1/4 in thick
      (2) Plate to distribute load over minimum of two full cells
      (3) Coordinate with floor layouts to clear cells with wiring

D. Side Wall Supports

1. Concrete walls
   a. As specified for hangers
2. Stud Walls
   a. Toggle bolts
   b. Studs welded to structural studs

E. Support Spreaders

1. Install spreaders spanning between structural members when hangers fall between them, and hanger load is too great for slab or deck attachment
2. Spreaders may be one of methods listed below, or combination of both as required
   a. Fabricated from structural channel
      (1) End fittings bolted or welded
      (2) Secure to structural members
         a) As required by construction
         b) As reviewed by Structural Engineer
   b. Formed channels with fittings, Superstrut or equal
      (1) Submit manufacturer's calculations for installation

3.04 DUCT HANGERS AND SUPPORTS

A. See Section 23 31 13 – Ducts

3.05 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure above or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

3.06 METAL FABRICATION

A. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports.

B. Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.07 ADJUSTING

A. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

3.08 PAINTING

A. Painting and Touching Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780.

END OF SECTION

SECTION 23 05 48 MECHANICAL SOUND AND VIBRATION CONTROL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. These heating, ventilating and air conditioning (HVAC) provisions specified herein apply to all Sections of Division 23.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 23.

1.02 SUMMARY

A. Work Included in This Section: Materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Vibration isolators for equipment
2. Vibration isolators for piping systems
3. Equipment bases

B. Related Sections

1. Section 23 00 10 – Mechanical General Provisions
2. Section 23 05 00 – Basic Mechanical Materials and Methods
3. Section 23 33 00 – Duct Accessories
4. Section 23 05 16 – Piping Specialties

1.03 REFERENCE STANDARDS

A. AFBMA – Anti-Friction Bearing Manufacturer's Association

B. ASHRAE – American Society of Heating, Refrigerating and Air Conditioning Engineers

C. NEMA – National Electrical Manufacturer's Association

D. Underwriters' Laboratories, Inc.: UL 778 – Motor Operated Water Pumps

E. American Society of Mechanical Engineers: ASME Section VIII – Boiler and Pressure Vessel Code – Pressure Vessels

F. Published specifications standards, tests or recommended methods of trade, industry or governmental organizations apply to work in this section where cited below

1. Mason Industries “Seismic Restraint Guidelines for Suspended Piping, Ductwork, and Electrical Systems”
2. SMACNA and PPIC “Guidelines for Seismic Restraints of Mechanical Systems and Plumbing Piping Systems”.

G. Publication references below are basic industry standards; however, regulatory requirements may reference, modify or supersede:

1. American Institute of Steel Construction (AISC) publications
   a. Specification for the Design, Fabrication and Erection of Structural Steel Buildings (Eighth Edition)

2. American National Standards Institute (ANSI) Standard
   a. B027.2-965 – Plain Washers
3. American Society for Testing and Materials (ASTM) Specifications
   a. A 6 – General Requirements for Delivery and Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use
   b. A 36 – Structural Steel
   c. A 53 – Welded and Seamless Steel Pipe
   d. B633 – Electrodeposited Coatings of Zinc on Steel
   e. A 307 – Carbon Steel Externally and Internally Threaded Standard Fasteners
   f. A 500 – Cold-Formed Welded and Seamless Carbon Steel Structural Tubing
   g. A1011 – Hot Rolled Carbon Steel Sheet and Strip
4. American Society for Testing and Materials (ASTM) Specifications
   a. A 6 – General Requirements for Delivery and Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use
   b. A 36 – Structural Steel
   c. A 53 – Welded and Seamless Steel Pipe
   d. B633 – Electrodeposited Coatings of Zinc on Steel
   e. A 307 – Carbon Steel Externally and Internally Threaded Standard Fasteners
   f. A 500 – Cold-Formed Welded and Seamless Carbon Steel Structural Tubing
   g. A1011 – Hot Rolled Carbon Steel Sheet and Strip
5. American Welding Society (AWS) Publication
   a. D 1.1 – Structural Welding Code

1.04 QUALITY ASSURANCE

A. Qualifications

1. Manufacturer
   a. All equipment and accessories to be the product of a manufacturer regularly engaged in its manufacture for not less than five years

B. Manufacturer or manufacturer's representative of vibration isolation equipment shall have the following responsibilities

1. Determine vibration isolator sizes and locations
2. Provide piping and equipment isolation systems as scheduled or specified
3. Guarantee specified isolation system static deflection under installed actual load.
4. Provide installation instructions, drawings and field supervision to assure proper installation, adjustment and performance

C. The installation of all vibration isolation units and associated hangers and bases shall be as directed by the vibration isolation manufacturer's representative.

D. It is the objective of this Specification to provide the necessary design for the control of excessive noise and vibration in the building due to the operation of machinery or equipment, and due to interconnected piping, ductwork or conduit

1. All vibration isolators shall have either known undeflected heights or calibration markings so that, after adjustment, when carrying their load, the deflection under load can be verified, thus determining that the load is within the proper range of the device and that the correct degree of vibration isolation is being provided according to the design.
2. All isolators shall operate in the linear portion of their load versus deflection curve. Load versus deflection curves shall be furnished by the manufacturer and must be linear over a deflection range of not less than 50 percent greater than the design deflection.

3. The theoretical vertical natural frequency for each support point, based upon load per isolator and isolator stiffness, shall not differ from the design objectives for the equipment as a whole by more than ±10 percent.
4. All neoprene mountings shall have a Shore hardness of 30 to 60 ±5, after minimum aging of 20 days or corresponding oven-aging.

E. Acoustical Testing

1. The contractor shall cooperate with regard to sound tests (ARI 575, ANSI S1.13) which may be conducted by Architect to verify that noise criteria are met.
2. The contractor shall notify the Architect of any changes which will affect the acoustical performance.

1.05 SUBMITTALS

A. See Section 23 00 10 – Mechanical General Provisions

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. "R" means required.
2. "R2" means required only for products and equipment differing for the specified manufacturer and model and for "or equals" where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Vibration isolation devices: catalog cuts, static deflections, quantity, load per isolator, mounting details, etc.	R	R		
Concrete and steel details for equipment pads				R
Weld or anchor bolt locations				R
Reinforcing and template steel locations and details				R
Equipment bases	R	R		R
Anchors, inserts and fasteners and fastening details	R	R		R
Flexible pipe connectors	R	R		R
Flexible duct connectors	R	R		R

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Vibration Isolation

1. Mason Industries, Inc.
2. Kinetics Noise Control, Inc.
3. Amber-Booth

2.02 VIBRATION ISOLATOR TYPES

A. Spring type

1. Spring isolators shall incorporate following
   a. All springs to be single coil steel with minimum spring coil outer diameter 0.8 of loaded operating height
   b. Horizontal spring stiffness within 0.8 to 1.25 times rated vertical spring stiffness
   c. Corrosion resistance
      (1) Where exposed to corrosive environment including but not limited to:
         a) Outdoors
         b) Exposed to outdoor air within 5 feet of outdoor air intake
      (2) Corrosion protection: painted with outdoor paint
      (3) Springs neoprene coated
      (4) Hardware cadmium plated
      (5) All other metal parts hot dip galvanized
   d. Reserve deflection (from loaded to solid height) of 50 percent of rated deflection
   e. Designed and installed so that ends of springs remain parallel; neoprene cups not acceptable
   f. Noise pads of ½ inch or 1 inch thickness below the spring base to reduce the chance that the springs shall be resonant with equipment forcing frequencies or support structure natural frequencies. See Table in Paragraph 3.04B.
   g. Leveling device
   h. Where operating weight differs from installed weight provide built-in adjustable limit stops to prevent equipment rising when weight is removed. Stops shall not be in contact during normal operation.
2. Type "A": Similar to Mason Type SLF
3. Type "B": same as Type "A" except
   a. Provide built-in resilient vertical limit stops
   b. Tapped holes in top plate for bolting to equipment
   c. Capable of supporting equipment at fixed elevation during equipment erection
   d. Mason Type SLRS or equal for 1 inch and 2 inch deflection, Type SLR Series 100 for 3 inch to 5 inch deflection
4. Type "C": spring hanger rod isolators shall incorporate the following
   a. Spring element seated on steel washer within neoprene cup
   b. Steel retainer box encasing spring and neoprene cup
   c. Minimum 1/2 inch clearance between retainer box and spring hanger rod
   d. Minimum 15 degrees angular clearance between rod and retainer box
   e. Double deflection neoprene element at top of hanger box
   f. Mason 30N or equal

B. Elastomer mounting types

1. Type "D": Double deflecting type incorporating following
   a. Bolt holes for bolting to equipment base
   b. Bottom steel plates for bolting to sub-base as required
   c. Unit type design molded in black oil-resistant neoprene
   d. Neoprene compounded to meet following:
      (1) Not greater than 50 durometer
      (2) Minimum tensile strength 2000 pounds per square inch
      (3) Minimum elongation 300 percent
      (4) Maximum compression set of 25 percent of the original deflection
   e. Mason Type ND or equal
   f. Mason Type BR or equal

2. Type "E": Elastomer hanger rod isolators shall incorporate following
   a. Molded unit type neoprene element
   b. Compounding described in Type "D" above
   c. Steel retainer box encasing neoprene mounting.
   d. Minimum 1/2 inch box
   e. Mason Type HD or equal
3. Type "F": pad type elastomer mountings to incorporate following
   a. 5/16 to 3/8 inch minimum thickness per layer
   b. 50 psi maximum loading
   c. Ribbed or waffled design
   d. 1/16 inch galvanized steel plate between multiple layers of pad thickness
   e. 1/16 inch deflection per pad thickness
   f. Suitable bearing plate to distribute load
   g. Bolts through equipment and pad shall be oversized and provided with resilient washers, bushings and lock nuts
   h. Mason Type W Series or equal
4. Type "G": Pad type elastomer mountings to incorporate following
   a. High quality bridge bearing neoprene
   b. Maximum loading 800 psi
   c. Suitable bearing plate to distribute load
   d. Minimum thickness 2 inch
   e. Mason Type BBP or equal
5. Type "H": Combination spring/elastomer hanger rod isolators to incorporate following
   a. Spring and neoprene isolator elements in steel box retainer
   b. Characteristics of spring and neoprene as described in Type "C" and Type "E" hanger isolators
   c. Factory preloading to 75 percent of rated load
   d. Mason PC30N or equal

2.03 EQUIPMENT BASES

A. Integral structural steel bases, Type "B-1"

1. Reinforced as required to prevent base flexure at start-up and misalignment of drive and driven units
2. Fan bases complete with motor slide rails
3. Drilled for drive and driven unit mounting template
4. Mason Type WFSL or equal

B. Concrete inertia base, Type "B-2"

1. Formed in structural steel frame
2. Structural base reinforced as required to prevent flexure, misalignment of drive and driven unit or stress transferal into equipment
3. Minimum thickness of the inertia base shall be 6 inches or greater if required to meet weight ratio specified below
4. Fan bases complete with motor slide rails
5. Pump bases shall be large enough to support suction and discharge elbows and suction diffusers
6. Bases complete with
   a. Height saving brackets
   b. Reinforcing
   c. Equipment bolting provisions
   d. Isolators provided by vibration control supplier, type as scheduled
7. Base ready for concrete pour

8. Inertia Base Weights
    a. Centrifugal Fans, except as noted: Minimum 1.0 times weight of fan, motor and drive
    b. Air handling Units, except as noted: Minimum 1.0 times weight of fan and coil cabinet, coils, fan, motor and drive
    c. Pumps: Minimum 1.5 times weight of pump, motor and base
        (1) Base to be sized to support suction diffuser when used
    d. Air compressors
        (1) Minimum 2 times weight of compressor, motor and base
        (2) Weight can be reduced by weight of tank when tank mounted unit is provided
9. Mason Type KSL/BMK or equal

2.04 ANCHORS, INSERTS AND FASTENERS

A. All anchors and inserts shall be installed according to the ICBO standards

B. Do not use any anchor or insert in concrete which does not have a signed structurally engineered design value based on its installed application and one of the following

1. ICBO evaluation report
2. Lab test report verifying compliance

C. Do not use powder driven and power driven (Shoot-In) fasteners, expansion nails or friction spring clips

D. All over-head concrete anchors or inserts shall be selected to comply with the ICBO report table for the anchor or insert

E. Torque testing of anchors shall be allowed to verify compliance of anchor installation. However, torque testing shall not justify usability of anchor. Only load or pull testing shall be allowed to justify usability of anchors. Failure of torque shall constitute failure of anchor.

F. Bolts and nuts

1. Bolts and heavy hexagon nuts: ANSI B18.2.1 and ASTM A307 or A576
2. Bolts, underground: ASTM A325
3. Expansion anchors: Federal Specification A-A-1922

2.05 FLEXIBLE PIPE CONNECTORS

A. Piping Connections for Vibration Isolation

1. Molded twin-sphere type connectors made of peroxide cured EPDM and Kevlar tire cord reinforcement
2. Connectors up to 2 inch diameter may have threaded ends
3. Connectors 2-1/2 inch diameter and larger to have floating steel flanges recessed to lock the connector's neoprene flanges
4. Connectors rated a minimum of 150 pounds per square inch at 220 degrees Fahrenheit without control rods or cables
5. Mason SAFEFLEX Type SFDEJ or equal

2.06 FLEXIBLE DUCT CONNECTORS

A. See Section 23 31 13 – Ducts

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install isolators in accordance with manufacturer's written instructions

B. Vibration isolators must not cause any change of position of equipment or piping resulting in piping stresses or misalignment

C. Make no rigid connections between equipment and building structure that degrade noise and vibration isolation system herein specified

1. Electrical conduit connections to isolated equipment shall be flexible liquid tight conduit of sufficient length to incorporate a right angle bend, an offset of not less than 8 inches or a loop to allow free motion of isolated equipment
2. The HVAC Sub-contractor shall not install any equipment, piping or conduit which makes rigid contact with the building unless permitted in this Specification; building includes, but is not limited to, slabs, beams, columns, studs and walls
3. Coordinate work with other trades to avoid rigid contact with the building. Inform other trades following work, such as plastering or electrical, to avoid any contact which would reduce the vibration isolation

D. Do not use isolator leveling bolts as jacking screws

E. Verify that all installed isolators and mounting systems permit equipment motion in all directions

3.02 FLOOR MOUNTED EQUIPMENT

A. Concrete housekeeping pads

1. Isolation supplier to determine dimensions and thickness required
   a. Minimum thickness: 5.5 inches
2. Support all vibration isolation devices and bases
3. Key with stirrups as required, integral with structural slab

3.03 EQUIPMENT ISOLATION

A. General

1. Provide 1 inch operating clearance between equipment or structural bases and housekeeping pad
   a. 1 inch minimum clearance for inertia bases over 96 inches in any dimension
2. Position equipment, structural base and concrete bases on blocks or wedges at proper operating height
3. Provide operating load conditions prior to transferring base isolator loads to springs and removing wedges
4. Adjust or provide additional resilient restraints to flexibly limit start-up equipment lateral motion to 1/4 inch
5. Prior to start-up, clean out all foreign matter between bases and equipment
6. Verify that there are no isolation short circuits in the base, isolators, or conduit, pipe and duct connections
7. Locate spring hanger boxes directly adjacent to the structural support element above, as opposed to down at the location of the supported equipment

8. Where isolator base pad is called for in Vibration Isolator Schedule, install pad between the isolator base and structure
9. For isolator pads penetrated by anchors to the structure, to prevent short-circuiting, provide neoprene grommet between the anchor and isolator. Hand-tighten nut so that grommet is not compressed then secure with lock nut.

B. Vibration Isolator Schedule

Equipment	Base Type	Isolator Type	Isolater Static Deflection	Thickness
Frame/Plenum-mounted AHUs (internally isolated)	None	F	1/4 inch	–
Suspended fan-coils, AC, HP	None	C	1 inch	–
Suspended fans direct drive	None	E	0.2 inch	–
Suspended fans belt drive	None	C	As for floor mounted fans plus 1/4 inch	1/2 inch
Wall mounted propeller fans				
1 HP and larger	None	F	1/4 - inch	–
<1 HP	None	–	–	–

3.04 PIPING AND DUCTWORK ISOLATION

A. See Section 23 23 00 – Refrigerant Piping and Section 23 31 13 – Ducts.

B. Ductwork :No vibration isolation required.

C. Piping Other Than Risers: No vibration isolation required.

D. Pipe Risers

1. For pipe risers less than 75 feet, vertical risers shall be laterally supported with a riser clamp at each floor set on a Type F isolation pad, ¼" deflection.
2. For pipe risers greater than 75 feet, riser supports shall be engineered by the vibration isolation vendor as follows
   a. All vertical risers shall be supported by spring isolators designed to support the riser filled with water. Assigned loads must be within the building design limits at the support points.
   b. Neutral central resilient anchors close to the center of the run shall direct movement up and down. The anchors shall be capable of holding an upward force equal to the water weight when the system is drained. If one level cannot accommodate this force, anchors can be located on 2 or 3 adjacent floors. Anchors shall be Mason ADA or equal.
   c. Resilient guides shall be spaced and sized properly depending on the pipe diameter. Guides shall be Mason VSG Vertical Sliding Guides or equal.

d. Support spring mountings shall be Type A. The initial spring deflection shall be a minimum of 0.75 inches or four times the thermal movement at the isolator location, whichever is greater.
e. Submittals must include the initial load, initial deflection, change in deflection, final load and change in load at all spring and anchor support locations, as well as guide spacing. Calculations shall include pipe stress at end conditions and branch off locations and the manufacturer must include installation instructions. Submittal must be stamped and signed by a licensed professional engineer in the employ of the vibration isolator vendor.

E. Wall and Floor Penetrations

1. All piping and ductwork to be vibration isolated, and all piping and ductwork passing through acoustically rated partitions, shall freely pass through walls and floors without rigid contacts or connections. Penetration points shall be sleeved or otherwise formed to allow passage of piping or ductwork, and maintain 0.75 inches to 1.25 inches clearance around the pipe or duct outside surfaces.
   a. For installations through air plenum partitions and through acoustically rated partitions, clearance space shall be tightly packed with fiberglass, and caulked airtight after installation of piping or ductwork
   b. For installation in rated walls, see Section 23 23 00 – Refrigerant Piping and Section 23 31 13 – Ducts
2. Provide sleeves and escutcheons as specified in Section 23 23 00 – Refrigerant Piping and Section 23 31 13 – Ducts.

3.05 FIELD QUALITY CONTROL

A. Inspection by manufacturer's representative of all vibration isolating devices

1. After installation of all devices
2. Provide written report by manufacturer regarding
   a. Installation errors
   b. Improper selection of devices
   c. Other fault that could affect performance of system

B. Submit written report to Architect

1. Include manufacturer's report indicating required corrections
2. Include report on steps to properly complete isolation work

END OF SECTION

SECTION 23 05 53 MECHANICAL SYSTEM IDENTIFICATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. These heating, ventilating and air conditioning (HVAC) provisions specified herein apply to all Sections of Division 23.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 23.

1.02 SUMMARY

A. This Section includes the following mechanical identification materials and their installation:

1. Equipment nameplates.
2. Equipment markers.
3. Equipment signs.
4. Access panel and door markers.
5. Pipe markers.
6. Duct markers.
7. Valve tags.
8. Valve schedules.
9. Warning tags.

B. Related Sections

1. Section 23 00 10 – Mechanical General Provisions
2. Section 23 05 00 – Basic Mechanical Materials and Methods

1.03 REFERENCE STANDARDS

A. Pipe marker shall comply with ANSI A13-1

1.04 SUBMITTALS

A. See Section 23 00 10 – Mechanical General Provisions

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. “R” means required.
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Pipe markers	R		R	
Duct markers	R		R	
Equipment tags	R		R	
Valve tags	R		R	
Concealed equipment markers	R		R	

C. Samples: For color, letter style, and graphic representation required for each identification material and device.

D. Valve numbering scheme.

E. Valves Schedules: For each piping system. Furnish extra copies (in addition to mounted copies) to include in maintenance manuals.

1.05 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping.

1.06 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 location of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable:

1. W.H. Brady
2. Seton
3. Marking Systems, Inc. (MSI)

2.02 EQUIPMENT IDENTIFICATION DEVICES

A. Equipment Nameplates: Metal, with data engraved or stamped, for permanent attachment on equipment.

1. Data:
   a. Manufacturer, product name, model number, and serial number.
   b. Capacity, operating and power characteristics, and essential data.
   c. Labels of tested compliances.

2. Location: Accessible and visible.
3. Fasteners: As required to mount on equipment.

B. Equipment Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.

1. Data: Instructions for operation of equipment and for safety procedures.
2. Engraving: Manufacturer's standard letter style, of sizes and with terms to match equipment identification.
3. Thickness: 1/8 inch, unless otherwise indicated.
4. Thickness: 1/16 inch for units up to 20 sq. in. or 8 inches in length, and 1/8 inch for larger units.
5. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

C. Access Panel and Door Markers: 1/16-inch thick, engraved laminated plastic, with abbreviated terms and numbers corresponding to identification. Provide 1/8-inch center hole for attachment.

1. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

2.03 PIPING IDENTIFICATION DEVICES

A. Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.

1. Colors: Comply with ASME A13.1, unless otherwise indicated.
2. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.
3. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers extending 360 degrees around pipe at each location.
4. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or shaped pipe markers at least three times letter height and of length required for label.
5. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.

B. Pretensioned Pipe Markers: Precoiled semirigid plastic formed to cover full circumference of pipe and to attach to pipe without adhesive.

C. Shaped Pipe Markers: Preformed semirigid plastic formed to partially cover circumference of pipe and to attach to pipe with mechanical fasteners that do not penetrate insulation vapor barrier.

D. Background Color

Service	Pipe marker	Background color	Lettering
Cold water	Domestic cold water	Green	Black
Hot water	Domestic hot water supply	Yellow	Black
	Domestic hot water return	Yellow	Black
Sprinkler water	Fire protection water	Red	Black
Air, Compressed	Compressed air	Green	Black
Sanitary waste	Sanitary waste	Green	Black
Storm drain	Storm drain	Green	Black
Overflow drain	Overflow drain	Green	Black

Service	Pipe marker	Background color	Lettering
Vent	Vent	Green	Black
Emergency eyewash and shower	Emergency shower	Yellow	Black
Refrigerant Suction/Gas	Refrigerant Suction/Gas	Yellow	Black
Natural gas	Natural gas	Yellow	Black

2.04 DUCT IDENTIFICATION DEVICES

A. Duct Markers: Engraved, color-coded laminated plastic. Include direction and quantity of airflow and duct service (such as supply, return, and exhaust). Include contact-type, permanent adhesive.

2.05 VALVE IDENTIFICATION

A. Valve Tags: Numbering scheme approved by Architect

1. General: Identify valves with metal tags, legends to be stamped or embossed. It shall indicate the function of the valve and its normal operating position; such as:
   a. “56 HW” (NUMBER AND CONTENT OF PIPE)
   b. “ISOLATION” (VALVE FUNCTION)
   c. “NO” (NORMAL OPERATION POSITION)
2. Not required at isolation valves located adjacent to equipment they isolate.
3. Size: Valve tags 2-inch diameter with 1/4-inch high letters for piping system abbreviation and 1/2-inch numbers with numbering scheme approved by Architect.
4. Material: Use 0.050 or 0.064-inch brass tags
5. Automatic Valves and Regulating Valves: Use 1/16-inch thick laminated 3-ply plastic, center ply white, outer ply red, “lamicoid” or equal. Form letters by exposing center ply
6. Valve Tag Directory: Include tag number, location, exposed or concealed, service, valve size, valve manufacturer, valve model number, tag material, and normal operating position of valve

2.06 VALVE SCHEDULES

A. Valve Schedules: For each piping system, on plastic laminated, standard-size bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-Schedule Frames: Glazed display frame for removable mounting on masonry walls for each page of valve schedule. Include mounting screws.
2. Frame: Extruded aluminum.
3. Glazing: ASTM C 1036, Type I, Class 1, Glazing Quality B, 2.5-mm, single-thickness glass.

2.07 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.

2.08 EQUIPMENT LOCATOR TACKS

A. 7/8" diameter tack for pushing into ceiling tile near closest equipment access point. Colors to be as specified.

PART 3 - EXECUTION

3.01 HVAC EQUIPMENT IDENTIFICATION

A. Install and permanently fasten equipment nameplates on each major item of mechanical equipment that does not have nameplate or has nameplate that is damaged or located where not easily visible. Locate nameplates where accessible and visible. Include nameplates for the following general categories of equipment:

1. Fuel-burning units, including boilers, makeup air units, and domestic water heaters.
2. Pumps, chillers, condensing units, cooling towers and similar motor-driven units.
3. Coils, evaporators, tanks, and similar equipment.
4. Fans, blowers, primary balancing dampers, and VAV terminal units.
5. Packaged HVAC central-station and zone-type units, including modular air handling units, ductless split-system units, unit heaters, etc.
6. Tanks, large piping specialties (expansion tanks and air separators).

B. Install equipment signs with screws or permanent adhesive on or near each major item of mechanical equipment. Locate signs where accessible and visible.

1. Identify mechanical equipment with equipment markers in the following color codes:
   a. Blue: For cooling equipment and components.
   b. Orange: For heating equipment and components.
   c. Green: For combination cooling and heating equipment and components.
   d. Brown: For energy-reclamation equipment and components.
2. Letter Size: Minimum 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.
3. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
4. Include signs for the following general categories of equipment:
   a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
   b. Meters, gages, thermometers, and similar units.
   c. Fuel burning units including boilers, gas-fired makeup air units, domestic water heaters.
   d. Pumps, chillers, condensing units, and similar motor-driven units.
   e. Heat exchangers, coils, evaporators, and similar equipment.
   f. Fans, blowers, primary balancing dampers, and control dampers.
   g. Packaged HVAC central-station units, including modular air handling units, ductless split system heat pumps, terminal units, unit heaters, etc.
   h. Tanks and pressure vessels.
   i. Strainers, filters, water-treatment systems, and similar equipment.
   j. Starters, variable frequency drives, contactor, push-button station, control switch, disconnect and thermal overload switch

C. Install access panel markers with screws on equipment access panels.

3.02 PIPING IDENTIFICATION

A. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.

1. Pipes with OD, Including Insulation, Less Than 6 Inches: Pretensioned pipe markers. Use size to ensure a tight fit.

B. Locate pipe markers and color bands where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior nonconcealed locations as follows:

1. Within 18” of each valve, valve assembly and control device.
2. Within 3’ of each 90 degree elbow, connection to equipment or vessel and where pipe enters shafts and penetrates outside walls, floors, ceilings and nonaccessible enclosures.
3. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
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 20 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings (maximum of 20 feet). Omit intermediately spaced markers.

3.03 HVAC DUCT IDENTIFICATION

A. Install duct markers with permanent adhesive on air ducts in the following color codes:

1. Green: For cold-air supply ducts.
2. Yellow: For hot-air supply ducts.
3. Blue: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
4. ASME A13.1 Colors and Designs: For hazardous material exhaust.
5. Letter Size: Minimum 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.

B. Locate markers near points where ducts enter into concealed spaces and at maximum intervals of 25 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.04 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; plumbing fixture supply stops; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following:

1. Valve-Tag Size and Shape:
   a. Domestic and Hydronic Cold Water: 1-1/2 inches round.
   b. Domestic and Hydronic Hot Water: 1-1/2 inches round.

c. Refrigerant: 1-1/2 inches round.
d. Fire Suppression Water: 1-1/2 inches round.

2. Valve-Tag Color:
   a. Domestic and Hydronic Cold Water: Blue
   b. Domestic and Hydronic Hot Water: Yellow
   c. Refrigerant: Green
   d. Fire Suppression Water: Red
3. Letter Color:
   a. Domestic and Hydronic Cold Water: Black
   b. Domestic and Hydronic Hot Water: Black
   c. Refrigerant: White
   d. Fire Suppression Water: White

3.05 VALVE-SCHEDULE INSTALLATION

A. Mount valve schedule on wall in accessible location in each major equipment room.

3.06 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

3.07 EQUIPMENT LOCATOR TACKS

A. Install tacks into the ceiling tile or insulation at the closest access point to the device.

B. Install tacks to locate above ceiling equipment and devices as follows:

1. Fire dampers (red)
2. Manual volume dampers (orange)
3. Motorized control dampers (yellow)
4. HVAC equipment (black)
5. Hydronic system valves (green)
6. Control system devices (light blue)
7. Cold water (blue)
8. Hot water (red)

3.08 ADJUSTING

A. Relocate mechanical identification materials and devices that have become visually blocked by other work.

3.09 CLEANING

A. Clean faces of mechanical identification devices and glass frames of valve schedules.

END OF SECTION

SECTION 23 05 93 TESTING, ADJUSTING AND BALANCING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. These heating, ventilating and air conditioning (HVAC) provisions specified herein apply to all Sections of Division 23.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 23.

1.02 SUMMARY

A. Work included in this section: materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Operational testing and adjusting of air handling equipment
2. Balancing of air distribution systems
3. Adjustment of air terminal devices

B. Related Sections

1. Section 23 00 10 – Mechanical General Provisions
2. Section 23 05 00 – Basic Mechanical Materials and Methods
3. Section 23 31 13 – Ducts

1.03 REFERENCE STANDARDS

A. National Environmental Balancing Bureau Procedural Standards

B. Associated Air Balance Council National Standards

C. ASHRAE Standard 111 Practices for Measurement, Testing, Adjusting, and Balancing of Building Heating, Ventilating, and Air-Conditioning Systems

1.04 QUALITY ASSURANCE

A. Agency shall be member of Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB)

B. Agency shall have satisfactorily balanced at least three systems of comparable type and size

C. Prior to start of testing, adjusting and balancing, verify that required Project conditions are met

1. Systems installation is complete and in full operation
2. All pre-functional tests have been performed
3. Equipment has been started and tested in accordance with manufacturers written installation instructions
4. Doors and windows are in place or under normal traffic conditions

1.05 SUBMITTALS

A. See Section 23 00 10 – Mechanical General Provisions.

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. "R" means required.
2. "R2" means required only for products and equipment differing for the specified manufacturer and model and for "or equals" where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
AABC, NEBB or TABB certification	R			
Report forms	R			
List of instrumentation	R			
Final air balancing report		R		

C. Submit to Architect documentation that

1. Agency is a member of Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB).
2. Agency has satisfactorily balanced at least three systems of comparable type and size
   a. Include list of such projects
   b. Include sample forms for use in compiling and recording test and balance data

D. Pre-Test Submittal

1. At least 15 days prior to starting field work, submit paper copies of the following
   a. Set of final report forms
      (1) Complete with design conditions of all equipment and design flow rates for all equipment and devices to be balanced.
      (2) Forms shall include blank entry space for all data requested in this Section. Carefully review requested data; standard balancing forms may not be acceptable.
      (3) Verify that forms are in acceptable word-searchable electronic format per Section 23 05 00 – Basic Mechanical Materials and Methods.
   b. Complete list of instruments proposed to be used
      (1) Organize in appropriate categories
      (2) Include data sheets for each
      (3) Show
         a) Manufacturer and model number
         b) Description and use when needed to further identify instrument
         c) Size or capacity range
         d) Latest calibration date
   c. Provide certification that
      (1) All instruments have been calibrated prior to tests
      (2) Instruments comply with requirements of AABC or NEBB for tests required
      (3) Agency is currently certified by AABC or NEBB
2. Do not proceed with field work until the above submittal has been approved by Architect.

E. Final Test & Balance Report

1. At least 15 days prior to Contractor's request for final inspection, submit three paper copies of final reports on approved reporting forms for review and approval by Architect. Once approved, provide required quantity of paper and electronic copies per 23 00 10 – Mechanical General Provisions.

2. Form of Final Reports
   a. Fully completed report forms for all systems specified to be tested and balanced including at a minimum all data specified herein to be recorded
   b. Each individual final reporting form must bear
      (1) Signature of person who recorded data
      (2) Signature of air balance supervisor of reporting organization
   c. When more than one certified organization performs total air balance services, firm having managerial responsibility shall make submittals.
   d. Identify instruments of all types that were used and last date of calibration of each.

1.06 PROJECT REVIEW

A. Pre-Construction Review

1. Review following documents
   a. Contract documents
      (1) Drawings
      (2) Specifications
      (3) Addenda
      (4) Change orders
   b. Design intent documents
   c. Submittal data
   d. Shop drawings
   e. Temperature control drawings
   f. Pre-functional test reports
2. Assure that design intent and all sequences of operation are clearly understood.
3. Identify potential problems from standpoint of total system balance.
4. Review of specifications for
   a. Scope of work
   b. Special requirements
   c. Items that will make balancing difficult or impossible
5. Review of Drawings for
   a. Potential problems for total system balance
      (1) Location of balancing devices
      (2) Lack of balancing devices
      (3) General System layout
      (4) Architectural features
      (5) Accessibility
   b. Most effective system balance procedures
   c. Scheduling and coordination requirements
6. Review of submittal data for
   a. Completeness of data
   b. Conformity with contract documents
   c. Special instructions for use of balancing devices
   d. Factors for flow meters
   e. Limitations affecting accuracy of measurements
   f. Balancing forms shall show design data and submittal data where different
   g. Equipment performance data and curves
7. Review of shop drawings for potential problems for total system balance, as specified above for review of the contract Drawings.

8. Review of temperature control drawings for:
    a. Thorough understanding of system functions
    b. Determining most effective total system balance procedure for minimum control manipulation
9. Submit report recommending addition and/or relocation of balancing devices, including, but not limited to
    a. Volume dampers
    b. Balancing valves
    c. Flow metering devices, for air
    d. Pressure and temperature measuring points

B. Construction Review

1. Make on-site visits during progress of construction: Number of visits to be as required to perform the functions specified below.
2. Purpose of review
    a. Identify potential problem for performing total system balance
    b. Identify modifications that will affect air total system balance
    c. Schedule and coordinate total system balance with other work
    d. Identify conditions that could create hazardous environment for building occupants
3. Typical activities
    a. Check that necessary balancing and measuring hardware is
        (1) In place
        (2) Located properly and accessibly
        (3) Installed correctly
    b. Identify and evaluate variations from system design
    c. Record data from equipment nameplates
    d. Identify and report possible restrictions in systems; such as
        (1) Closed fire dampers
        (2) Long runs of flexible duct
        (3) Poorly designed duct fittings
        (4) Questionable piping connections
        (5) Others as may arise or based on Agency's experience
    e. Verify that construction progress will not delay total system balance
    f. Identify best location for duct Pitot tube traverses
    g. Identify scaffolding needs

PART 2 - PRODUCTS

2.01 TEST EQUIPMENT

A. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified herein. If not otherwise noted, the following minimum requirements apply

1. Volt-meter: plus or minus 1 percent scale
2. Ammeter: plus or minus 1 percent scale
3. Ohmmeter: plus or minus 0.1 percent scale for calibrating plus or minus 0.4 degrees Fahrenheit resistance temperature sensors, plus or minus 0.25 percent scale for calibrating plus or minus 1 degrees Fahrenheit temperature sensors, plus or minus 1 percent scale for measuring motor current
4. Ultrasonic time-of-travel strap-on flow sensor: plus or minus 5 percent of reading
5. Other flow sensors: plus or minus 2 percent of reading
6. Water pressure gauge: plus or minus1/2 percent scale, ASME Grade 2A

7. Watt meter, plus or minus1/2 percent scale: 3 phase split core current transducers
8. Temperature: plus or minus 0.4 degrees Fahrenheit

B. All equipment shall be calibrated within 6 months of use, or according to the manufacturer's recommended interval, whichever is shorter, and when dropped or damaged. Calibration tags shall be affixed or certificates readily available and proof of calibration shall be included reports.

PART 3 - EXECUTION

3.01 GENERAL

A. Coordinate with work of other trades.

B. Report to Architect any discrepancies or items not installed in accordance with the Contract Drawings pertaining to proper balance and operation of air distribution systems.

C. Perform testing, adjusting and balancing in accordance with AABC or NEBB standards.

D. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to Section 23 07 00 – Mechanical Insulation.

E. Mark equipment settings with paint or other suitable, permanent identification material, including damper control positions, valve indicators, and similar controls and devices, to show final settings.

3.02 AIR SYSTEM BALANCING

A. General

1. Do not operate fan systems for test or balance until spaces served have been cleaned of dust and debris, to avoid contamination of supply air or return air paths and equipment.
2. Check that filters are installed, free of bypass, and clean; type as specified herein
   a. Make allowance for air filter resistance at time of tests
      (1) Pressure drop across filter banks midway between drop for clean and dirty filters at design airflow
   b. For systems with construction prefilters and high efficiency final filters
      (1) Perform all zone level balancing with only pre-filter installed, no final filter, and system operating on 100 percent outdoor air.
      (2) Immediately prior to occupancy replace prefilters with new clean filters and install final filters. With final filters in place, perform tests of air handling unit.
3. Set adjustments of automatically operated dampers to operate as indicated.

B. Air Outlets

1. Adjust diffusers' throw pattern, grilles and registers to pattern indicated on the Drawings.
2. Test and adjust each diffuser, grille and register to within plus or minus 10 percent of design requirements
   a. Start with all dampers wide open.
   b. Adjust dampers, starting with nearest to terminal unit or fan. Make adjustments using duct mounted volume dampers rather than dampers at diffuser face unless absolutely required.
   c. At least one damper shall remain wide open at end of balance.

3. Plenum return air grilles or slots in lights: No balance required
4. Read and Report
   a. Tag each grille, diffuser and register and mark tag on copy of floor plan.
   b. For each grille, diffuser and register, indicate tag, size, type, and effective area (where applicable).
   c. Required velocity/cubic feet per minute
   d. Initially tested velocity/cubic feet per minute
   e. Finally tested cubic feet per minute after adjustments

C. Air Handling Unit Airflow Rate Readings

1. Total supply air quantities shall be determined at all of the following where applicable:
   a. Pitot traverse in the supply duct downstream, positive pressure side of the fan
   b. Pitot traverse at coil or filter bank
   c. Totaling the readings of individual air outlets
2. Total return air quantities shall be determined at all of the following where applicable:
   a. Pitot traverse in the return air duct or damper entering air handler
   b. Totaling the readings of individual air outlets, if ducted return system
3. Outside air quantities shall be determined by all of the following where applicable:
   a. Subtracting pitot traverses of supply and return ducts
   b. Pitot traverse of outdoor air intake duct
   c. Note: Balance by measurement of return air, outside air, and mixed air temperatures shall not be used due to inherent inaccuracy.
4. Test and Record
   a. Unit Data:
      (1) Unit identification.
      (2) Location.
      (3) Make and type.
      (4) Model number and unit size.
      (5) Manufacturer's serial number.
      (6) Unit arrangement and class.
      (7) Discharge arrangement.
      (8) Sheave make, size in inches, and bore.
      (9) Center-to-center dimensions of sheave, and amount of adjustments in inches.
      (10) Number, make, and size of belts.
      (11) Number, type, and size of filters.
   b. Motor Data:
      (1) Motor make, and frame type and size.
      (2) Horsepower and rpm.
      (3) Volts, phase, and hertz.
      (4) Full-load amperage and service factor.
      (5) Sheave make, size in inches, and bore.
      (6) Center-to-center dimensions of sheave, and amount of adjustments in inches.
   c. Test Data (Indicated and Actual Values):
      (1) Total air flow rate in cfm.
      (2) Total system static pressure in inches wg.
      (3) Fan rpm.
      (4) Discharge static pressure in inches wg).
      (5) Filter static-pressure differential in inches wg.
      (6) Cooling-coil static-pressure differential in inches wg.
      (7) Heat exchanger static-pressure differential in inches wg.
      (8) Outdoor airflow in cfm.
      (9) Return airflow in cfm.
      (10) Outdoor-air damper position.
      (11) Return-air damper position.

D. Apparatus-Coil Test Reports:

1. Coil Data:
   a. System identification.
   b. Location.
   c. Coil type.
   d. Number of rows.
   e. Fin spacing in fins per inch o.c.
   f. Make and model number.
   g. Face area in sq. ft..
   h. Tube size in NPS.
   i. Tube and fin materials.
   j. Circuiting arrangement.
2. Test Data (Indicated and Actual Values):
   a. Air flow rate in cfm.
   b. Average face velocity in fpm.
   c. Air pressure drop in inches wg.
   d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
   e. Return-air, wet- and dry-bulb temperatures in deg F.
   f. Entering-air, wet- and dry-bulb temperatures in deg F.
   g. Leaving-air, wet- and dry-bulb temperatures in deg F.
   h. Refrigerant expansion valve and refrigerant types.
   i. Refrigerant suction pressure in psig.
   j. Refrigerant suction temperature in deg F.

E. Constant Volume Exhaust Fans

1. See air outlet balancing above
2. Total air quantities for fan shall be determined by both
   a. Pitot tube traverse of main ducts near the fan inlet, and
   b. Totaling the readings of individual air outlets
3. Total air quantities shall be obtained within 10 percent of design by adjustment of fan speed
   a. Adjust sheaves on fans with adjustable sheaves.
   b. Change sheaves on fans with fixed sheaves. See Paragraph 3.4H.
4. Test and record
   a. Tag
   b. Manufacturer and model of fan and motor
   c. Sheave data at motor and fan; belt data
   d. Motor horsepower, rpm, volts, phase, full load amps
   e. Fan airflow rate at all locations measured, as listed above
   f. Final measured amps
   g. Inlet and outlet static pressure

3.03 ADDITIONAL ITEMS

A. Fans: If drives are not capable of being adjusted to meet required performance, inform Architect and replace sheaves as required.

3.04 SPOT CHECKING

A. Spot checks shall take place after test and balance work is complete and reports have been prepared and approved.

B. Spot checks shall be witnessed by an Architect. Schedule spot checks with Architect at least 1 week prior to proposed test date.

C. Architect shall select subsets of any tested and balanced air system to be spot-checked on the day of tests without prior notice to the Contractor.

1. Spot-checking will not require more than one working day.
2. If additional spot checks are requested by the Architect causing the time limit above to be exceeded, inform Architect and indicate added price to perform the additional tests. Do not include additional tests in initial bid.

D. Discrepancies

1. If any of the spot-check measurements differ more than 25 percent from those documented in test and balance reports, the Agency shall completely rebalance the associated system. For balance discrepancies at or downstream of a VAV box, rebalance only is required at or downstream of that box.
2. If discrepancies as described above are found on more than 25 percent of the spot-checks for air systems, all air systems shall be rebalanced.
3. Rebalance work shall be witnessed by the Architect at the option of the Architect.
4. All rebalance work shall be documented and documentation shall be resubmitted as specified above.
5. All rebalance work shall be provided at no additional cost to the Owner.

3.05 TRAINING OWNER PERSONNEL

A. Go over the final Testing, Adjusting and Balancing Report, explaining the layout and the meanings of each data type.

B. Discuss any outstanding deficient items in control, ducting, piping or design that may affect the delivery of air.

C. Identify and discuss any systems or system components that are not meeting their design capacities.

D. Discuss any temporary settings and steps to finalize them for any areas that are not finished or fully occupied.

E. Any other appropriate points that may be helpful for facilities operations, relative to testing, adjusting and balancing or the mechanical systems.

END OF SECTION

SECTION 23 07 00 MECHANICAL INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. These heating, ventilating and air conditioning (HVAC) provisions specified herein apply to all Sections of Division 23.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 23.

1.02 SUMMARY

A. Work Included in This Section: Materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Piping insulation
2. Pipe insulation jacket
3. Ducts insulation

B. Related Sections

1. Section 23 00 10 – Mechanical General Provisions
2. Section 23 05 00 – Basic Mechanical Materials and Methods

1.03 REFERENCE STANDARDS

A. ASTM B209 – Aluminum and Aluminum-Alloy Sheet and Plate

B. ASTM C177 – Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus

C. ASTM C335 – Steady-State Heat Transfer Properties of Horizontal Pipe Insulation

D. ASTM C585 – Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe

E. ASTM C921 – Properties of Jacketing Materials for Thermal Insulation

F. ASTM E84 – Surface Burning Characteristics of Building Materials

G. ASTM E96 – Water Vapor Transmission of Materials

H. NFPA 255 – Surface Burning Characteristics of Building Materials

I. SMACNA – HVAC Duct Construction Standards - Metal and Flexible

J. UL 723 – Surface Burning Characteristics of Building Materials

K. ASTM E 814 – Standard Test Method for Fire Tests of Through-Penetration Fire Stops

1.04 QUALITY ASSURANCE

A. Source Quality Control

1. Service: Use insulation specifically manufactured for service specified
2. Labeling: Insulation labeled or stamped with brand name and number

B. Applicator: Company specializing in performing the work of this section with minimum three years experience

1.05 SUBMITTALS

A. See Section 23 00 10 – Mechanical General Provisions

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. "R" means required.
2. "R2" means required only for products and equipment differing for the specified manufacturer and model and for "or equals" where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Equipment insulation	R			
Piping insulation	R			
Jackets	R			
Duct insulation, wrap and liner	R			
Adhesives and coatings	R			
Mechanical fasteners	R			

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Insulation: fiberglass

1. Owens-Corning Fiberglass Corporation
2. Manville
3. Certainteed Corporation

C. Insulation: Elastomeric Closed Cell

1. Armstrong World Industries, Inc.
2. Rubatex Corporation
3. Aeroflex

D. Weatherproof Aluminum Jacket

1. Childers Products Company
2. Insul-Coustic/Birma Corporation
3. Industrial Insulation Sales

E. Pre-molded pipe fitting covers and Jacketing

1. Manville: Zeston
2. Childers Products Company
3. Proto Corporation

F. Adhesives

1. Foster Div. Amchem Products Inc.
2. Childers Products Company
3. Armstrong 520 Adhesive

G. Mechanical Fasteners

1. AGM Industries, Inc.
2. Miracle Adhesives Corporation
3. Grip-Nail

2.02 GENERAL

A. All insulation materials, including jackets, facings, adhesives, coatings, and accessories are to be fire hazard rated and listed by Underwriters' Laboratories, Inc., using Standard UL 723 (ASTM E-84), (NFPA-255), (ASA A2.5-1963)

1. Flamespread: maximum 25
2. Fuel contributed and smoke developed: maximum 50
3. Flameproofing treatments subject to deterioration from moisture or humidity are not acceptable

B. Insulation and accessories shall not provide any nutritional or bodily use to fungi, bacteria, insects, rats, mice, or other vermin, shall not react corrosively with equipment, piping or ductwork, and shall be asbestos free: Duct lining shall meet ASTM C1136 and ASTM C665 for biological growth in insulation

2.03 MATERIALS

A. Pipe Insulation

1. Fiberglass
   a. ASTM C547, Type I, Molded: one piece, with factory-applied, all purpose, vapor retarder jacket, maximum 0.26 K factor at 75 degrees Fahrenheit mean temperature: Owens-Corning ASJ/SSL-II Pipe Insulation or equal
   b. ASTM C553, Type II, Blanket: without facing and with all service FSK jacket manufactured from kraft paper, reinforced scrim and aluminum foil, minimum 1 lb. density, maximum 0.28 K factor at 75 degrees Fahrenheit mean temperature: Owens-Corning Faced Duct Wrap or equal

c. ASTM C612, Type 1B, Board: Density as noted with FSK all service jacket manufactured from kraft paper, reinforced scrim and aluminum foil, maximum 0.26 K factor at 75 degrees Fahrenheit mean temperature: Owens-Corning 700 Series with face or equal

2. Flexible, closed cell elastomeric thermal insulation
   a. Insulation ASTM C534
   b. Service rating of 220 degrees Fahrenheit
   c. Density 6.0 pounds per cubic foot
   d. Closed cell foam: Vapor permeability ASTM E96 0.2 perm
   e. Max moisture absorption: 1.0 percent by volume, 10 percent by weight
   f. Molded pipe insulation
      (1) Maximum 0.27 K factor at 75 degrees Fahrenheit mean temperature
      (2) Maximum water vapor transmission rating of 0.17 perm-inches
   g. Sheet insulation
      (1) Maximum 0.28 K factor at 75 degrees Fahrenheit mean temperature
      (2) Maximum water vapor transmission rating of 0.17 perm-inches
   h. Seal with Rubatex adhesive or equal: Armstrong Armaflex II or equal: Aeroflex or equal.

B. Jackets

1. Factory Applied Vapor Barrier All Service Jacket (ASJ)
   a. ASTM C921, White kraft paper bonded to aluminum foil and reinforced with glass fiber yarn
   b. Moisture Vapor Transmission: ASTM E96; 0.02 perm inches
   c. Secure with self sealing longitudinal laps and butt strips
   d. Secure vapor barrier mastic
   e. Tie Wire: See Paragraph E.1, with twisted ends on maximum 12 inch centers
2. Vapor Barrier Lap Adhesive: Compatible with insulation
   a. Canvas Jacket: UL listed
   b. Fabric: ASTM C921, 6 ounce/square yard, plain weave cotton treated with dilute fire retardant lagging adhesive
   c. Lagging Adhesive: Compatible with insulation
3. Aluminum Jacket: ASTM B209
   a. Use for weatherproof jacket
   b. Thickness: 0.016 inch sheet
   c. Finish: Embossed
   d. Joining: Longitudinal slip joints and 2 inch laps
   e. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner
   f. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum or 0.010 inch thick stainless steel
4. Preformed PVC
   a. Polyvinylchloride covers similar to Manville Zeston, Knauf, or Speedline
   b. Color: white
5. Equipment insulation facings: Foil-scrim-kraft laminate of aluminum foil facing, glass scrim reinforcing, kraft paper backing

C. Preformed Pipe Fitting Covers

1. Aluminum
   a. Factory fabricated formed covers
   b. General Aluminum Supply Corporation GASCO
   c. ITW Insulation Systems
   d. Extol Metal Fabrication

2. PVC
    a. Factory fabricated formed covers
    b. Manville Zeston
    c. Knauf Proto.
    d. Speedline

D. Adhesives and coatings

1. Foster product names and figure numbers or equal
    a. Lagging adhesive: 30-36
    b. Fiberglass: Zeston Z-Glu
    c. Vapor barrier coating: Tite-fit 30-80, UP Label, comply with MIL-C-19565C, Type II; fire and water resistant
    d. Vaporseal adhesive: 85-60
    e. Outdoor mastic: 30-90
    f. Asphalt mastic: C.I. Mastic 60-25
    g. For elastomeric insulation: 520 contact adhesive

E. Wire, banding and fastening devices

1. Wire: minimum 16 gauge copper clad annealed steel wire
2. Bands: 3/4 inches nominal width with wing seals, of minimum thickness as follows:
    a. Aluminum: 0.007 inches. Except where exposed to weather, 0.020 inches
    b. Stainless steel: 0.010 inches
3. Staples: outward clinching type of corrosion resistant steel

F. Mechanical Fasteners

1. Mild steel, copper plated
2. AGM Industries Power Base insulation pins or equal
3. Insulation washers
    a. Galvanized steel
    b. 1- 1/2 inch diameter
    c. AGM Industries SLW-1 or equal

G. Provide a continuous vapor seal for any service piping that carries liquid below 60 degrees Fahrenheit.

H. Fire-stopping

1. At pipe penetrations through rated assemblies
2. Commercial pipe sleeve assemblies that are UL listed and that have been approved by the fire marshal for this purpose
3. Insulation shall be continuous through penetration.

I. Accessories

1. Insulation Protection Saddles: 12-inch long, 16 gauge steel
2. Paint: Ultraviolet resistant latex paint with special adherence capabilities to the fitting covers, elastomeric, aluminum facing, Kraft paper, tapes and adhesives

J. Duct Insulation

1. Duct Wrap With Vapor Barrier; Type DW-V
   a. Insulation: ASTM C553 and C612; flexible, noncombustible blanket
      (1) 'K' ('Ksi') value: ASTM C518, 0.24 at 75 degrees Fahrenheit
      (2) Maximum service temperature: 350 degrees Fahrenheit
      (3) Maximum moisture absorption: 0.20 percent by volume
   b. Vapor Barrier Jacket - factory installed. (FSK)
      (1) Kraft paper reinforced with glass fiber yarn and bonded to aluminized film
      (2) Moisture vapor transmission: ASTM E96 Procedure E; 0.02 perm
      (3) Secure with pressure sensitive tape
   c. Vapor Barrier Tape: Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive
      (1) Flexible fiberglass wrap. 1-1/2 pounds per cubic foot
      (2) Installed conductance: 0.30 BTU-inch/hr/square foot/degree Fahrenheit
      (3) Factory applied jacket
         a) Foil-scrim-kraft laminate: Aluminum foil facing
         b) Glass scrim reinforcing
         c) Kraft paper backing
      (4) Maximum vapor permeance: 0.02 perms
   d. Owens-Corning All Service Faced Duct-Wrap or equal

PART 3 - EXECUTION

3.01 PIPE & EQUIPMENT INSULATION SCHEDULE

A. Insulation Application Types

1. Type P-1
   a. Molded fiberglass
   b. All-service jacket
   c. Vapor-sealed
2. Type P-1A
   a. Molded fiberglass
   b. PVC jacket
   c. Vapor-sealed
3. Type P-1B
   a. Molded fiberglass
   b. Aluminum jacket
   c. Vapor-sealed
4. Type P-2: Flexible elastomeric insulation

B. Application Schedule

Service	Type	Size	Minimum Thickness	Freeze Protection
Condensate, and sanitary sewer waste/vent piping receiving condensate (horizontal piping and first three feet of vertical piping, Underside of floor drain bodies receiving condensate)	P-2	All	1/2 inch	-
Refrigerant (suction)	P-2	All	3/4 inch	-
Domestic cold water (indoor concealed)	P-1	All	1/2 inch	-
Domestic cold water (indoor exposed)	P-1A	All	1/2 inch	-
Domestic cold water (exterior exposed)	P-1B	All	1 inch	Yes
Domestic hot water (indoor concealed)	P-1	All	1 inch	-
Domestic hot water (indoor exposed)	P-1A	All	1 inch	-
Roof drains (horizontal and first three feet of vertical piping)	P-1	All	1/2 inch	-
Roof drains (underside of roof drain bodies/bowl)	P-2	All	1/2 inch	-

3.02 INSTALLATION

A. Install materials in accordance with manufacturer's instructions

B. Coordinate with work of other trades

C. Deliver material to job site in original non-broken factory packaging, labeled with manufacturer's density and thickness

D. Install insulation where it cannot become wet. If insulation becomes wet, remove and dispose of properly and replace with new, dry insulation. Wetted insulation is not acceptable. Ensure insulation is dry before and during installation.

E. Insulate all piping, valves, fittings, flanges and accessories

F. On piping exposed to public view, locate insulation and cover seams in least visible locations

G. Insulate fittings, joints and valves with insulation of same material and thickness as adjoining pipe. Use pre-molded fiberglass fitting covers or radial mitered segments of pipe insulation. For strainers, expansion joints, fittings and accessories requiring servicing or inspection insulation shall be removable and replaceable without damage. Enclose within two-piece no. 15 gauge aluminum covers fastened with cadmium-plated bolts and nuts.

H. Insulate flanges with insulation sleeve of same material as pipe insulation to cover flange and overlap insulation on adjacent piping

I. Continue insulation through walls, sleeves, pipe hangers and other pipe penetrations

J. Finish insulation at supports, protrusions and interruptions. No hangers or supports shall be embedded in insulation. Do not insulate expansion bellows.

K. Fiberglass insulation

1. Provide insulation with factory applied vapor barrier jackets
2. Butt edges neatly. ASJ with 3 inch minimum butt strips
3. Longitudinal overlaps: Minimum 2 inch self sealing, double adhesive
4. Apply additional jacket as specified
5. For insulation with factory-applied jackets, secure laps with aluminum or stainless steel bands at 18 inches o.c.
6. For piping conveying fluids below ambient temperature finish with vapor barrier adhesive

L. Elastomeric Tubing

1. Provide insulation
2. Butt edges neatly. Seal longitudinal and transverse joints with adhesive to maintain minimum vapor permeance. Adhesive shall be selected and applied in accordance with insulation manufacturer's recommendations.
3. Apply additional jacket as specified

M. For all pipe systems exposed in the mechanical equipment rooms, finish with an all service PVC jacket

N. For exterior applications, provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

O. For buried piping, provide factory fabricated assembly with inner all-purpose service jacket with self sealing lap, and asphalt impregnated open mesh glass fabric, with one mil thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with a polyester film.

P. Perform work at ambient and equipment temperatures as recommended by adhesive manufacture

Q. Protection: Protect against dirt, water, chemical, or mechanical damage before, during, and after installation. Repair or replace damaged insulation at no additional cost

R. Paint all insulation exposed to ultraviolet light (sunlight); see Paragraph 2.3J.2

S. All vapor barriers shall be continuous. Tears, holes, staples, etc. shall be coated with vapor barrier mastic and patch with facing or tape.

T. Joints between insulation and access shall be sealed with vapor barrier mastic

U. See Section 23 23 00 – Refrigerant Piping

V. See Section 23 31 13 – Ducts

3.03 PIPE INSULATION APPLICATION

A. General

1. Before applying insulation
   a. Test piping for tightness and obtain approval
   b. Clean surfaces to be insulated of dust, grease and foreign matter

2. Butt edges neatly
3. Fill voids with insulating cement
4. Longitudinal overlaps
   a. 2 inches minimum
   b. For exposed work: toward ceiling or wall
   c. For weatherproof aluminum jackets: on side to shed water
5. Circumferential overlaps on weatherproof aluminum jackets: 2 inches minimum
6. Continuous insulation passing through sleeves or other openings
7. Oversize insulation to accommodate heat tracing on piping

B. Valves, fittings, flanges and accessory insulation

1. Unless otherwise noted, insulate
   a. Valves including bonnets
   b. Flanges
   c. Fittings
   d. Strainers
   e. Expansion joints
   f. Specialties
2. Insulation for strainers, expansion joints, fittings and accessories requiring servicing or inspection
   a. Insulation removable and replaceable without damage
   b. Enclosed within two piece, No. 18 gauge aluminum covers fastened with cadmium plated bolts and nuts
3. Insulation of same thickness as adjacent piping insulation
4. For piping systems insulated with fiberglass
   a. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
   b. When premolded insulation elbows and fittings are not available, apply mitered sections of pipe insulation (blanket insulation is not acceptable) to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire, tape, or bands.
   c. Cover fittings with heavy PVC fitting covers. Overlap PVC covers on pipe insulation jackets at least 1 inch at each end. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
5. For piping systems insulated with elastomeric thermal insulation
   a. Apply mitered sections of pipe insulation.
   b. Secure insulation materials and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.
6. Flanges
   a. Apply preformed pipe insulation to outer diameter of pipe flange
   b. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation
   c. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with the same insulation material as adjacent piping insulation
   d. Apply canvas jacket material with manufacturer's recommended adhesive, overlapping seams at least 1 inch, and seal joints with vapor-retarder mastic
7. Finish for outdoor locations only: weatherproof aluminum jacket compatible with weatherproof jacket on adjoining pipe insulation.

C. At pipe hangers

1. Insulation protection shields specified in Section 23 05 29 Hangers and Supports
2. Butt insulation to shields
3. Cold piping: Wet coat of vapor barrier lap cement on all butt joints

D. Jackets and facings

1. Vapor-sealed types: continuous; staples not permitted
2. Adhere longitudinal laps: Adhere 3 inches wide joint strip, of same material as facing, at center of each butt joint
3. Adhesives
   a. Vapor-sealed insulation: vapor-seal adhesive
   b. Heating service insulation: vapor-seal adhesive
   c. Weatherproof aluminum jacket: sealing compound
   d. Underground asphalt felt jacket: asphalt mastic

E. Wiring, banding and fastening devices: Secure insulation to piping and equipment in accordance with following minimum requirements

1. Piping insulation section 3 foot long
   a. Concealed vapor-sealed insulation banded at ends and center
   b. Other concealed insulation banded at ends and center
2. Pipe fitting insulation
   a. Loops of wire to secure mitered segments of insulation
   b. Wire spiraled on from end to end on blanket insulation
3. Outdoor piping weatherproof aluminum jackets banded at circumferential joints and center of each section: Lap joint at bottom

3.04 DUCT & PLENUM INSULATION

A. Duct Insulation Type and Thickness Schedule

Location	Cooling or Heat/Cool Supply	Return/Outdoor Air	Exhaust	Exhaust to ERV
Concealed in ceiling or return air plenum	2 inches DW-V	1-1/2 inches DW-V		1-1/2 inches DW-V
Concealed in unconditioned spaces	2 inches DW-V	1-1/2 inches DW-V	-	1-1/2 inches DW-V
Exposed within mechanical rooms	2 inches DW-V	1-1/2 inches DW-V	-	1-1/2 inches DW-V
Flex duct	By manufacturer	By manufacturer	-	
Air distribution devices (backpans of grilles, registers, and diffusers)	2 inches DW-V	1-1/2 inches DW-V	-	1-1/2 inches DW-V

3.05 DUCT INSULATION INSTALLATION

A. General
1. Ensure that insulation is continuous through all walls: See 23 05 48 Mechanical Sound and Vibration Control for packing openings through walls
2. Finish insulation neatly at hangers, supports and other protrusions
3. Locate insulation joints or cover seams in least visible locations

4. Where ducts run in groups too close to be individually insulated and finished
   a. Completely fill all spaces between ducts with rigid or flexible insulating material
   b. Insulate and finish exterior surfaces of group as specified for particular service
5. Where ducts cannot be insulated after erection, insulate prior to installation
6. Where specified thickness of insulation and/or lining exceeds available thickness in single layer, provide insulation and/or lining in 2 or more layers with joints staggered
7. Preparation
   a. Do not install covering before ductwork and equipment has been tested and reviewed
   b. Ensure surface is clean and dry prior to installation
   c. Ensure insulation is dry before and during application
8. Mechanical fasteners
   a. Use spot weld anchors in all shop fabricated internally lined ducts
   b. Adhered anchors
   c. Clip off pin penetrations flush with insulation surface or facing
   d. Seal pins and washers where pins penetrate vapor barriers
      (1) With 4 inch square pieces of vapor barrier material to match facing
      (2) Adhere with vaporseal adhesive
   e. Spacing on rectangular ducts
      (1) Typical of horizontal and vertical, unless otherwise specified
      (2) Duct Wrap

Side Dimension	Maximum Spacing
24 inches and under	None required.
25 to 32 inches	Horizontal - none. Vertical: 1 row centered, 12 inches on center
33 to 48 inches	2 rows, 12 inches on center.
49 to 60 inches	3 rows, 12 inches on center.
61 inches and over	16 inches on center, all directions.

      (3) Duct wrap spacing applicable to flat surfaces of flat oval ducts
9. Provide 24 gauge sheet metal Z section frames over edges of duct and plenum lining
   a. At access openings and doors
   b. Along edges exposed to air flow

B. Rectangular Duct Wrap

1. Without vapor barrier
   a. Comply with published recommendations of manufacturer and with following
   b. Secure with 4 inch strips of adhesive, 8 inches on center
   c. For rectangular ducts 24 inches and wider, secure to bottom of duct with mechanical fasteners 18 inches on center
   d. Wrap with 18 gauge galvanized wire, 16 inches on center
2. With Vapor Barrier
   a. Vapor barrier and sealing continuous without breaks. Vapor proof seal around supports and bracing
   b. 2 inches lap strip at one end
   c. Peel insulation for 2 inch lap strip along longitudinal joints
   d. Seal lap strips with vaporseal adhesive; Foster's 85-60 or equal

C. Round Duct Wrap

1. General
   a. Adhere flexible insulation to ductwork with adhesive applied in 6 inch wide strips on 16 inch centers
   b. Provide 16 gauge annealed tie wire tied, spiral wound or half hitched at 16 inch centers
   c. Overlap insulation 2 inches and seal joints and breaks with 2 inch lap of foil adhered over joint
2. Apply duct wrap with vapor barrier as specified above for rectangular ducts

3.06 FIELD QUALITY CONTROL

A. Repair separation of joints or cracking of insulation due to thermal movement or poor workmanship

B. All vapor barriers shall be continuous; tears, holes, staples, etc. shall be coated with vapor barrier mastic and patch with facing or tape

C. See Section 23 31 13 – Ducts for protection of lined duct during construction

END OF SECTION

SECTION 23 11 00 FUEL GAS PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. These heating, ventilating and air conditioning (HVAC) provisions specified herein apply to all Sections of Division 23.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 23.

1.02 SUMMARY

A. This Section includes fuel gas piping, specialties and accessories within the building.

1.03 PROJECT CONDITIONS

A. Site Gas System Pressure: (CONTRACTOR SHALL VERIFY)

B. Building Gas System Pressure: Primary pressure (CONTRACTOR SHALL VERIFY) reduced to secondary pressure of 8 Inch of Water Column (CONTRACTOR SHALL COORDINATE WITH ALL SUBMITTED AND APPROVED NATURAL GAS-FIRED EQUIPMENT)

1.04 RELATED WORK AND REQUIREMENTS

A. Section 23 21 14 – Piping Specialties, for pressure gages

B. Section 22 13 19 – Plumbing Specialties

1.05 SUBMITTALS

A. See Section 23 00 10 – Mechanical General Provisions

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. “R” means required.
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Piping (below ground and above ground	R			R
Valves, all types	R			R
Meters	R	R		R
Pressure regulators	R			R
Specialties	R	R		R

C. Field quality-control test reports. Indicate an interpret test results for compliance with performance requirements.

1.06 QUALITY ASSURANCE

A. FM Standard: Provide components listed in FM's Fire Protection Approval Guide if specified to be FM approved.

B. IAS Standard: Provide components listed in IAS's Directory of AGA and CGA Certified Appliances and Accessories if specified to be IAS listed.

C. UL Standard: Provide component listed in UL's Gas and Oil Equipment Directory if specified to be UL listed.

D. ANSI Standard: Comply with ANSI Z223.1 and NFPA 54 (2009 Edition), "National Fuel Gas Code."

1.07 COORDINATION

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Owner not less than seven days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's written permission.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Appliance Connector Valves
   a. Conbraco Industries, Inc.: Apollo Div.
   b. Mueller Co.: Mueller Gas Products Div.
   c. Watts Industries, Inc.: Water Products Div.
2. Gas Valves, NPS 2 and Smaller
   a. Nibco, Inc.
   b. Flow Control Equipment, Inc.
   c. Grinnell Corp.
3. Plug Valves, NPS 2-1/2 and Larger
   a. Walworth Co.
   b. Olson Technologies, Inc.; Homestead Valve Div.
   c. Milliken Valve Co., Inc.
4. Service Meters: As approved by the Utility Provider or Owner
5. Line Pressure Regulators
   a. American Meter Co.
   b. Equimeter, Inc.
   c. Fisher Controls International, Inc.
6. Appliance Pressure Regulators
   a. Eaton Corp.: Controls Div.
   b. Harper Wyman Co.
   c. Maxitrol Co.

2.02 PIPING MATERIALS

A. Steel Pipe: ASTM A 53; Type E or S; Grade B (Grade A for pipe 1-1/2 inch and smaller) Schedule 40; black.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern, with threaded ends according to ASME B1.20.1.
2. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends according to ASME B1.20.1.
3. Cast-Iron Flanges and Flanged Fittings: ASME B16.1, Class 125.
4. Steel Welding Fittings: ASME B16.9, wrought steel or ASME B16.11, forged steel.
5. Steel Threaded Fittings: ASME B16.11, forged steel with threaded ends according to ASME B1.20.1.
6. Joint Compound and Tape: Suitable for natural gas.
7. Steel Flanges and Flanged Fittings: ASME B16.5.
8. Gasket Material: Thickness, material, and type suitable for natural gas.

B. Polyethylene Pipe: All polyethylene pipe used in the Project must comply with ASTM D-2513 and be manufactured in the United States

1. Pipe and Fitting Material. All pipes shall conform to the requirements of the currently approved ASTM D-25 13 specification “Thermoplastic Gas Pressure Pipe, Tubing and Fittings.” All fittings shall conform to the requirements of ASTM D-2683 specification “Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe” or ASTM D3261 “Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.” All pipes shall be manufactured of virgin material, with the exception of the clean rework material that is generated from the manufacturer’s own production, as long as the pipe and/or fittings meet the required specifications. All pipe formulation must have suitable outdoor weather resistance. The color of all polyethylene pipes shall be either orange or yellow.
2. Pipe Design. All pipe shall be designed for direct burial as specified in D.O.T. Title 49, Part 192, “Transportation of Natural and Other Gas By Pipeline: Minimum Federal Safety Standards,” through current Amendment, for natural gas mains and services operated at 60p.s.i.g. Orless. The pipe must also be suitable for replacing old steel mains and services. The pipe must be homogeneous and be free of holes, cracks, foreign material, blisters or other deleterious faults. The minimum design stress must comply with the requirements of ASTMD-2513.
3. Any defect such as a groove, notch, or gouge, greater than ten percent (10%) of the wall thickness of the pipe, shall not be used

C. Transition Fittings: Type, material, and end connections to match piping being joined.

D. Common Joining Materials: Refer to Section 23 05 00 Basic Plumbing Materials and Methods for joining materials not in this Section.

2.03 PIPING SPECIALTIES

A. Flexible Connectors: ANSI Z21.24, copper alloy.

B. Quick-Disconnect Devices: ANSI Z21.41, convenience outlets and matching plug connector.

2.04 SPECIALTIES VALVES

A. Valves, NPS 2 and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.

B. Valves, NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.

C. Appliance Connector Valves: ANSI Z21.15 and IAS listed.

D. Gas Stops: Bronze body with AGA stamp, plug type with bronze plug and flat or square head, ball type with chrome-plated brass ball and lever handle, or butterfly valve with stainless-steel disc and fluorocarbon elastomer seal and lever handle; 2-psig minimum pressure rating.

E. Gas Valves, NPS 2 and Smaller: ASME B16.33 and IAS-listed bronze body and 125-psig pressure rating.

1. Tamperproof Feature: Include design for locking.

F. Plug Valves, NPS 2-1/2 and Larger: ASME B16.38 and MSS SP-78 cast-iron, lubricated plug valves, with 125-psig pressure rating.

1. Tamperproof Feature: Include design for locking.

G. Automatic Gas Valves: ANSI Z21.21, with electrical operator for actuation by appliance automatic shutoff device.

2.05 GAS REGULATORS

A. Description: Single stage and suitable for fuel gas service. Include steel jacket and corrosion-resistant components, elevation compensator, and atmospheric vent.

1. NPS 2 and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.
2. NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.
3. Line Pressure Regulators: ANSI Z21.80.
4. Appliance Pressure Regulators: ANSI Z21.18. Regulator may include vent limiting device, instead of vent connection, if approved by Architect

B. Pressure Regulator Vents: Factory- or field-installed, corrosion-resistant screen in opening if not connected to vent piping.

2.06 METERS

A. Coordinate with natural gas serving utility company.

PART 3 - EXECUTION

3.01 EXCAVATION

A. Refer to Division 31 – Earthwork and Grading

B. Refer to Division 31 – Trenching, Backfilling and Compacting

3.02 INSTALLATION

A. Coordinate with Work of other trades

3.03 PREPARATION.

A. Close equipment shutoff fuel gas to premises or section of piping. Perform leakage test as specified in Article entitled, Field Quality Control, to determine that all equipment is turned off in affected piping section.

B. Comply with ANSI Z223.1, paragraph entitled, Prevention of Accidental Ignition.

3.04 SERVICE ENTRANCE PIPING

A. Extend fuel gas piping and connect to fuel gas distribution for service entrance to building.

B. Install dielectric fitting downstream from and adjacent to each service meter unless meter is supported from service-meter bar with integral dielectric fitting. Install shutoff valve downstream from and adjacent to dielectric fitting. Refer to Section 23 05 00 – Basic Mechanical Materials and Methods for dielectric fittings.

3.05 PIPING APPLICATIONS

A. Flanges, unions, transitions and special fittings with pressure ratings same as or higher than system pressure rating may be used in applications below, provided compliance with the IPC is maintained.

B. Fuel Gas Piping above ground: Use the following:

1. NPS 2 and Smaller: Steel pipe, malleable-iron threaded fittings, and threaded joints.
2. NPS 2-1/2 and Larger: Steel pipe, steel welding fittings, and welded joints.

C. Fuel Gas Piping below ground:

1. Thermoplastic gas pressure pipe, tubing and fittings, ASTM D2513 with transition riser.

3.06 VALVE APPLICATIONS

A. Appliance Shutoff Valves for Pressure 0.5 psig or Less.: Appliance connector valve or gas stop.

B. Appliance Shutoff Valves for Pressure 0.5 to 2 psig: Gas stop or gas valve

C. Appliance Shutoff Valves for Pressure 2 to 5 psig: Gas valve

D. Piping Line Valves, NPS 2 and Smaller: Gas valve.

E. Piping Line Valves, NPS 2-1/2 and Larger: Plug valve or general-duty valve.

3.07 PIPING INSTALLATION

A. Refer to Section 23 05 00 - Basic Mechanical Materials and Methods for basic piping installation requirements and piping joint construction.

B. Install regulator assemblies aboveground. Include gas valve or plug valve for each assembly.

1. Install gas valve or plug valve and strainer upstream from each service pressure regulator.
2. Install service pressure regulators with vent outlet turned down and with corrosion-resistant-metal insect screen.

C. Service Entrance Piping: Extend fuel gas piping and connect to fuel gas distribution for service entrance to building.

1. Exterior service meter will be provided by gas utility.

D. Concealed Locations: Except as specified below, install concealed gas piping in airtight conduit constructed of Schedule 40, seamless, black steel pipe with welded joints. Vent conduit to outside and terminate with screened vent cap.

1. Above-Ceiling Locations: Gas piping may be installed in accessible spaces, subject to approval of authorities having jurisdiction, whether or not such spaces are used as plenums. Do not locate valves above ceilings.
2. In Partitions: Do not install concealed piping in solid partitions. Protect tubing from physical damage when installed inside partitions or hollow walls.
3. In Walls: Gas piping with welded joints and protective wrapping specified in "Protective Coating" Article in Part 2 may be installed in walls, subject to approval of authorities having jurisdiction.
4. Prohibited Locations: Do not install gas piping in or through circulating air ducts, chimneys or gas vents (flues), ventilating ducts, or elevator shafts.
   a. Exception: Accessible above-ceiling space specified above.

E. Drips and Sediment Traps: Install drips at points where condensate may collect. Include outlets of service meters. Locate where readily accessible for cleaning and emptying. Do not install where condensate would be subject to freezing.

1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use minimum-length nipple of 3 pipe diameters, but not less than 3 inches long, and same size as connected pipe. Install with space between bottom of drip and floor for removal of plug or cap.

F. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings and in floor channels, unless indicated to be exposed to view.

G. Install fuel gas piping at uniform grade of 0.1 percent slope upward toward risers.

H. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

I. Connect branch piping from top or side of horizontal piping.

J. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment, and elsewhere as indicated. Unions are not required on flanged devices.

K. Installed corrugated, stainless-steel tubing system according to manufacturer’s written instructions. Include striker plates to protect tubing from puncture where tubing is restrained and cannot move.

L. Install strainer on inlet of each line pressure regulator and automatic and electrically operated valve.

M. Install pressure gage upstream and downstream from each line pressure regulator.

N. Install flanges on valves, specialties, and equipment having NPS 2-1/2 and larger connections.

O. Install vent piping for gas pressure regulators and gas trains, extend outside building, and vent to atmosphere. Terminate vents with turned-down, reducing-elbow fittings with corrosion-resistant insect screens in large end.

P. Purging Pipes and Fittings: A combustible gas indicator shall be used when purging mains and piping. When purging gas from abandoned lines, the air and the gas must be discharged aboveground and directed away from power lines or structures. When purging air from new lines, installation of a 3/4 service saddle and non-corrodible riser is required four (4) feet from each deadend on all new installations of pipe in order to purge air from all deadends simultaneously. Release gas into new lines at a rate that will prevent formation of a hazardous mixture of gas and air or precede natural gas with a slug of inert gas.

Q. Pipe Placement and Backfill.

1. When installing polyethylene pipe, sufficient slack shall be provided to allow for possible contraction. The polyethylene pipe shall not have a bend that is less than 25 times the outside diameter of the pipe. If a bend is required that is less than 25 times the outside diameter of the pipe, then an approved polyethylene elbow fitting is required. A fusion joint shall not be placed at a bend. During extremely high temperature conditions it may be necessary to cool the pipe before the last connection.
2. No polyethylene gas line shall be installed above ground. During maintenance, repair, and tie-in work, temporary polyethylene gas lines may be used above ground.
3. The minimum clearance required between the distribution piping and other underground structures is twelve (12) inches. Trench width and minimum cover shall comply with another Section of specification, Excavation, Trenching and Backfilling for Utilities. Unless otherwise shown on plans, pipe embedment shall be select material and remainder of trench may be backfilled with spoil from trenching operation.

3.08 VALVE AND VALVE BOXES

A. Provide valves and valve boxes plumb. All boxes shall be installed flush with the finished grade. Support box with brick or other approved material. Adequate backfill shall be placed around the valve boxes and valve extension boxes to prevent any damage or settlement to the pipeline that may be transferred to the pipe through the valve box. Protective sleeves shall be installed over fusion joints and extend through the valve boxes on the polyethylene valve installations.

3.09 HANGERS AND SUPPORTS

A. Refer to Section 23 05 29 - Hangers and Supports for pipe hanger and support devices.

3.10 CONNECTIONS

A. Install piping adjacent to appliances to allow service and maintenance. Connect piping to appliances using gas with shutoff valves and unions. Install valve upstream from and within 72 inches of each appliance. Install union downstream from valve.

B. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance using gas.

C. Ground equipment

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
2. Do not use gas pipe as grounding electrode.

3.11 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each service meter, pressure regulator and specialty valve.

1. Text: In addition to name of identified unit, distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.
2. Refer to Section 23 05 53 – Mechanical System Identification for nameplates and signs.

3.12 PAINTING

A. Use materials and procedures in Division 09 – Painting

B. Paint exterior pipe, fittings, pressure regulators, specialty valves, etc.

1. Pipe and Fittings, Color: Yellow (Confirm color with Architect prior to painting)
2. Pressure Regulators, Specialty valves, Etc., Color: Red (Confirm color with Architect prior to painting)

C. Paint exposed interior pipe, fittings, pressure regulators, specialty valves, etc.

1. Pipe and Fittings, Color: Yellow (Confirm color with Architect prior to painting)
2. Pressure Regulators, Specialty valves, Etc., Color: Red (Confirm color with Architect prior to painting)

3.13 FIELD QUALITY CONTROL

A. Inspect, test, and purge piping according to ANSI Z223.1, Part 4 "Inspection, Testing, and Purging," and requirements of authorities having jurisdiction.

B. Repair leaks and defects with new materials and retest system until satisfactory results are obtained.

C. Report test results promptly and in writing to Architect.

D. Verify capacities and pressure ratings of pressure regulators, valves and specialties.

E. Verify correct pressure settings for pressure regulators.

F. Verify that specified piping tests are complete

3.14 ADJUSTING

A. Adjust controls and safety devices. Replace damaged and malfunctioning controls and safety devices.

END OF SECTION

SECTION 23 23 00 REFRIGERANT PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. These heating, ventilating and air conditioning (HVAC) provisions specified herein apply to all Sections of Division 23.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 23.

1.02 SUMMARY

A. Work included in this section: materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Refrigerant system piping

B. Related Sections

1. Section 23 00 10 – Mechanical General Provisions
2. Section 23 05 00 – Basic Mechanical Materials and Methods

1.03 REFERENCE STANDARDS

A. ANSI/ARI 495 – Refrigerant Liquid Receivers

B. ANSI/ARI 710 – Liquid Line Dryers

C. ANSI/ASHRAE 34 – Number Designation of Refrigerants

D. ANSI/ASTM B32 – Solder Metal

E. ANSI/ASTM B88 – Seamless Copper Water Tube

F. ASTM B280 – Seamless Copper Tube for Air Conditioning and Refrigeration Field Service

G. ANSI/AWS A5.8 – Brazing Filler Metal

H. ANSI/AWS D1.1 – Structural Welding Code

1.04 QUALITY ASSURANCE

A. Each length of pipe, fitting, trap, fixture or device used in any piping system shall be stamped or indelibly marked with

1. Weight or quality
2. Maker's name or mark

B. Examine piping layouts and determine requirements for piping offsets, loops or expansion joints to adequately protect systems.

1. Determine locations and design of anchors and pipe guides to maintain proper piping alignment.
2. Determine anchor reaction forces and coordinate locations of anchors with Contracting Officer.

C. Coordinate expansion and flexibility requirements of this Section with seismic bracing requirements of Section 23 05 48 – Mechanical Sound and Vibration Control.

D. Conform to ANSI/ASME B31.1

1.05 SUBMITTALS

A. See Section 23 00 10 – Mechanical General Provisions

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. "R" means required.
2. "R2" means required only for products and equipment differing for the specified manufacturer and model and for "or equals" where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Piping materials	R			R
Valves and specialties	R			R
Solder	R			

1.06 PERFORMANCE REQUIREMENTS

A. 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

PART 2 - PRODUCTS

2.01 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B 280, Type ACR.

B. Wrought-Copper Fittings: ASME B16.22.

C. Wrought-Copper Unions: ASME B16.22.

D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.

E. Brazing Filler Metals: AWS A5.8.

F. 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.

2.02 VALVES AND SPECIALTIES

A. Service Valves:

1. Body: Forged brass with brass cap including key end to remove core.
2. Core: Removable ball-type check valve with stainless-steel spring.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Copper spring.
5. Working Pressure Rating: 500 psig.

B. Solenoid Valves: Comply with ARI 760 and UL 429; listed and labeled by an NRTL.

1. Body and Bonnet: Plated steel.
2. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Threaded.
5. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch (16-GRC) conduit adapter, and 24-V ac coil.
6. Working Pressure Rating: 400 psig.
7. Maximum Operating Temperature: 240 deg F
8. Manual operator.

C. Thermostatic Expansion Valves: Comply with ARI 750.

1. Body, Bonnet, and Seal Cap: Forged brass or steel.
2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
3. Packing and Gaskets: Non-asbestos.
4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
5. Suction Temperature: See DX Coil (AHU) Schedule.
6. Superheat: Adjustable.
7. Reverse-flow option (for heat-pump applications).
8. End Connections: Socket, flare, or threaded union.
9. Working Pressure Rating: 700 psig.

D. Moisture/Liquid Indicators:

1. Body: Forged brass.
2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
3. Indicator: Color coded to show moisture content in ppm.
4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
5. End Connections: Socket or flare.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 240 deg F.

E. Replaceable-Core Filter Dryers: Comply with ARI 730.

1. Body and Cover: Painted-steel shell with ductile-iron cover, stainless-steel screws, and neoprene gaskets.
2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
3. Desiccant Media: Activated alumina.
4. End Connections: Socket.
5. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
6. Maximum Pressure Loss: 2 psig
7. Working Pressure Rating: 500 psig.
8. Maximum Operating Temperature: 240 deg F.

2.03 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.

B. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT R-410A.

A. Suction Lines NPS 3-1/2 and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

B. Hot-Gas and Liquid Lines: Copper, Type ACR, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered.

3.2 VALVE AND SPECIALTY APPLICATIONS.

A. Install solenoid valves upstream from each expansion valve and hot-gas bypass valve. Install solenoid valves in horizontal lines with coil at top.

B. Install thermostatic expansion valves as close as possible to distributors on evaporators.

1. Install valve so diaphragm case is warmer than bulb.
2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.

C. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary.

D. Install filter dryers in liquid line between compressor and thermostatic expansion valve.

E. Install flexible connectors at condensing units.

3.3 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 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. 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 – Mechanical System Identification.

R. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 23 05 00 – Basic Mechanical Materials and Methods.

S. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 23 05 00 – Basic Mechanical Materials and Methods.

T. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 23 05 00 – Basic Mechanical Materials and Methods.

3.4 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. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or soldering, to prevent scale formation.

D. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."

E. 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 BAg, cadmium-free silver alloy for joining copper with bronze or steel.

3.5 HANGERS AND SUPPORTS

A. Hanger, support, and anchor products are specified in Section 23 05 29 Hangers and Supports.

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
2. 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.
7. NPS 2-1/2: Maximum span, 108 inches; minimum rod size, 3/8 inch.

D. Support multifloor vertical runs at least at each floor.

3.6 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 dry nitrogen to the required test pressure.
    b. System shall maintain test pressure at the manifold gage throughout duration of test.
    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.

3.7 SYSTEM CHARGING

A. Charge system using the following procedures:

1. Install core in filter dryers after leak test but before evacuation.
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 with a new filter-dryer core in charging line.

3.8 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.

D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:

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.

E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION

SECTION 23 31 13 DUCTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. These heating, ventilating and air conditioning (HVAC) provisions specified herein apply to all Sections of Division 23.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 23.

1.02 SUMMARY

A. Work included in this section: materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Ductwork
2. Fasteners and Sealants
3. Exceptions: Where integral with manufactured piece of equipment

B. Related Sections

1. Section 23 00 10 – Mechanical General Provisions
2. Section 23 05 00 – Basic Mechanical Materials and Methods

1.03 REFERENCE STANDARDS

A. SMACNA HVAC Duct Construction Standards, latest edition

1.04 DEFINITIONS

A. Seam: locks or weld applied longitudinally to close section of duct, for example longitudinal seam, spiral seam.

B. Joint: abutting connection between duct sections for continuity of air passage, for example cross joint, transverse joint, coupling.

C. Reinforcement: hardware applied to strengthen duct, for example girth angles, tie rods, fasteners (not connectors), and the like.

D. Stiffening: folding, bending, beading, crossbreaking or corrugating of sheets to achieve strength through shape, for example pocket lock secures joint and is transverse stiffener, with girth angle and fasteners applied (not connectors), joint or stiffener is reinforced.

E. Duct Classification

1. Velocity
   a. Low: to 2000 feet per minute
   b. High: above 2000 feet per minute
2. Pressure classification: except as indicated on the Drawings
   a. Low: to 2 inches water gage
   b. Medium: above 2 inches to 6 inches water gage. Default 3 inches if not otherwise indicated on the Drawings
   c. High: above 6 inches water gage

1.05 QUALITY ASSURANCE

A. Regulatory Requirements

1. Entire ductwork system, including materials and installation, installed in accordance with NFPA 90A
2. Ductwork and components shall be listed as U.L. 181, 181A and 181B, Class I air duct, flame rating not to exceed 25 and smoke rating not to exceed 50.
3. Flues shall conform to the requirements of NFPA-211. Products shall be listed to UL-103 and shall carry the appropriate UL listing mark or label.

1.06 QUALITY ASSURANCE

A. See Section 23 00 10 Mechanical General Provisions

B. Submit product data, O&M data, and samples and show item on shop and coordination drawings according to the following table.

1. "R" means required
2. "R2" means required only for products and equipment differing for the specified manufacturer and model and for "or equals" where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Ductwork materials and fittings	R			R
Flexible ducts	R			R
Duct sealants	R			
Duct pressure testing reports		R		

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Spiral oval and round ducts

1. United Sheet Metal Division, United McGill
2. Semco Manufacturing, Inc.
3. Eastern Sheetmetal

C. Duct Connection Systems

1. Ductmate Industries, Inc.
2. Fabriduct Transverse Duct Connection system
3. Ward Industries, Inc.

D. Flexible Connections

1. Ventfabrics
2. Duro Dyne
3. Ductmate Industries, Inc.

E. Flexible Ducts

1. Thermaflex
2. Hart & Cooley
3. Flexmaster

F. Duct Sealants

1. United Sheet Metal Division United McGill Corporation
2. Hardcast Corporation, Inc.
3. 3M

G. Flexible Duct Clamps

1. Panduit
2. Dura Dyne
3. Young Regulator Company

H. Hi-Efficiency Branch Take-Off Fittings

1. Flexmaster
2. Crown
3. Sheet Metal Connectors

2.02 MATERIALS

A. Galvanized Steel Sheet Metal

1. Cold rolled soft steel sheets
2. ASTM A653 and A924
3. Galvanizing: 1-1/4 ounces per square foot, total both sides
   a. General: G-90
   b. Exposed to weather: G-90
   c. Plenum walls and blank-offs where in contact with cooling coil: G-90
4. Lock-forming quality

B. Miscellaneous Products

1. Screws and rivets
   a. Same material as sheet, except as indicated on the Drawings
   b. On aluminum sheets, provide cadmium plated or stainless steel
   c. Zinc or cadmium plated, permitted on galvanized sheets
   d. Minimum screw size: No. 10
   e. Minimum rivet size: 4 pound
2. Duct Sealants
   a. Sealing compound: UL-181 approved, Safetee Duct Sealant 32-17, Foster Products Corporation, Design Polymerics DP-1010, or equal
   b. Tape: Nashua or equal, comply with UL 181B
   c. Gaskets
      (1) Continuous, reinforced, inert self-conforming type
      (2) 1/8 inch thick
      (3) Width: to match angle connection.
      (4) 3M Weatherban Ribbon Sealant PF5422 or equal
3. Hard-setting joint tape, two-part
   a. Two part tape
   b. Mineral impregnated woven fiber tape

c. Impregnated with activator/adhesive of polyvinyl acetate type
d. UL Listed
e. Flame spread: 10
f. Smoke contributed: 0
g. Equal to Hardcast RTA-50 sealant and DT-5400 4 inch tape

4. Spring Fasteners
   a. Oval head stud and receptacle
   b. Screwdriver slot
   c. Self-ejecting
   d. Dzus or equal
5. Angles, tie rod and shapes for reinforcing ducts: In accordance with SMACNA HVAC Duct Construction Standards, except as indicated on the Drawings
6. Duct connection system
   a. Transverse bolted duct joints
   b. Flanges with permanent, non-hardening sealant
   c. Ductmate Industries Ductmate 25 and 35, Fabriduct TDC, or equal

C. Flexible Connections

1. Conforming to UL Standard No. 214 and NFPA 90A
2. SMACNA HVAC Duct Construction Standards, except as indicated on the Drawings
3. With metal edges at each end: No. 24 USSG galvanized steel
4. Length of fabric connections
   a. Minimum: 4 inch
   b. Maximum: 10 inch
5. Materials
   a. Coated glass fabric
   b. Flame spread rating: 25
   c. Smoke development rating: 50
   d. 30 ounces per sq yard
   e. Sewed and cemented seams
   f. Indoors
      (1) Neoprene
      (2) Ventfabrics, Inc. Ventglas, Duro-Dyne or Ductmate

D. Turning vanes

1. Galvanized steel ductwork: galvanized steel or painted black steel, except as indicated on
   the Drawings
2. Other ductwork: same material as ductwork
3. Construction per SMACNA HVAC Duct Construction Standards for
   a. Single wall vanes with 3/4 inch trailing edge
   b. Double wall vanes: Not acceptable
   c. Vane length: Provide separate equal size sections for vane length greater than those indicated in referenced Standards.
   d. Vane runners: Type 1 or 2 acceptable
4. Vane radius
   a. 2 inch radius: duct width up to 36 inches
   b. 4-1/2 inch radius: duct with 36 inches or larger
5. Vane shall be at the correct angle for airflow (leading edge in line with the entering duct section; leaving edge in line with existing duct section). If only 45° angles are available, turning vanes shall only be used in 90° elbows where the entering width equals the exiting width; all other elbows shall be full radius type unless otherwise indicated on the drawings.

E. Low pressure round duct take-off fittings in rectangular duct

1. Factory-fabricated hi-efficiency take-off fitting
2. 26 gage body, G90 galvanized steel
3. 1” wide mounting flange with fully closed corners and pre-punched screw holes, adhesive coated gasket on flange.
4. Balancing damper
   a. 20 gage blade
   b. G90 galvanized steel 3/8 inch square control shaft.
   c. Nylon shaft bearings/bushings
   d. 2 inches high insulation stand-off
   e. Duro Dyne KR-3 Locking hand quadrant, Greenheck or Ruskin
5. No scoop allowed for any application
6. Flexmaster STOD, Ductmate, or Royal Metal Products

2.03 RECTANGULAR DUCT

A. General: Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction with galvanized sheet metal, according to SMACNA’s “HVAC Duct Construction Standards – Metal and Flexible.” Comply with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.

1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure classification.
2. Materials: free from visual imperfections such as pitting, seam marks, roller marks, stains, and discolorations.

B. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches and larger and 0.0359 inches thick or less, with more than 10 square feet of unbraced panel area, unless ducts are lined.

2.04 ROUND AND OVAL DUCTWORK

A. General

1. Factory-fabricated spiral lock seam duct
   a. Snap lock is not acceptable
   b. Factory-fabricated longitudinal seam acceptable for ducts larger than standard factory sizes
   c. Ducts up to 20 Inches in Diameter: Interior, center-beaded slip coupling, sealed before and after fastening, attached with sheet metal screws.
   d. Ducts 21 to 72 Inches in Diameter: Three-piece, gasketed, flanged joint consisting of two internal flanges with sealant and one external closure band with gasket.
   e. Ducts larger than 72 Inches in Diameter: Companion angle flanged joints per SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," Fig. 3-2.
   f. Round Ducts: Prefabricated connection system consisting of double-lipped, EPDM rubber gasket. Manufacture ducts according to connection system manufacturer's tolerances.

2. Fittings
   a. Same material and construction as duct in which installed
   b. For ductwork exposed to occupant view, do not use fabricated fitting at taps to VAV boxes and outlets. Instead use saddle tap cut into continuous spiral duct. Intent is for spiral duct to be continuous for aesthetic reasons. Saddle tap flange shall be 0.5 inches or less.
   c. 90 degree tees, laterals, and conical tees
      (1) Fabricate to comply with SMACNA's "HVAC Duct Construction Standards – Metal and Flexible", with metal thicknesses specified for longitudinal-seam straight ducts.
      (2) Center-line take-off, unless otherwise indicated on the Drawings
   d. Elbows
      (1) Seams
         a) 4 inch and higher pressure class and all ducts exposed to occupant view: continuously welded seams
         b) 1 inch to 3 inch pressure: spot welded with bonded (sealed) seams
      (2) Gores
         a) 2 gores - less than or equal to 30 degrees
         b) 3 gores - 31 degrees through 45 degrees
         c) 4 gores – 46 degrees through 60 degrees
         d) 5 gores - over 61 degrees

2.05 FLEXIBLE DUCTS

A. Flexible ducts
   1. Use only where indicated on the Drawings
   2. UL 181, Class I Air Duct
   3. Labeled for compliance with IMC
   4. Minimum working pressure
      a. 0 to 4 inch positive static pressure class: 4 inches
      b. 0 to 1 inch negative static pressure class: 1 inch
   5. Acoustic Performance
      a. Regenerative noise due to air turbulence within the duct shall not exceed the following sound power levels for a 12 inch diameter duct with an air speed of 1,000 feet per minute.

Sound Power Levels, dB re. 10^{-12} Watts, at Octave Band Center Frequency, Hz

	125	*250*	*500*	*1000*	*2000*
Maximum Regenerative Noise	*30*	*31*	*30*	*22*	*20*

   6. Insulated Flexible Duct
      a. Chlorinated polyethylene (CPE) inner liner duct permanently bonded to a vinyl or zinc coated spring steel wire helix
      b. Fiberglass insulating blanket; minimum R-value
         (1) Ducts outside the conditioned space and in conditioned envelope: 4.2
         (2) Ducts outside conditioned space and conditioned envelope: 8.0
      c. Low permeability outer vapor barrier of fiberglass bi-directional reinforced metallized film laminate
      d. Flexmaster Type 8M

7. Uninsulated Flexible Duct
   a. Woven fiberglass fabric with flame retardant coating permanently bonded to a vinyl or zinc coated spring steel wire helix
   b. Flexmaster Type 4NI

B. Flexible ductwork clamps

1. Straps listed for use with flexible ductwork
2. Stainless-steel strap with cadmium-plated hex screw to tighten band with a worm-gear action.
   a. Adjustable toggle type
   b. Dura Dyne Dyna-Clamps, Thermaflex, or Flexmaster

PART 3 - EXECUTION

3.01 INSTALLATION

A. Coordinate with work of other trades

3.02 DUCT CLASSIFICATION

A. Minimum operating pressure for each duct system, general

1. Scheduled static pressure for each fan or unit, positive or negative, unless otherwise indicated on the Drawings
2. Adjust upward to nearest pressure class tabulated in SMACNA HVAC Duct Construction Standards

B. Static pressure class, unless otherwise indicated on the Drawings

Application	SMACNA Pressure Class
Discharge of air handlers through air distribution device	2 inches
Exhaust	-2 inches
Return	-2 inches
Other fans systems	Per fan static
Return air transfers	1 inch negative

3.03 DUCTWORK INSTALLATION

A. General

1. Install ducts in accordance with manufacturer's written installation instructions
2. Ductwork exposed to occupant view shall be run straight and true, in line with building elements. No sagging or out-of-true straight runs shall be acceptable. Sidewall taps and duct joints shall be clean and free of visual blemishes and all sealant shall be internal to joint and not visible. Ducts shall have no external markings or tags. All duct beads shall be parallel.
3. Construct with gages, joints, bracing, reinforcing, and other details per latest IMC, ASHRAE, SMACNA and NFPA, unless specified otherwise
   a. Comply with most stringent
   b. Provide ducts with IMC gages or thicker when traversing rated corridors
   c. Combustion air ducts: Minimum 24 gage

4. Construct of galvanized sheet metal, except where otherwise indicated herein or on Drawings
5. Provide for duct rigidity by either of these methods
   a. Beading at 12 inches on center, maximum
   b. Crossbreak outward in ducts having positive internal pressure
   c. Crossbreak inward in ducts having negative internal pressure
      (1) Exception: All ducts exposed to rain shall outward crossbreak on top of the duct.
6. Duct dimensions indicated are outside duct dimensions (OD) unless indicated on the Drawings as inside dimension (ID or net, clear dimension).
7. Alter duct sizes on basis of equal friction where required to facilitate installation. Reflect changes in shop drawings for review by Architect.
8. At duct penetrations of walls, floors and ceilings where exposed to occupant view, provide sheet metal angle type escutcheons with no sharp corners or edges
   a. Clearance from duct to opening shall not exceed 2 inches
   b. Escutcheons shall overlap wall, floor, or ceiling surface by ½ inch minimum
9. Frame, trim, caulk and seal all duct penetrations through acoustical walls and partitions
10. Tapers
    a. Pitch sides of duct in diverging or converging airflow maximum of 1 to 4 taper
    b. Abrupt, bushing type fitting not allowed
11. Duct openings
    a. Provide openings where required to accommodate thermometers, smoke detectors, controllers, and the like. Insert through airtight rubber grommets.
    b. Where openings are provided in insulated ductwork for insertion of instruments, install insulation material inside metal ring for use as plug.
    c. At fire dampers allow adequate length of duct to install access door.
12. Avoid penetration of ducts; provide airtight seal at unavoidable penetrations of hanger rods
13. No exposed sharp metal allowed
    a. All exposed pins, screws and sharp objects shall be covered with hardening silicon
    b. All exposed sheet metal edges shall be hemmed with exposed corners rounded smooth
    c. Remove all sheet metal fish hooks
14. Flexible Connections
    a. Coated glass fabric
    b. For indoor or outdoor use
    c. Use diaphragm type at plug fan inlets
    d. Install at connections to fans and air handling units and as indicated on Drawings
    e. 2 inch slack in fabric; install to allow minimum movement of 1 inch in both tension and compression
    f. Protect from direct solar and rain exposure with sheet metal shroud where outdoors
15. Volume dampers: Install dampers as specified in Section 23 33 00 – Duct Accessories

B. Elbows and Splits

1. Use radius elbows in rectangular ducts unless otherwise indicated on the Drawings: Centerline radius dimension shall not be less than 1-1/2 duct width

2. Where space does not permit duct radius specified above install short radius splitter vanes per SMACNA HVAC Duct Construction Standard
   a. Number of vanes determined by ratio of inner radius (R) to duct width in plane of radius (W)
   b. One vane: Radius to width ratio above 0.3
   c. Two vanes: Radius to width ratio between 0.1 to 0.3
   d. Three vanes: Radius to width ratio 0.1 and smaller
3. Use square turns with turning vanes in rectangular ductwork, unless otherwise indicated on the Drawings, at following locations
   a. Use only where full radius elbow cannot fit
   b. Use only in ducts with 2000 fpm or less design velocity
   c. In high and medium pressure ductwork spot weld turning vane to duct

C. Rectangular Duct Joints

1. Transverse Joints
   a. In medium pressure ductwork shall be Fabriduct TDC or Ductmate or equal
   b. In low pressure ductwork shall be Fabriduct TDC or equal except that ducts under
      19 inches longest side may be slip & drive (S&D)
2. Longitudinal seams shall be Pittsburgh. Snap lock not allowed

D. Plenum walls, blank-offs, and casings

1. Construct per SMACNA HVAC Duct Construction Standard, Casings and Plenums
2. Static pressure class
   a. Upstream of fan: -2 inches
   b. Downstream of fan: fan static pressure or greater
3. Seal all joints, edges, and penetrations as per HVAC ducts as specified herein.

E. Round and oval ductwork

1. Joints between ducts
   a. Made with beaded sleeve joints as scheduled
   b. Duct sealer applied to male end
   c. Mechanically fastened with sheet metal screws or pop rivets
   d. Over joint and screw or rivet heads, apply coating of duct sealer.
      (1) Duct where exposed to occupant view: Sealant shall be within joint only and not visible
2. Joints, duct and fitting
   a. Slip projecting collar of fittings into duct: Per SMACNA HVAC Duct Construction Standard
   b. Apply duct sealer: Seal and tape as specified above
   c. Mechanically fasten: Fastening schedule: Per SMACNA HVAC Duct Construction Standard
3. Branch take-offs
   a. Medium pressure: 45 degrees (fittings)
   b. Low pressure: straight 90 degrees (fittings)
4. Horizontal supports
   a. One or two piece clamp band strap
   b. Minimum: one per section
   c. Support fittings as required to prevent sagging

5. Vertical Supports: one of the following
   a. Clamp bands with extended ends supported by floor
   b. Clamp bands with knee bracing
   c. Pedestal at base of vertical

F. Flexible ductwork

1. Return or exhaust air.
2. Continuous, single pieces
3. Length
   a. Low pressure
      (1) Maximum 5 feet, except where longer lengths are indicated on drawings. Where longer lengths are shown, the last 3 feet to 5 feet shall be wire flex duct and remaining ductwork shall be aluminum flex duct.
      (2) Minimum length: 3 feet
4. End Connections
   a. Connect to duct collars, terminal unit connections and round air outlets per manufacturer's instructions
   b. Secure with strap clamps specified above
5. Installation
   a. Support adequately to avoid excessive droop
   b. Minimum inside bending radius not less than one duct diameter
   c. Install as straight as possible except as shown on drawings for sound attenuation
   d. Cut ducts to lengths required rather than create bends to take up excess lengths except as shown on drawings for sound attenuation

G. Grille connections

1. Provide at entry to diffuser collar either
   a. Straight duct for 1 duct diameters or greater
   b. Full radius elbow
   c. Side inlet plenum
      (1) Height: 4 inches minimum taller than top of grille to provide room for uniform airflow to grille
      (2) Width/length: 2 inches wider than duct or round diffuser collar, whichever is larger
      (3) Internal surfaces lined with minimum 1/2 inch thick Type AL duct liner as specified under Section 23 07 00 – Mechanical Insulation
      (4) At contractor’s option, where plenum is required at round neck diffuser, square neck diffuser with length and width equal to diffuser diameter may be substituted
   d. Flexmaster FlexRight Elbow or equal
2. Connections at grilles shall be insulated to the extent the duct is insulated including the final register box.
3. Seal connections at grilles per seal class of upstream ductwork.

H. Duct hangers and supports

1. General
   a. port horizontal ducts with hangers of size and spacing as indicated in pertinent SMACNA HVAC Duct Construction Standards
   b. Attachment to structure: See Section 23 05 29 – Hangers and Supports

2. Horizontal Duct Supports
   a. Install hangers at each change in direction of duct
   b. Strap hangers
      (1) Extend strap down both sides of ducts
      (2) Turn under bottom one inch minimum
      (3) Metal screw hangers to
         a) Bottom of duct
         b) Upper and lower sides of ducts
         c) Not more than 12 inches on center
   c. Angle hangers
      (1) Provide angle hangers formed by extended vertical bracing angles
      (2) Or by rods connecting to bottom angles if size or bracing angles conform to hanger schedule
3. Vertical duct supports
   a. Support vertical ducts at every floor
   b. Use angles or channels mechanically fastened to ducts with screws or pop rivets.
   c. Set angles or channels on floor slab or structural steel members placed in opening, unless otherwise indicated on the Drawings

I. Joint Sealing

1. Seal ducts per the Seal Levels tables below
   a. Provide more stringent sealing if required to meet requirements of herein.

Seal Level Requirement				
Duct Location	Duct Type			
	Supply		Exhaust	Return
	≤2 in. water column[b]	>2 in. water column[b]		
Outdoors	A	A	A	A
Unconditioned Spaces	A	A	A	A
Return Air Plenums	A	A	A	A
Conditioned Spaces	A	A	A	A

[b] Duct design static pressure classification.

Seal Level Definitions	
Seal Level	Sealing Requirements
A	All transverse joints, longitudinal seams, and duct wall penetrations
B	All transverse joints and longitudinal seams
C	Transverse joints only

Longitudinal seams are joints oriented in the direction of airflow. Transverse joints are connections of two duct sections oriented perpendicular to airflow. Duct wall penetrations are openings made by any screw fastener, pipe, rod or wire. Spiral lock seams in round and flat oval duct need not be sealed. All other connections are considered transverse joints, including but not limited to taps and other branch connections, access door frames and jambs, duct connections to equipment, etc.

2. Ducts not exposed to weather: Seal using one of the following:
   a. Duct sealer
   b. Gasketted TDC or Duct-Mate

c. Flexible duct
(1) Secure with straps or clamps as specified herein.
(2) Supplement with duct tape, both inner and outer liner.

3. Indoor duct where exposed to occupant view: Sealant shall be within joint only and not visible
4. Fire and fire/smoke dampers: Sealant shall be listed as approved on manufacturer's UL installation sheet.
5. Seal punched holes and corner cracks
6. Seal all factory fabricated ducts, including transverse joints on gored elbows
7. Seal end caps
8. After installation and testing reseal joints found to be leaking at no additional cost to the Owner. See Paragraph 3.7.

3.04 DUCT PRESSURE TESTING

A. Scope of Testing

1. HVAC Ductwork and Plenums
a. Supply
(1) Test only 1-inch (positive or negative) pressure class and greater Standard 90.1 requires 3 inches and above.
(2) Test representative sections totaling no less than 100% of the total installed duct area for the designated pressure class in each system: Duct sections to be tested are to be chosen by Architect. Do not proceed with tests until test sections are designated.
(3) Test field installed supply fan plenums
b. Return: Required, same as supply above
c. Exhaust: Required, same as supply above
d. Outdoor air: Required, same as supply above

B. General

1. Pretesting shall be conducted prior to conducting test in presence of Architect. Once all required ductwork has passed the pretest duct pressure test, the Architect shall be notified to visit the site for witness testing.
2. Use portable high pressure blower and necessary instruments to indicate amount of leakage
3. Conduct tests as prescribed in SMACNA HVAC Air Duct Leakage Test Manual, and make test before duct sections are concealed
4. Procedure
a. Seal openings in ducts and plenums to be tested.
b. Connect test apparatus to test section using flexible duct connection or hose.
c. Close damper on blower suction side, to prevent excessive buildup of pressure.
d. Start blower and gradually open damper on suction side of blower.
e. Build up pressure in test section equal to static pressure class.
f. Noise generated from duct leakage not acceptable. Seal as required.

g. Determine amount of air leakage by makeup air flow measurements:
(1) Maximum permitted leakage for HVAC ductwork shall be:

$$CFM_{max} = \left(\frac{A}{100}\right) C_L P^{0.65}$$

Where,

CFM_{max} = The maximum permitted leakage, cubic feet per minute (cfm).
A= Surface area of the tested duct sections, square feet.
C_L= Duct leakage class, cfm/100 square feet at 1 inch water column.
= 6 for rectangular sheet metal, rectangular fibrous ducts, and round flexible ducts
= 3 for round/flat oval sheet metal or fibrous glass ducts
P= Test pressure which shall be equal to the design duct pressure class rating, inches water column.

(2) Allowable leakage can also be calculated as 1 percent of the design operating air volume for the entire system. If this method is used, the total system leakage must first be determined and then compared with the 1 percent (of system volume flow) allowable leakage. Acceptance is indicated if the actual measured leakage of the entire system is less than the calculated allowable leakage.
(3) Maximum permitted leakage for life safety ductwork shall be per IMC.
(4) If leakage exceeds permitted limit, repair leaks and retest duct sections at no additional cost to the Owner until permitted leakage limits are obtained.

5. Visually mark tested sections with certification sticker and initials of field test inspector.

C. Documentation

1. Submit certification of test results of compliance to Commissioning Authority.
2. Include certified test results showing compliance per Section 23 00 10 – Mechanical General
3. Provisions.

3.05 PROTECTION

A. Adhere to SMACNA Duct Cleanliness for New Construction Guidelines for Intermediate Level Duct Cleanliness unless more stringent requirements are indicated herein.

B. Storage: Porous materials, such as lined and flexible duct, shall be stored where they will not be exposed to rain or other moisture sources.

C. Temporary closure: Provide temporary closure of polyethylene film or other covering which will prevent entrance of dust and debris at the following conditions:

1. Exposed ends of unlined installed ducts at the end of each day
2. Exposed ends of lined ducts or plenums whether in storage or installed

D. Duct cleaning

1. Using the connected fan(s) force air at high velocity through duct to remove accumulated dust
2. Protect equipment and spaces, which may be harmed by excessive dirt with filters, or bypass during cleaning
3. In areas, which must be kept dust free, seal all outlets duct tight. When closures are removed avoid spilling dust in room

3.06 INSPECTION

A. Verify that adequate clearance between ducts and adjacent walls or equipment is available to permit proper sealing, maintenance and repairs.

3.07 TESTING AND ADJUSTING

A. Before starting the duct systems: Clean the duct system

B. After starting the duct systems: Check for noise and leakage. Repair as required at no additional cost to the Owner.

C. See Section 23 05 93 – Testing, Adjusting, and Balancing: Coordination with Balance Agency:

1. Provide services of a sheet metal installer familiar with the system ductwork to provide assistance to the balancing agency during the initial phases of air balancing in locating all sheet metal dampers
2. Install missing dampers

END OF SECTION

SECTION 23 33 00 DUCT ACCESSORIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. These heating, ventilating and air conditioning (HVAC) provisions specified herein apply to all Sections of Division 23.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 23.

1.02 SUMMARY

A. Work included in this section: materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Access Doors
2. Balancing and Automatic Dampers
3. Fire dampers
4. All duct accessories except, where integral with manufactured piece of equipment.

B. Related Sections

1. Section 23 00 10 – Mechanical General Provisions
2. Section 23 05 00 – Basic Mechanical Materials and Methods

1.03 QUALITY ASSURANCE

A. Fire, smoke, and fire/smoke dampers shall be UL listed and constructed in accordance with UL Standard 555 Fire Dampers and UL Standard 555S.

B. Demonstrate operation of smoke dampers to authorities having jurisdiction and Architect as part of life safety testing.

C. Access doors shall be UL labeled.

D. Damper pressure drop and leakage ratings shall be based on tests and procedures performed in accordance with AMCA 500 - Test Methods for Louvers, Dampers and Shutters.

1.04 SUBMITTALS

A. See Section 23 00 10 Mechanical General Provisions

B. Submit product data, O&M data, and samples and show item on shop and coordination drawings according to the following table.

1. “R” means required
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Access doors	R2			R
Balancing dampers	R2			R
Automatic dampers	R	R		R
Backdraft dampers	R2			R
Fire dampers	R	R		R
Wall louvers	R			R
Combination louvers/dampers	R	R		R
Condensate pumps	R	R		
Belt guards	R2			

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers
are acceptable.

B. Access Doors, Ducts

1. Ventfabrics, Inc.
2. Duo Dyne, Corporation
3. Ruskin Mfg. Company

C. Balancing and Automatic Dampers

1. Ruskin Manufacturing Company
2. Air Balance Inc.
3. Johnson Controls

D. Backdraft Dampers

1. Greenheck Fan Corp
2. Ruskin Manufacturing Company
3. Air Balance, Inc.

E. Damper Hardware

1. Ventfabrics, Inc.
2. Duo Dyne, Corporation
3. Young Regulator Company

F. Fire Dampers

1. Ruskin Manufacturing Company
2. Greenheck Fan Corp.
3. Air Balance Inc.

2.02 DUCT ACCESS DOORS

A. In accordance with SMACNA Duct Construction Manuals, except as indicated in the Drawings

B. In ductwork
1. Construction
a. Galvanized steel
b. Rating same as duct pressure class
c. Where duct is insulated
(1) Fiberglass insulation, thickness to match duct insulation installed R-value, see 23 07 00 – Mechanical Insulation
(2) Double wall
d. Removable type with safety chain linking door permanently to frame
e. Positive seal polyethylene gasket
f. Paired progressive cam-locks, quantity as required for tight, low leakage fit
g. No tools required for opening and closing
2. Size
a. 20 inches x 14 inches unless otherwise indicated in the Drawings
b. Ducts less than 16 inches: one dimension 20 inches; other dimension 2 inches less than duct width
c. Larger sizes where required for access
3. Provide in following locations
a. Coils in ducts (including at VAV boxes)
(1) Entering and leaving side for cooling coils
(2) Entering side for heating coils
b. Automatic dampers: linkage side
c. Smoke dampers
d. Fire dampers
e. Smoke detection heads
f. At the top of each lined duct riser accessible from the fan room floor (for inspection of duct liner)
g. Fan bearings enclosed in ducts
h. Sprinkler heads in ducts
i. Motors, actuators or other accessories that require access or service inside ducts
j. Outdoor air plenums as required to clean plenum from dirt and debris.
k. Where otherwise indicated on the Drawings

2.03 DAMPERS

A. Volume Dampers

1. Conform to requirements of SMACNA HVAC Duct Construction Standards.
2. General
a. Blades of same material as duct where damper is located
b. Damper Hardware
(1) Ventlok 400 and 4000 series or equal; for low pressure systems 2 inch SMACNA pressure class and less
(2) Ventlok HiVel hardware or equal; for greater than 2 inch SMACNA pressure class
c. Actuating quadrants typical for single and multi-blade dampers; provide closed bearing on opposite end from quadrant to prevent air leakage: Ventlok No. 609 or equal
d. Bearing at one end of damper rod: Ventlok No. 609 or equal
e. Sealed bushings installed at both ends to avoid duct leakage

f. Accessible quadrant at other end of damper rod
(1) With lever and lock screw: Ventlok No. 635 or equal
(2) Insulated ducts
a) Quadrants mounted on collar to clear insulation
b) Ventlok Nos. 637, 638, or 639 or equal
c) Selection based on insulation thickness
g. For dampers above non-removable ceilings and without ceiling access panels provide Ventlok No. 677 or equal concealed damper regulator
(1) With paintable cover plate
(2) Required interconnecting hardware

3. Single blade dampers
a. Galvanized steel ductwork: galvanized steel, except as indicated in the Drawings
b. Blade: Two gages heavier than duct gage, or 18 gage, whichever is lighter

4. Multi-blade Dampers
a. Low Pressure/Low Velocity Systems (2 inch water column or less static pressure class and 1500 fpm or less face velocity)
(1) Opposed blade damper
(2) Ruskin Model CD35 or equal
b. High Pressure/High Velocity Systems (greater than 2 inch water column static pressure class or greater than 1500 fpm face velocity):
(1) Rectangular
a) Opposed blade damper
b) Ruskin Model CD60, Greenheck, or ABI
(2) Round and Oval
a) Oval: Ruskin Model CDR25 and DO25 or equal
b) Round: Up to 20 inch diameter: Ruskin Model MDRS25 or equal
c) Round: Larger than 20 inch diameter: Ruskin Model CDRS25 or equal

B. Automatic Dampers

1. Refer to Section 23 73 13 – Air Handling Units dampers provided with factory packaged air handling equipment.
2. Actuators: See Section 23 09 13 – EMCS Basic Materials and Control System
3. Construction
a. Return air dampers (AHUs)
(1) Class 2 smoke-rated Ruskin Model SD-36 or equal
(2) End switches: Provide end switch to indicate fully-closed position.
b. Blade Action
(1) Throttling duty: opposed
(2) Mixing duty: parallel
(3) Two-position: parallel or opposed
c. Bearings: Molded synthetic sleeve, turning in extruded hole in frame.
d. Seals:
(1) Blade: Inflatable PVC coated fiberglass material or neoprene mechanically attached to blade edge.
(2) Jamb: Flexible metal compression type.
e. Linkage: concealed in frame. External linkage and jack-shafts will not be accepted.
f. Axles: Minimum 1/2 inch diameter plated steel, hex-shaped, mechanically attached to blade. Side access for direct-coupled actuator.
4. Finish: Mill galvanized
5. Damper area: See Drawings for sizes

6. Low Pressure/Low Velocity Systems (2 inch water column or less static pressure class and 1500 fpm or less face velocity)
   a. Ruskin Model CD36 or equal
   b. Integral, heavy-duty factory-installed motorized damper acceptable for exhaust fans unless otherwise scheduled
7. High Pressure/High Velocity Systems (greater than 2 inch water column static pressure class or greater than 1500 fpm face velocity):
   a. Ruskin Model CD60
   b. Greenheck
   c. ABI

C. Backdraft Dampers

1. Required locations
   a. Where indicated on the Drawings
   b. In suction or discharge of all exhaust fans as listed in equipment schedule
      (1) Integral, heavy-duty factory-installed type acceptable unless otherwise scheduled
2. General Applications
   a. Construction
      (1) Extruded aluminum construction
      (2) Extruded vinyl locked into blade edge
      (3) Blade ends overlapping frame
   b. Performance
      (1) Start to open: .02 inches w.g. or less
      (2) Fully open: .05 inches w.g. or less
      (3) Leakage for 24 inch wide damper: 25 cfm per ft^2 or less.
   c. Ruskin Series CBD4 or equal
3. High Velocity Applications
   a. Applies to discharge of air handlers and where velocity exceeds 1500 fpm. Damper shall be specifically designed for location at turbulent fan discharge.
   b. Frame
      (1) Minimum 12 gage galvanized steel channel
      (2) Bolt Holes: Both flanges
   c. Blades
      (1) Airfoil-shaped with integral structural reinforcing tube running full length of each blade
      (2) Material: 7 inches x minimum 0.080 inch Alloy 6063-T5 extruded aluminum
      (3) For multiple section dampers, provide galvanized steel or aluminum bracket to link dampers so they operate together.
   d. Axles: Minimum 3/4 inch diameter plated steel
   e. Bearings: Bolt-on bearings with re-lube ball bearings
   f. Linkage
      (1) 3/16 inch thick x 3/4 inch plated steel tie bar with minimum 16 gage plated steel linkage arms; stainless steel pivot pins
      (2) Located out of airstream (side or external linkage)
   g. Counterbalance: Located out of airstream
   h. Seals
      (1) Blade
         a) Mechanically attach blade seals to blade
         b) Silicone rubber, rated for 300 degrees Fahrenheit

(2) Jamb: Vinyl

i. Ruskin CBS92
j. Greenheck
k. ABI

2.04 FIRE DAMPERS

A. Ratings (test conditions and label) per UL Standard 555

1. 250 degrees Fahrenheit minimum
2. 1-1/2 hour fire rating, unless otherwise indicated in the Drawings
3. Dynamic (closes against air flow)

B. Factory sleeve

C. Damper

1. Multi-bladed, equipped with fusible link, spring loaded type
2. Style
   a. As indicated on the Drawings
   b. Ducted, rectangular duct: Style B (out of airstream)
   c. Ducted, round duct: Style A (in airstream) with damper sleeve 2” in each dimension larger than duct; plus cap and collar.
   d. Unducted: Style A (in airstream)

D. Fusible link

1. UL listed
2. Fusible links on fire dampers shall be constructed to UL Standard 33 – Fusible Links for Fire Protection Service
3. Temperature rating: Per code

E. Type: as indicated on the Drawings

F. Type:

1. Rectangular type up to 1000 feet per minute: Ruskin DIBD2 or DIBD10 Style A or equal
2. Rectangular type 1000 feet per minute and higher: Ruskin DIBD2 or DIBD10 Style B or equal
3. Circular and oval type: Ruskin DIBD2 Style CR and CO, or DIBD10 Style R and LO or equal

G. Status end switches:

1. Where indicated on the Drawings
2. Ruskin SP100 or equal Switch Package

2.05 CONDENSATE PUMP

A. Manufacturer: Little Giant, Diversitech, or equal

B. Provide where scheduled

C. Contractor shall verify pumping head requirements

D. Features

1. Discharge check valve
2. 115-volt with grounded plug connection
3. High level alarm contact

2.06 BELT GUARDS

A. Fabricated per OSHA and SMACNA Duct Construction Standards

PART 3 - EXECUTION

3.01 INSTALLATION

A. Coordinate with work of other trades

B. Install duct accessories in accordance with manufacturer's written installation instructions

C. See Section 23 31 13 – Ducts

D. Volume dampers

1. Provide at locations indicated on the Drawings
   a. Volume dampers shall be installed as far away from air outlets as functionally reasonable to avoid noise in the occupied space.
   b. Provide also in wyes and branch take-offs to outlets whether indicated on the Drawings or not, except
      (1) Where dampers are not indicated on the Drawings above inaccessible ceilings
      (2) To sidewall outlets in exposed ducts (opposed blade dampers in outlets shall be provided)
2. Additional locations where dampers appear to be required for balancing, place request for information with Engineer prior to construction.
3. For ductwork exposed to occupant view, volume damper handles shall be on top of duct or otherwise concealed from occupant view.

E. Fire dampers

1. Provide in ducts and openings as indicated in the Drawings
2. Provide access door in duct adjacent to each in location where damper may be inspected and internal fusible link or fire-stat may be replaced
3. Fire dampers installed in tunnel corridors shall have weight of damper supported from structure above.

F. Control dampers

1. Field mounted control dampers installed with concealed linkage shaft accessible on side of damper with space for direct-coupled actuator

G. Install belt guards at all exposed belts

3.02 MOUNTING AND ALIGNMENT

A. Install all accessories to prevent air leakage.

B. Install closed bearing end on all damper blades that penetrate duct to prevent air leakage.

C. Support extra weight of duct accessories. See Section 23 05 48 – Mechanical Sound and Vibration Control

3.03 INSPECTION

A. Verify that adequate clearance between duct accessories and adjacent walls or equipment is available to permit maintenance and repairs.

3.04 PRE-OPERATING CHECKS

A. Before operating duct accessories: Set all components in normal operating condition

3.05 TESTING AND ADJUSTING

A. After starting duct accessories

1. Check for noise and leakage; repair as required at no additional cost to the Owner
2. Operation test: Test each piece of equipment to show that it will operate in accordance with requirements.

B. See Section 23 05 93 – Testing, Adjusting, and Balancing

END OF SECTION

SECTION 23 34 00 FANS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. These heating, ventilating and air conditioning (HVAC) provisions specified herein apply to all Sections of Division 23.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 23.

1.02 SUMMARY

A. Work included in this section: materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Propeller fans
2. Centrifugal inline fans
3. Ceiling exhaust fans

B. Related Sections

1. Section 23 00 10 – Mechanical General Provisions
2. Section 23 05 00 – Basic Mechanical Materials and Methods

1.03 REFERENCE STANDARDS

A. ANSI/AFBMA Standard 9 – Load Rating and Fatigue Life for Ball Bearings

B. AMCA 99 – Standards Handbook

C. AMCA 210 – Laboratory Methods of Testing Fans for Aerodynamic Performance Rating

D. AMCA 300 – Reverberant Room Method for Sound Testing of Fans

E. AMCA 301 – Methods for Calculating Fan Sound

F. ANSI/AFBMA 11 – Load Ratings and Fatigue Life for Roller Bearings

1.04 QUALITY ASSURANCE

A. AMCA certified ratings per applicable AMCA standard based on the testing conducted in an independent laboratory

B. Performance Ratings: Conform to AMCA 210 and bear the AMCA Certified Rating Seal

C. Sound Ratings: AMCA 301; tested to AMCA 300 and bear the AMCA Certified Sound Rating Seal

D. Fabrication: Conform the AMCA 99

E. Conform to AMCA Bulletins regarding construction and testing

1. Fans shall bear AMCA certified rating seal

F. Scheduled equipment performance is minimum capacity required.

G. Scheduled electrical capacity shall be considered as maximum available.

1.05 SUBMITTALS

A. See Section 23 00 10 – Mechanical General Provisions

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. "R" means required.
2. "R2" means required only for products and equipment differing for the specified manufacturer and model and for "or equals" where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Fans	R	R		R
Fan accessories	R	R		

C. Include

1. Complete graph of fan curves, not just curve for design conditions
2. Sound power levels
   a. Fans 1 horsepower and larger: dB by octave bands
   b. Fans less than 1 horsepower: sones

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable:

1. Greenheck Fan Corporation
2. Loren Cook Company
3. PennBarry

2.02 GENERAL

A. AMCA certification in accordance with ARI Standard 210 and 211, and AMCA Standard 2408 for centrifugal fans

B. Fans used shall not increase motor size, increase noise level, or increase tip speed by more than 10 percent, or increase inlet air velocity by more than 20 percent, from specified criteria.

C. Performance

1. See fan schedule on the Drawings
2. Capacities: minimum as scheduled on the Drawings
3. Brake horsepower rating: Maximum 10 percent above that scheduled on the Drawings

4. Fans and drives shall be capable of accommodating static pressure variations of plus or minus 10 percent
5. Motor horsepower: No larger than that scheduled on the Drawings, or compensate Division 26 contractor for any associated cost to increasing motor size

D. Wheels

1. Class as stated per AMCA rating for static pressure.
2. Formed steel or extruded aluminum
3. Statically and dynamically balanced in its own bearings with a maximum full amplitude shaft deflection at bearings not to exceed 0.001-inch at 1200 RPM
4. Exposed fan wheels protected by finger proof screen

E. Motors: See Section 23 05 13 – Motors and Controllers

F. Housing

1. Heavy gage steel, spot welded for AMCA 99 designated Class I and II fans, and continuously welded for Class III, adequately braced, designed to minimize turbulence with spun inlet bell and shaped cut-off.
2. Factory finish before assembly with enamel or prime coat
3. Provide bolted construction
4. Weatherproof motor and drive covers at utility sets
5. Provide inspection access panels at the wheels of all blowers
6. Externally paint fans exposed to weather to provide corrosion resistance to the environment
7. Provide 3/4-inch threaded scroll drain.

G. Direct Drive

1. Less that 1 horsepower: Internal thermally protected motor

H. Belt Drive

1. Matched, multiple V-belt
2. Capacity: minimum 1.5 times motor horsepower
3. Pulleys
   a. Cast iron
   b. Variable pitch diameter
      (1) Except motors with variable speed drives
      (2) Fans up to 7-1/2 hp motor
      (3) Fans from 10 hp to 25 hp, under 1000 rpm
   c. Fixed pitch diameter
      (1) All motors with variable speed drives
      (2) Fans 10 hp and over 1000 rpm
   d. Select at mid-point of range
   e. For fans that operate as part of the life safety system, provide a minimum of two belts
4. Companion sheaves to maintain belts parallel

5. Drive guards
   a. Comply with requirements of State OSHA
   b. Provide holes in belt guards for tachometer readings
   c. Indoor Belt Drives: 16 gage expanded metal or wire screen enclosure with 70 percent free area and steel frame
   d. Outdoor Belt Drives: 16 gage solid galvanized sheet metal with stamped louvers near top and bottom for ventilation

I. Bearings

1. Ball, roller or taper
   a. Pressure type lubricating fittings with pressure relief fittings
      (1) Extended to accessible locations
      (2) Lubricating fittings: Equal to Alemite
      (3) Pressure relief fittings: Equal to Keystone.
2. Air Handling Quality Bearings
3. Bearing shaft mounting mechanism shall be concentric mount, not set screw mount.
4. Life rating: minimum L10-200,000 hours per AFBMA Standard 9 rating, at maximum catalog rating

J. Painting

1. Prime coat fan wheels and housing factory inside and outside: Prime coating on aluminum parts is not required
2. Provide two additional coats of paint on fans handling air downstream of humidifiers
3. Finish painting not required for fans with corrosion resistant coatings

K. Variable Speed Drive: See Section 23 05 13 – Motors and Controllers

L. Discharge: As indicated on the Drawings

M. Removable flanged screens at inlets or outlets where no connecting ductwork is indicated: Exclude inlets to fans in field erected casings

PART 3 - EXECUTION

3.01 INSTALLATION

A. Coordinate with work of other trades

B. Install fans in accordance with manufacturer's written installation instructions.

C. See Section 23 31 13 – Ducts for duct connections

D. Flexible duct connection at inlet and outlet: See Section 23 31 13 – Ducts

E. Backdraft Dampers

1. Comply with ASHRAE 90.1 and IMC
2. Provide backdraft or shutoff dampers for suction or discharge of every exhaust fan as scheduled on the Drawings
3. See schedules on the Drawings and Section 23 33 00 – Duct Accessories for where fan manufacturer may provide dampers and when specialty damper manufacturer must provide them.

F. Propeller Fans

1. Secure housing or sleeve to wall
2. Provide additional support from overhead construction or floor by steel rods or angles if fan extends more than approximately 24 inches from wall.

G. Pipe scroll drains to code compliant waste receptacle

3.02 MOUNTING AND ALIGNMENT

A. See Section 23 05 48 – Mechanical Sound and Vibration Control

3.03 INSPECTION

A. Verify that adequate clearance between fans and adjacent walls or equipment is available to permit maintenance and repairs.

3.04 PRE-OPERATING CHECKS

A. Do not operate fans for any purpose, temporary or permanent, until

1. Ductwork is clean
2. Filters in place
3. Bearings lubricated

3.05 TESTING AND ADJUSTING

A. Before starting fans : Install belt and motor guards

B. Start and test fans in accordance with manufacturers written installation instructions.

C. Start up and adjust fans to insure proper operation.

D. The submitted sound power level shall be verified through actual measurements and calculations in accordance with AMCA standards 300 and 301.

1. In the event the sound power level data measured or being submitted exceeds the designed level, provide additional sound traps or other sound attenuating devices to supplement the design in order to comply with sound power level specifications. Perform this work, including the additional noise control and any increase in motors Hp and increase in electrical service at no additional cost to the Owner. Submit calculations or measurement results to the Architect, which substantiate that sound power level produced by the submitted equipment and any required sound attenuating devices do not exceed the specified sound power levels.

E. After starting fans: Check for objectionable noise or vibration. Correct as needed at no additional cost to the Owner.

F. Balancing: See Section 23 05 93 – Testing, Adjusting and Balancing

3.06 TRAINING

A. See Section 23 00 10 – Mechanical General Provisions

END OF SECTION

SECTION 23 37 00 AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. These heating, ventilating and air conditioning (HVAC) provisions specified herein apply to all Sections of Division 23.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 23.

1.02 SUMMARY

A. Work included in this section: materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following: All air outlets, inlets, grilles, registers and diffusers except where integral with manufactured piece of equipment

B. Related Sections

1. Section 23 00 10 – Mechanical General Provisions
2. Section 23 05 00 – Basic Mechanical Materials and Methods

1.03 REFERENCE STANDARDS

1.04 QUALITY ASSURANCE

A. Comply with ARI Standard 650 – Air Outlets and Inlets

B. Comply with ASHRAE Standard 70 – Methods of Testing for Rating the Airflow Performance of Outlets and Inlets

C. Comply with AMCA Standard 500 – Laboratory Methods of Testing dampers for Rating

D. Comply with NFPA Standard 90A – Installation of Air Conditioning and Ventilating Systems

E. Comply with BSR/NFPA 90B – Standard for the Installation of Warm Air Heating and Air Conditioning Systems

F. Provide outlets and inlets that have, as minimum, throw and noise criteria ratings for each size device as listed in manufacturer's current data, rated as required by the above standards.

1.05 SUBMITTALS

A. See Section 23 00 10 – Mechanical General Provisions

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. “R” means required.
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Grilles, registers, and diffusers	R			R
Accessories	R			

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

1. Titus
2. Price
3. MetalAire

2.02 GENERAL

A. Manufacturer shall examine and approve of application of each outlet.

B. Noise level at design capacities: no larger than diffuser selection indicated on the drawings.

C. Volume dampers

1. Do not provide dampers built into grille or directly attached to the grille unless specifically called out on drawings or in this Section.
2. Volume damper key-operated adjustable from face of diffuser on register except as noted
3. Opposed blade

D. Diffuser frame

1. Frame type shall be coordinated with ceiling type. Refer to architectural reflected ceiling Drawings.
2. Plaster or drywall ceilings: lay-in diffuser with drywall frame (to allow for ceiling access through grille). Drywall frame to match diffuser color.
3. No visible screw allowed on diffusers or frames, unless otherwise indicated on the Drawings.

E. Outlets may be steel or aluminum unless otherwise indicated on the Drawings.

F. Color

1. Face and frame: Factory-baked #26 white enamel unless otherwise indicated on the Drawings
2. Internal parts of grille visible from occupied space, including all parts behind perforated face diffusers and visible parts of plenums: flat black

2.03 STYLES

A. General

1. See diffuser schedule on the Drawings for outlet style and size
2. Throw pattern per the Drawings

3. Specific frame, border, and other product references refer to Price Products
4. Provide square to round adapters where required

B. Square Cone Diffuser Price SCD: 3 cones

C. Louvered Face Diffuser Price SMDA: Adjustable air pattern

D. Double Deflection Supply Register Price 620

1. 3/4 inch blade spacing, fully adjustable.
2. Front set of blades shall run parallel with the short grille dimension.
3. Drywall frame with recessed screw holes.
4. Register with aluminum opposed blade damper.

E. Egg Crate Grille Price 80

1. 1/2 inch by 1/2 inch by 1/2 inch aluminum grid core.
2. Drywall frame with recessed screw holes.

F. Fixed Grille 45 Deg, Deflection Price 630

1. 3/4 inch blade spacing, fully adjustable.
2. Front set of blades shall run parallel with the short grille dimension.
3. Drywall frame with recessed screw holes.
4. Register with aluminum opposed blade damper.

2.04 SCREENED OPENINGS

A. Mesh

1. 3/4 in. square pattern
2. No. 16 galvanized wire
3. Interwoven
4. Welded or secured to frame

B. Frames:

1. 1 inch by 1 inch by 1/8 inch galvanized steel angles
2. Continuous around perimeter of screen (welded at corners)

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate with work of other trades.

B. Install air outlets and inlets in accordance with manufacturer’s written installation instructions and Section 23 31 13 – Ducts.

C. Return and exhaust registers: Install with blades oriented to prevent sight through outlets.

D. Grille backs or plenums visible through grilles painted flat black

E. Transfer grilles

1. See indications on the Drawings
2. Wall installations, unless otherwise indicated, provide two grilles
   a. One on each side of wall, except where open to return air plenum
   b. Connecting sheet metal collar with 18 inch elevation offset for sound and light attenuation

F. Provide duct screens at termination ducts as indicated on the Drawings

3.2 MOUNTING AND ALIGNMENT

A. See Section 23 05 48 – Mechanical Sound and Vibration Control

B. All air outlets and inlets shall be secured to building

1. Ceiling grilles shall be secured to prevent falling from ceiling during construction or service with minimum of two 16-gage ceiling wires, two 22-gage by 1 inch galvanized sheet metal strap or two No.10 sheet metal screws.
2. Comply with IBC

C. Mount directional grilles as indicated on the Drawings.

D. Adjust grille throw patterns

1. As indicated on the Drawings
2. For double-deflection grilles, adjust rear blades horizontal and front blades in 45 degree pattern at each end gradually rotating to be almost straight at blades in center of grille.
3. Prior to test and balance

3.3 INSPECTION

A. Verify mounting, direction and adjustments are installed as indicated on the Drawings.

3.4 TESTING AND ADJUSTING

A. See Section 23 05 93 – Testing, Adjusting and Balancing

END OF SECTION

SECTION 23 40 00 AIR CLEANING DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. These heating, ventilating and air conditioning (HVAC) provisions specified herein apply to all Sections of Division 23.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 23.

1.02 WORK INCLUDED

A. Work included in this section: materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Filter media
2. Filter frames in built-up systems

B. Related Sections

1. Section 23 00 10 – Mechanical General Provisions
2. Section 23 05 00 – Basic Mechanical Materials and Methods

1.03 REFERENCE STANDARDS

A. ASHRAE Standard 52.1-1992 – Gravimetric and Dust Spot Procedures for Testing Air Cleaning Devices Used in General Ventilation for Removing Particulate Matter

B. ASHRAE Standard 52.2-1999 – Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size

C. ANSI/UL 900 – Test Performance of Air Filter Units

1.04 QUALITY ASSURANCE

A. All filters shall be dust-spot rated in accordance with ASHRAE/ANSI Standard 52.1 – Atmospheric Dust Spot Method.

B. Filters shall have MERV ratings in accordance with ASHRAE Standard 52.2-1999 – Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.

1.05 SUBMITTALS

A. See Section 23 00 10 – Mechanical General Provisions

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. “R” means required.
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Filters	R			
Filter frames	R			

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Filter Media and Frames

1. Camfil/Farr Filtration Group
2. Flanders/Precisionaire
3. American Air Filter

2.02 FILTERS

A. General

1. Underwriters' Laboratories as Class 2
2. Disposable type
3. Each filter shall consist of media, media support grid and enclosing frame.

B. Type 1: Pleated Filter

1. 2 inch or 4 inch pleated
2. Media: Cotton & synthetic media (no polyester)
3. Minimum performance:
   a. 25 percent to 30 percent dust spot efficiency, complying with ASHRAE 52.1
   b. MERV 8, complying with ASHRAE 52.2
4. Maximum initial pressure drop at 500 feet per minute face velocity shall not to exceed 0.3 inches water column. Final pressure drop shall be no less than 1.0 inch water column.
5. Equal to Camfil/Farr Aeropleat IV

2.03 FRAMES

A. For air handlers and fan-coils, see individual specifications Sections.

PART 3 - EXECUTION

3.1 FILTER MEDIA

A. Media as selected in equipment schedules on the Drawings

B. Construction filters

1. Type 1 for all equipment; roll media not acceptable

3.2 INSTALLATION

A. Factory installed in air handling equipment

B. Coordinate with work of other trades

C. Install Air Cleaning Devices in accordance with manufacturer's written installation instructions.

D. See Section 23 05 93 – Testing, Adjusting and Balancing

3.3 START-UP PROCEDURES

A. Do not operate air handling unit fan systems for any reason until spaces served have been cleaned of dust and debris, to avoid contamination of supply air or return air paths and equipment.

B. Supply fans shall not be operated unless filters are installed, including temporary filters for use during test and balance.

C. If the final pressure drop of the temporary filters is reached during test and balance, replace them with a spare set.

D. Immediately before turning system over to Owner, remove temporary construction filters and install clean final filters. See also Section 23 05 93 – Testing, Adjusting and Balancing and Section 23 00 10 – Mechanical General Provisions for media installation during test and balance.

3.4 INSPECTION

A. Verify that adequate clearance between Air Cleaning Devices and adjacent walls or equipment is available to permit maintenance and replacement of filters.

B. Verify that filters are firmly seated in frame to minimize bypass.

3.5 TRAINING

A. See Section 23 00 10 – Mechanical General Provisions

END OF SECTION

SECTION 23 55 23 FUEL-FIRED RADIANT HEATERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. These heating, ventilating and air conditioning (HVAC) provisions specified herein apply to all Sections of Division 23.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 23.

1.02 SUMMARY

A. Work included in this section: materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Gas-Fired Radiant Heaters

1.03 RELATED SECTIONS

1. Section 23 00 10 – Mechanical General Provisions
2. Section 23 05 00 – Basic Mechanical Materials and Methods

1.04 SUBM ITTALS

A. See Section 23 00 10 – Mechanical General Provisions.

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. “R” means required.
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Radiant Heaters	R	R		R
Controls	R	R		
Accessories	R			

C. See Section 23 00 10 – Mechanical General Provisions

D. Product Data: Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.

E. Shop Drawings:

1. Wiring Diagrams: Power, signal, and control wiring.

F. Field Quality-Control Test Reports: From Contractor.

G. Operation and Maintenance Data: For fuel-fired radiant heaters to include in emergency, operation, and maintenance manuals. Refer to Division 15 Section “Operation and Maintenance Data”.

E. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.

B. Source Limitations: Obtain fuel-fired radiant heaters through one source from a single manufacturer.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of fuel-fired radiant heaters and are based on the specific system indicated. Refer to Division 1 Section "Product Substitutions".

D. Equipment shall be certified to the ANSI Z83.20 standard and bear the CSA certification label.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace heat exchanger of fuel-fired radiant heater that fails in materials or workmanship within specified warranty period.

B. Warranty Period: Five years from date of Final Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable:

1. Modine.
2. Reznor/Thomas & Betts.
3. Reverberray (Detroit Radiant Products Company)

2.2 GAS-FIRED, LOW INTENSITY INFRARED HEATERS

A. Description: Factory assembled, piped, and wired, and comp lying with ANSI Z83.6, "Gas-Fired Infrared Heaters."

1. AGA Approval: Designed and certified by and bearing label of American Gas Association.
2. Type of Gas: Designed and built to burn natural gas with characteristics same as those of gas available at Project site.

B. Fuel type: Burner shall be designed for natural gas having characteristics same as those of gas available at project site.

C. Burner type: Unit shall be a positive pressure power burner with a combustion fan upstream of the burner and exhaust gases. Negative pressure (pull through) type appliances will not be allowed.

D. Burner: Stainless-steel venturi burner. The flame anchoring screen shall have a minimum temperature rating equivalent to 304 grade stainless steel. Non stainless steel burners shall not be permitted.

E. Gas control: Operation shall include a defined input differential. Heater must be CSA Design Certified to operate at an input differential of at least 30 percent between the low and nominal rated input modes.

F. Combustion chamber: shall be 4 inch O.D. 16ga. Titanium stabilized aluminized steel (150-200MBH to allow for the operating temperature to exceed the 1030F as set forth in the ANSI Z83.20 standard) or aluminized steel (below 150 MBH), finished with a high emissivity rated, corrosion resistant, black coating with an emissivity level documented at .92 or higher.

G. Emitter tube: shall be 4 inch O.D. 16ga. aluminized steel finished with a high emissivity rated, corrosion resistant, black coating with an emissivity level documented at .92 or higher.

H. Fan enclosure: Combustion fan shall be totally housed inside burner control box and not exposed.

I. Tube connections: The heater's combustion chamber and radiant emitter tube shall incorporate a 4 inch slip-fit, interlocking connection in which the upstream tube slides into the next tube and is held by a bolted clamp.

J. Ignition system: Hot surface silicon carbide capable of temperatures achieving 2400 F. Ignitor shall be readily accessible and serviceable without the use of tools.

K. Reflectors: Shall be .025 polished aluminum with a multi-faceted design which includes reflector end caps. Reflector shall have a polished bright finish with clear visual reflection ability. (A sample will be required at time of submittal). Reflector shall have a minimum of 7 sheet metal bends in its fabrication to optimize downward radiation. Reflectors shall be rotatable from 0 to 45 degrees when required. The heater's reflector hanging system shall be designed to permit expansion while minimizing noise and/or rattles.

L. Control box: Heater's exterior control chassis shall be constructed of corrosion resistant enameled steel.

1. The heater's top cover shall be constructed of ABS plastic material.
2. Air intake: An air intake collar shall be supplied as part of the burner control assembly to accept a 4 inch O.D. supply duct.
3. The heater's control compartment shall be accessible without the use of tools and serviceable while heater is operating.
4. Outdoor modifications are required for any application that will be placed in space defined as outdoors. The rating label shall bear the outdoor certification approval.

M. Heaters shall be equipped with a sight glass allowing a visual inspection of ignitor and burner operation from the floor.

N. The heaters shall utilize a downstream turbulator baffle for maximum heat transfer.

O. Heater shall be supplied with a stainless steel flexible gas connector.

P. Burner Safety Controls:

1. Heater controls shall include a safety differential pressure switch to monitor combustion air flow, as to provide complete burner shutdown due to insufficient combustion air or flue blockage.
2. The heater shall incorporate a self-diagnostic ignition module, and recycle the heater after an inadvertent shutdown.
3. The heater's control system shall be designed to shut off the gas flow to the main burner in the event either a gas supply or power supply interruption occurs.
4. The heater's blower motor shall be thermally protected and the motor's impeller shall be balanced.
5. Heater control assembly shall include three indicator lights that define the units operating input ranges. One indicator shall validate air flow. Two indicator lights shall indicate low and high stages.
6. The heater's air flow control system shall provide a 45 second pre-purge prior to initiating burner operation and a 90 second post-purge upon completion, effectively removing all products of combustion from heat exchanger and/or radiant tubes.
7. No condensation shall form as a result of combustion in the combustion chamber or radiant tubes while at operating temperatures.
8. Thermostat control shall be two-stage operating on 24 volts.

Q. Venting: shall be per manufacturer approval and specifications.

R. Accessories:

1. Wire grid for increased efficiency.
2. Protective screen.
3. Heat-deflector shield. (where scheduled)
4. Stainless-steel flexible connector with manual valve.
5. Hanger chain with "S" hooks.
6. Preassembled chain mounting kit.

2.3 TEMPERATURE CONTROL

A. Wires and cables are specified in Division 16 Section.

B. Sensors, Components, and Wiring: Specified in Section 23 09 00 – Energy Management and Control System (General)

C. Thermostat: 2-stage, digital programmable wall-mounting type with 50 to 90 deg F operating range.

D. Control Transformer: Integrally mounted.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for radiant heater piping systems to verify actual locations of piping connections before equipment installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Coordinate with work of other trades

B. Install fans in accordance with manufacturer’s written installation instructions.

C. Install radiant heaters level and plumb.

D. Install and connect gas-fired radiant heaters and associated fuel features and systems according to NFPA 54, applicable local codes and regulations, and manufacturer's written installation instructions.

E. Suspended Units: Suspend from substrate using chain hanger kits and building attachments.

F. Maintain manufacturers' published clearances to combustibles.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to machine to allow service and maintenance.

C. Gas Piping: Comply with applicable requirements in Section 23 11 00 - Fuel Gas Piping. Connect gas piping to gas train inlet; provide union with enough clearance for burner removal and service. Provide AGA-approved flexible units.

D. Electrical: Comply with applicable requirements in Division 26 Sections.

1. Install electrical devices furnished with heaters but not specified to be factory mounted.

E. Ground equipment according to Division 26 Section.

F. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections.

1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
2. Test Reports: Prepare a written report to record the following:
   a. Test procedures used.
   b. Test results that comply with requirements.
   c. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

3.5 ADJUSTING

A. Adjust initial temperature set points.

B. Adjust burner and other unit components for optimum heating performance and efficiency.

3.6 TRAINING

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fuel-fired radiant heaters. Refer to Section 23 00 10 – Mechanical General Provisions.

END OF SECTION

SECTION 23 72 00 AIR-TO-AIR ENERGY RECOVERY EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. These heating, ventilating and air conditioning (HVAC) provisions specified herein apply to all Sections of Division 23.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 23.

1.02 SUMMARY

A. Work included in this section: materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Packaged energy recovery units.

B. Related Sections

1. Section 23 00 10 – Mechanical General Provisions
2. Section 23 05 00 – Basic Mechanical Materials and Methods

1.03 SUBMITTALS

A. See Section 23 00 10 – Mechanical General Provisions

B. Product Data including rated capacities of selected models, weights (shipping, installed, and operating), furnished specialties, accessories, and installation and startup instructions.

C. Shop Drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, loadings, required clearances, method of field assembly, components, and location and size of each field connection.

D. Wiring diagrams detailing wiring for power and control systems and differentiating between manufacturer-installed and field-installed wiring.

E. Maintenance data for each energy recovery unit, control, and accessory to include in the operation and maintenance manual specified in Division 23.

1.04 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with provisions of the following codes:

1. ASHRAE Compliance: Provide capacity ratings for energy recovery devices according to ASHRAE 84, "Method of Testing Air-to-Air Heat Exchangers."

B. UL Standard: Provide units complying with UL 1812, "Ducted Heat Recovery Ventilators"; or UL 1815, "Nonducted Heat Recovery Ventilators."

C. UL and NEMA Compliance: Provide ancillary electrical components required as part of energy recovery units that are listed and labeled by UL and that comply with applicable NEMA standards.

D. Comply with NFPA 70 for components and installation.

1.05 SEQUENCING AND SCHEDULING

A. Coordinate size and location of equipment supports and wall penetrations.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Greenheck

C. Loren Cook

D. Or equal

2.02 PACKAGED ENERGY RECOVERY UNITS

A. Unit Casing and Frames: Unit shall be of internal frame type construction of G90 galvanized steel. Exterior panels shall be a minimum of 18 gauge galvanized steel. Where top panels are joined there shall be a standing seam.

1. All exterior metal-to-metal-seams shall be sealed with closed cell neoprene gasketing, requiring no caulking at job site.

B. Energy Recovery Wheel: Wheel shall be of the enthalpy type for both sensible and latent heat recovery, and be designed to insure laminar flow. Desiccant shall be silica gel for maximum latent energy transfer. Wheel shall be constructed of light weight polymer media to minimize shaft and bearing loads. Polymer media shall be mounted in a stainless steel rotor for corrosion resistance.

1. Wheel design shall consist of removable segments (for wheels greater than 26" diameter) for ease of service and/or cleaning. Segments shall be removable without the use of tools. Silica gel desiccant shall be permanently bonded to wheel media to retain latent heat recovery after cleaning.
2. Wheels with sprayed on desiccant coatings are not acceptable. Wheels with desiccant applied after wheel formation are not acceptable.

C. Insulation: Unit casing to be insulated with 1" - 3# rigid board fiberglass with fire-resistant Foil-Scrim-Kraft facing. Insulation shall be in accordance with NFPA 90A and tested to meet UL 181 erosion requirements and to be secured to unit with water proof adhesive and permanent mechanical fasteners.

D. Access Door: All components shall be easily accessible through large removable access panels for both exhaust and supply compartments. Energy recovery wheel shall be mounted in a slide-out track for ease of inspection, removal and cleaning. Access to be provided in each individual section where blowers, filters and motorized damper are required.

E. Fan Sections: Centrifugal fans to be double width, double inlet, single fan forward curved type. All blower wheels shall be statically and dynamically balanced. Motors shall be permanently lubricated, heavy duty type, matched to the fan load and furnished at the specified voltage, phase and enclosure. Ground and polished steel fan shafts shall be mounted in permanently lubricated, sealed ball bearing pillow blocks. Bearings shall be selected for minimum (L10) life in excess of 100,000 hours at maximum cataloged operating speeds. Blowers shall be quiet running, forward curved type and enable independent balancing of exhaust and supply airflows by providing separate motors for exhaust and supply blowers.

F. Motor and Drives: Motors shall be minimum horse power scheduled 1800 RPM-single speed ball bearing, rigid base, T-frame, ODP. Motors shall operate on scheduled electrical service and be direct connect to the blowers.

G. Filters: Outside air and exhaust air filters shall be 2" thick pleated fiberglass, MERV 8 and tested to meet UL Class 2. Filter racks shall be of die formed galvanized steel.

H. Electrical: All internal electrical components shall be prewired for single point power connection. All electrical components shall be UL listed, approved or classified where applicable and wired in compliance with the National Electrical Code. Disconnect switch and motor starters shall be supplied as standard components. Control box shall include motor starters, control circuit fusing, control transformer for 24 VAC circuit and safety disconnect. Motor starters shall consist of a contactor and Class 20 adjustable overload protection and shall be provided for all motors in the unit.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas to receive energy recovery units for compliance with requirements for installation tolerances and other conditions affecting performance of energy recovery units. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Coordinate with work of other trades.

B. Install energy recovery units as indicated, according to manufacturer's written instructions.

C. See Section 23 31 13 – Ducts for duct connections

D. Flexible duct connection at inlet and outlet: See Section 23 31 13 – Ducts

E. Install new filters at completion of equipment installation and before testing, adjusting, and balancing.

3.03 CONNECTIONS

A. Ducts and fan installation requirements are specified in other Division 23 Sections. Drawings indicate the general arrangement of piping, fittings, and specialties.

B. Ground equipment.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.04 CLEANING

A. After completing system installation, including outlet fittings and devices, inspect and clean exposed finishes. Remove dirt and construction debris and repair damaged finishes.

3.05 COMMISSIONING

A. Startup Services: Engage a factory-authorized service representative to commission units as specified below.

1. Energize and verify correct rotation of heat wheels and fans.
2. Adjust seals and purge.
3. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.

3.6 TESTING AND ADJUSTING

A. Start and test units in accordance with manufacturers written installation instructions.

B. Start up and adjust units to insure proper operation.

C. After starting unitss: Check for objectionable noise or vibration. Correct as needed at no additional cost to the Government.

D. Balancing: See Section 23 05 93 – Testing, Adjusting and Balancing

3.7 DEMONSTRATION

A. Train Owner’s maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance. Refer to Section 23 00 10 – Mechanical General Provisions.

B. Review data in the operation and maintenance manuals. Refer to Section 23 00 10 – Mechanical General Provisions.

C. Schedule training with Owner, through Architect, with at least 7 days' advance notice.

END OF SECTION

SECTION 23 81 16 SPLIT SYSTEM/MULTIZONE VARIABLE REFRIGERANT FLOW (VRF) HEAT PUMP EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. These heating, ventilating and air conditioning (HVAC) provisions specified herein apply to all Sections of Division 23.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 23.

1.02 SUMMARY

A. This Section includes the following:

1. Outdoor units and accessories complete with controls.
2. Indoor units with direct-expansion coils, blowers, and controls.
3. Branch controllers.
4. Preinsulated refrigerant line sets.
5. Refrigerant piping system valves.
6. Control network with centralized controllers and system integration to Owner's IT LAN/WAN.

B. Related Sections include the following:

1. Section 23 00 10 – Mechanical General Provisions
2. Section 23 05 00 – Basic Mechanical Materials and Methods
3. Section 23 07 00 – Mechanical Insulation
4. Section 23 23 00 – Refrigerant Piping

1.03 DEFINITIONS

A. VRF: Variable refrigerant flow.

B. AHU: Air handling unit (indoor unit).

C. OAU: Outside air pre-conditioning unit.

D. Outdoor Unit: Compressor and condenser coil with all control components in a cabinet.

E. BC: Branch controller.

F. DDC: Direct digital controls.

G. PC: Personal Computer.

1.04 SYSTEM DESCRIPTION

A. The variable capacity, heat pump heat recovery air conditioning system shall be simultaneous heat and cooling variable refrigerant flow zoning system consisting of multiple variable capacity evaporators, DDC controls, branch refrigerant controllers, and outdoor units. Each system shall permit connection of up to 16 variable capacity indoor units to a single outdoor unit, each of which can be independently controlled.

1.05 SUBMITTALS

A. Product Data: For each complete system. Include rated capacities of selected models; shipping, installed, and operating weights; furnished specialties; and accessories. Include plan and elevation views of units, minimum clearances, and data on ratings and capacities.

B. Wiring Diagrams: Power, signal, and control wiring. (See Division 23 Section “Energy Management and Control System” for additional submittal requirements.)

C. Operation and Maintenance Data: For each system to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 23 Section "Mechanical General Provisions”, include the following:

1. Outdoor and indoor units and accessories complete with controls.
2. Branch controllers.
3. Filters.

D. Warranties: Special warranties specified in this Section.

1.06 QUALITY ASSURANCE

A. The VRF system installer must be factory-trained and certified prior to submission of bid. A factory-trained and certified employee of the installer must be on-site when HVAC system is being installed and placed in operation.

B. The lowest and best bidder is to provide a letter from the manufacturer verifying the training certification and a minimum of four (4) successful installations of specified VRF system with references within 72 hours of receipt of bid to Architect.

C. Copies to the certified installer’s Certificate must also be provided with the submittals described in Section 23 00 10-Mechanical General Provisions.

D. Product Options: Drawings indicate size, profiles, and dimensional requirements of equipment and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

E. The units shall be listed by Electrical Laboratories (ETL) and bear the ETL label.

F. All wiring shall be in accordance with the National Electrical Code (N.E.C.).

G. The units shall be manufactured in a facility registered to ISO 9001 and ISO 14001 which is a set of standards applying to environmental protection set by the International Standard Organization (ISO).

H. A full charge of R-410A for the condensing unit only shall be provided in the condensing unit.

I. System efficiency shall meet or exceed 11.0 System EER during full load conditions and 14.0 IPLV for part load conditions.

J. Units shall be stored and handled according to the manufacturer's recommendation.

1.07 WARRANTY

A. The units shall have a manufacturer's warranty for a period of one (1) year from date of installation covering all material, parts, refrigerant, labor, and freight. The compressors shall have a warranty of six (6) years from date of installation. If, during this period, any part should fail to function properly due to defects in workmanship or material, it shall be replaced or repaired at the discretion of the manufacturer. The second through sixth year warranty does not include labor.

B. The system shall be installed by a factory trained and manufacturer certified contractor with extensive training on this type equipment. Training to be performed and certification to be provided by the manufacturer. A completed system commissioning report shall be submitted to the Manufacturer's service department to ensure full warranty coverage for the Owner"

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Mitsubishi
   b. LG
   c. Trane

B. A LG VRF system is the basis of design for this project. The piping systems, controls, electrical systems, drains, equipment space (including service space), and equipment capacities are as required by the LG system. A bid based using any other equipment must also include the cost for the system design and installation which includes the additional or revised equipment, piping, electrical, supports, controls, and drains required for proper operation. Design must be prepared and documents sealed by a Architect Engineer registered in the State of Mississippi. The alternate system design must be approved by the Architect before executing the sub-contract. The Contractor shall assume all additional cost for design review, design revisions, controls, electrical, piping, and drains beyond those quantities required for City Multi.

2.02 OUTDOOR UNIT

A. General: The outdoor units shall be designed specifically for use with a variable refrigerant flow system and components. Units shall be equipped with multiple circuit boards that interface to the control system and perform all functions necessary for operation. The units shall have a powder coated finish and shall be completely factory assembled, piped and wired. Each unit must be run tested at the factory.

1. The sum of connected capacity of all indoor air handlers shall range from 50% to 150% of outdoor rated capacity.
2. Outdoor unit shall have a sound rating no higher than 57 dba.
3. Both refrigerant lines from the outdoor unit to the BC controller shall be insulated

B. Unit Cabinet:

1. The casing shall be fabricated of galvanized steel, bonderized and finished with a powder coated baked enamel.

C. Fan:

1. The unit shall be furnished with one direct drive, variable speed propeller type fan.
2. The motor shall have inherent protection, permanently lubricated bearings, and be completely variable speed.
3. The fan shall be provided with a raised guard to prevent contact with moving parts.
4. The outdoor unit shall have a vertical discharge airflow.

D. Coil:

1. The condenser coil shall be of nonferrous construction with lanced or corrugated plate fins on copper tubing and shall be protected with an integral metal guard and shall be protected with an integral metal guard.
2. Refrigerant flow from the condenser shall be controlled by means of an inverter driven compressor.
3. The condenser coil shall include 4 circuits with two position valves for each circuit, except for the last stage.

E. Compressor:

1. The compressor shall be a high performance, inverter driven, modulating capacity scroll compressor with a factory mounted crankcase heater.
2. The outdoor unit shall have an accumulator with refrigerant level sensors and controls.
3. The outdoor unit shall have an inverter to modulate capacity. The capacity shall be completely variable down to a 16% of rated capacity.
4. The compressor shall be equipped with an internal thermal overload, a high pressure safety switch, over-current protection and DC bus protection.
5. The compressor shall be mounted to prevent the transmission of vibration.
6. The outdoor unit shall be capable of operating at 0 deg F ambient temperature without additional low ambient controls.
7. The outdoor unit shall have high efficiency oil separator plus additional logic controls to ensure adequate oil volume in the compressor is maintained.

F. Electrical:

1. The outdoor unit electrical power shall be 208 volts, 3 phase, 60 hertz.
2. The unit shall be capable of satisfactory operation within voltage limits of 198 volts to 253 volts.
3. The outdoor unit shall be controlled by integral microprocessors.
4. The control voltage between the indoor units and the outdoor unit shall be completed using a 2 conductor shielded cable to provide total integration of the system.

2.03 BRANCH CONTROLLER FOR VARIABLE CAPACITY HEAT PUMPS

A. General: The BC Controller is designed specifically for use with a variable refrigerant flow system and components. These units shall be equipped with a circuit board that interfaces to the control system and shall perform all functions necessary for operation. The unit shall have a galvanized steel finish and shall be completely factory assembled, piped and wired. Each unit shall be run tested at the factory. The unit shall be mounted indoors where indicated on the drawings. The sum of connected capacity of all indoor air handlers shall be as scheduled on the drawings. Each BC controller shall operate the number of indoor units in accordance with the schedule on the drawings.

B. Unit Cabinet:

1. The casing shall be fabricated of galvanized steel.
2. Each cabinet shall house a liquid-gas separator and multiple refrigeration control valves.
3. The unit shall house a tube-in-tube heat exchanger.

C. Refrigerant Valves:

1. The unit shall be furnished with multiple two position refrigerant valves.
2. Each circuit shall have one (32,000 BTUH or smaller evaporator section) two-position liquid line valve and a two-position suction line valve.
3. The refrigerant connections shall be flare-type connections.
4. Linear electronic expansion valves shall be used to control the variable refrigerant flow.
5. Valves in the variable refrigerant flow system shall be Diamond Back VC series ball valves with HKG-20HF insulation kits (or equal). Valve shall be a 700 psig Schrader valve for service connections. This valve kit shall be used with all systems.

D. Integral Drain Pan: An integral condensate pan and drain shall be provided.

E. Electrical:

1. The unit electrical power shall be 208 volts, 1 phase, 60 hertz.
2. The unit shall be capable of satisfactory operation within voltage limits of 198 volts to 254 volts.
3. The BC controller shall be controlled by integral microprocessors.
4. The control voltage between the indoor units and the outdoor unit shall be communicated on a 2 conductor shielded cable.

2.04 RECESSED CEILING CASSETTE, DUCTLESS HEAT PUMPS INDOOR UNITS

A. General: The recessed ceiling cassette unit shall recess into the ceiling with a ceiling grille, an electronic expansion valve, controls that can be used with the outdoor unit and BC controller. Each system shall perform in accordance to the ratings scheduled on the drawings.

B. Indoor Unit: The indoor unit shall be factory assembled, wired and run tested and shall contain within the unit all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, an emergency operation function and a test run switch. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory.

C. Unit Cabinet: A four-way grille shall be fixed to bottom of cabinet allowing, two, three, or four - way blow.

D. Fan:

1. The evaporator fan shall be an assembly with a turbo fan direct driven by a single motor, be statically and dynamically balanced; fan motor shall have permanently lubricated bearings.
2. The indoor fan shall have four (4) speeds, High, Mid 1, Mid 2, and Low, two of which may be selected by the room controller.
3. The indoor unit shall have an adjustable air outlet system offering 4-way airflow, 3-way airflow, or 2-way airflow.
4. The auto air swing vanes shall be capable of automatically swinging up and down for uniform air distribution.

E. Filter: Return air shall be filtered by means of a long-life permanent filter to provide approximately 2,500 hours of use in a normal office environment before cleaning.

F. Coil:

1. The evaporator coil shall be of nonferrous construction with smooth plate fins on copper tubing with inner grooves for high efficiency heat exchange.
2. All tube joints shall be brazed with phoscopper or silver alloy and shall be pressure tested at the factory.
3. A condensate pan and drain shall be provided under the coil.
4. The condensate pump shall be able to raise drain water 33 inches above the condensate pan.
5. Both refrigerant lines from the BC controller to the indoor units shall be insulated.

G. Electrical:

1. The unit electrical power shall be 208 volts, 1 phase, 60 hertz.
2. The system shall be capable of satisfactory operation within voltage limits of 198 volts to 254 volts.

H. Controls: This unit shall have controls provided by the manufacturer to perform input functions necessary to operate the system.

2.05 WALL-MOUNTED HEAT PUMP INDOOR UNITS

A. General: The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, and a test run switch. Indoor unit and refrigerant piping shall be charged with dehydrated air before shipment from the factory.

B. Unit Cabinet:

1. The unit shall have multi-directional drain and refrigerant piping arrangements providing options for four (4) directions for refrigerant piping and two (2) directions for draining.
2. Unit shall have a separate back plate which secures the unit firmly to the wall.

C. Fan:

1. The evaporator fan shall be an assembly with one or two line-flow fan(s) direct driven by a single motor, be statically and dynamically balanced and run on a motor with permanently lubricated bearings.
2. A manual adjustable guide vane shall be provided with the ability to change the airflow from side to side (left to right).
3. A motorized air sweep louver shall provide an automatic change in airflow by directing the air up and down to provide uniform air distribution.
4. The indoor fan shall be capable of four (4) speeds, High, Mid 1, Mid 2, and Low, two of which may be selected by the room controller.

D. Filter: Return air shall be filtered by means of an easily removable washable filter.

E. Coil:

1. The evaporator coil shall be of nonferrous construction with smooth plate fins on copper tubing with inner grooves for high efficiency heat exchange.
2. All tube joints shall be brazed with phoscopper or silver alloy and shall be pressure tested at the factory.
3. A condensate pan and drain shall be provided under the coil.
4. The condensate pump shall be able to raise drain water 33 inches above the condensate pan.
5. Both refrigerant lines from the BC controller to the indoor units shall be insulated.

F. Electrical:

1. The unit electrical power shall be 208 volts, 1 phase, 60 hertz.
2. The system shall be capable of satisfactory operation within voltage limits of 198 volts to 254 volts.

G. Control: The unit shall have controls provided by the manufacturer to perform input functions necessary to operate the system.

2.06 CONTROLS

A. Overview:

1. General: The control network shall consist of a centralized controller, software, and remote room controllers for each indoor unit.
2. The Controls Network shall be capable of supporting remote controllers, schedule timers, system controllers, centralized controllers, an integrated web based interface, graphical user workstation, and system integration to Energy Management and Control System via BACnet/IP.

2.07 ELECTRICAL CHARACTERISTICS

A. General: The controls network shall operate at 24VDC. Controller power and communications shall be via a common non-polar communications bus.

B. Wiring:

1. Control wiring shall be installed in a system daisy chain configuration from indoor unit to remote controller to indoor unit, to the BC controller (main and subs, if applicable) and to the outdoor unit. Control wiring to remote controllers shall be run from the indoor unit terminal block to the controller associated with that unit.
2. Control wiring for schedule timers, system controllers, and centralized controllers shall be installed in a daisy chain configuration from outdoor unit to outdoor unit, to system controllers, to the power supply.
3. The central system controller shall be capable of being networked with other central system controllers for web based control.

C. Wiring Type:

1. Wiring shall be 2-conductor (16 AWG or 18 AWG), twisted shielded pair, stranded wire.
2. Network wiring shall be CAT-5e with RJ-45 connection.

2.08 CONTROLS NETWORK

A. The Controls Network consists remote controllers, schedule timers, system controllers, centralized controllers, and/or integrated web based interface communicating over a high-speed communication bus. The Controls Network shall support operation monitoring, scheduling, error email distribution, personal browsers, tenant billing, online maintenance support, and integration with Building Management Systems (BMS) using a BACnet/IP Gateway.

2.09 REMOTE CONTROLLERS

A. Simple Remote Controller

1. The Simple Remote Controller shall be capable of controlling up to 16 indoor units. The Simple Remote Controller shall be compact in size, approximately 3"x5" and have limited user/functionality. The Simple Remote Controller shall allow the user to change on/off, temperature setting, and fan speed setting. The room temperature shall be sensed at either the Simple Remote Controller or the Indoor Unit dependent on the indoor unit dipswitch setting. The Simple Remote Controller shall display a four-digit error code in the event of system abnormality/error.

2.10 CENTRAL CONTROLLER

A. Centralized Controller

1. The Centralized Controller shall be capable of controlling a maximum of 50 indoor units across multiple outdoor units. The Centralized Controller shall support operation superceding that of the remote controllers, system configuration, daily/weekly/annual scheduling, monitoring of operation status, error email notification, online maintenance tool and malfunction monitoring.
2. The Centralized Controller shall have basic operation controls which can be applied to an individual indoor unit, a group of indoor units (up to 50 indoor units) or all indoor units (collective batch operation).

3. This basic control set of operation controls for the Centralized Controller shall include on/off, operation mode selection (cool, heat, auto (R2-Series only), dry and fan), temperature setting, fan speed setting, airflow direction setting, error mail notification, and online maintenance.
4. Since the Centralized Controller provides centralized control it shall be able to enable or disable operation of local remote controllers via the PC. In terms of scheduling, the Centralized Controller shall allow the user to define daily, weekly, and annual schedules with operations consisting of ON/OFF, mode selection, temperature setting, and permit/prohibit of remote controllers.

2.12 WEB-BASED USER INTERFACE LICENSES PER FUNCTION SHALL BE REQUIRED ALL. ALL PCS ARE FIELD SUPPLIED

A. PC Monitoring: The VRF system controls system shall be capable of monitoring and operating all indoor units from a networked PC's web browser for up to 50 units per centralized controller.

B. PC Scheduling: The VRF system controls system shall be capable of creating customized daily, weekly, and annual schedules from a network PC's web browser for up to 50 units per centralized controller. Schedules shall be applied to a single indoor unit, a group of indoor units, or collectively (batch) to all indoor units controlled by the centralized controller.

C. Online Error Email: The VRF system controls system shall be capable of sending detailed alerts to customizable distribution lists based on user defined error types.

D. Personal Web Browser: The VRF system controls system shall be capable of allowing up to 50 individual users to monitor and control user defined zones via a network PC or MAC's web browser.

E. Online Maintenance Diagnostics: The VRF system controls system shall be capable of performing maintenance diagnostics via a network PC and centralized controller using Maintenance Tool Software.

2.13 VRF SYSTEM INTEGRATION

A. BACnet Interface

1. The BACnet interface shall be compliant with BACnet/IP (ANSI/ASHRAE 135, 135a) and UDP/IP of Ethernet (ANSI/ASHRAE 135-1005, 135b).
2. The BACnet® interface shall support BACnet Broadcast Management (BBMD).
3. The BACnet® interface shall support a maximum of 50 indoor units.
4. Operation and monitoring points include, but are not limited to, on/off, operation mode, fan speed, prohibit remote controller, filter sign reset, alarm state, error code, and error address.

2.14 POWER SUPPLY

A. The power supply shall supply 12VDC for the centralized controller and 24VDC voltage for the central control transmission. The power supply shall have the capacity to power a maximum of 2 centralized controllers.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of refrigerant and condensate drainage piping systems and electrical services to verify actual locations of connections before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Arrange installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

3.03 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Connect condensate drain piping and extend condensate collection piping system.

D. Electrical: Comply with applicable requirements in Division 16 Sections for power wiring, switches, and motor controls.

E. Ground Equipment according to Division 16 Section “Grounding and Bonding”.

F. Tighten electrical connectors and terminals according to manufacturer’s published torque-tightening values. If manufacturer’s torque values are not indicated, use those specified in UL 486A and UL 486B.

3.04 FIELD QUALITY CONTROL

A. Manufacturer’s Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.

3.05 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. Final Checks before Startup: Perform the following:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to piping, and electrical systems are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Perform cleaning and adjusting specified in this Section

3.06 CLEANING

A. Clean indoor units on completion of installation, according to manufacturer's written instructions.

3.07 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain Variable Refrigerant Flow Systems. Refer to Division 23 Section "Mechanical General Provisions".

END OF SECTION

SECTION 23 82 39 UNIT HEATERS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. These provisions specified herein apply to all Sections of Division 23.

B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 23.

1.02 SUMMARY

A. Work included in this section: materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following: All air terminal units including

1. Gas-fired, power-exhausted.

B. Related Sections

1. Section 23 00 10 – Mechanical General Provisions
2. Section 23 05 00 – Basic Mechanical Materials and Methods

1.03 SUBMITTALS

A. See Section 23 00 10 – Mechanical General Provisions

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. “R” means required.
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Unit heaters	R	R		R
Unit heater controls	R	R		
Accessories	R	R		

1.04 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."

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Gas-Fired Unit Heater:

1. Modine
2. Reznor
3. Trane

2.02 GAS-FIRED UNIT HEATERS

A. General

1. Conforming to ANSI Z83.8 standard for “Gas Unit Heater and Gas-Fired Duct Furnaces” for safe operation, construction and performance.
2. Casing
   a. 20 gage aluminized steel
   b. Painted with electrostatically applied baked-on polyester powder pain 7-mil thickness.
   c. Provide horizontal air deflectors
3. Efficiency
   a. 80 percent minimum efficiency provided by an indirect-fired heat exchanger.
4. Venting Arrangement
   a. Powered exhaust
   b. Factory test unit to insure proper ignition when it is subjected to 40 mph wind velocities.
   c. Factory mounted differential pressure switch designed to prevent main burner ignition.
   d. Venting materials and arrangement shall be per manufacturer’s recommendations.
5. Furnace Section
   a. 20 gage aluminized steel tubes
   b. The ignition controller shall be 100 percent shut-off with continuous retry.
   c. Gas pressure between 6-7 inches.
6. Electrical
   a. All electrical components shall carry UL or ETL listing.
   b. A low voltage terminal board shall be provided for direct wiring connection to an external thermostat
   c. Single step down transformer shall be provided for all unit controls.
7. Accessories:
   a. Suspension kit
   b. Thermostat

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas to receive unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Coordinate with work of other trades.

B. Install unit heaters in accordance with manufacturer's written installation instructions.

C. Install unit heaters to comply with NFPA 90A.

D. Install propeller unit heaters level and plumb.

3.03 INSPECTION

A. Verify that adequate clearance between unit heaters and adjacent walls or equipment is available to permit maintenance and repairs.

3.04 TRAINING

A. See Section 23 00 10 – Mechanical General Provisions

END OF SECTION

SECTION 26 00 10 GENERAL PROVISIONS

PART 1 - GENERAL

1.01 GOVERNING CLAUSE

A. For the sake of brevity, these specifications may omit phrases such as “Contractor shall provide”, “unless otherwise indicated or specified”, etc., but these phrases are nevertheless implied. Mention of materials and operations requires the Contractor to furnish, install and connect such materials and perform such operations to provide a complete and operating system to the satisfaction of the Professional.

1.02 GENERAL CONDITIONS

A. The General Conditions, Supplementary General Conditions, Information to Bidders, General Requirements, Addenda, Alternates and other pertinent documents issued by the Professional are a part of these specifications and shall be complied with in every respect.

B. Notwithstanding any reference in the specifications to any equipment, material or type of construction by name, make or catalog number, such reference shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition. Where the phrase “or approved equal” is used in the Division 26 Specification, substitute equipment, equivalent in all respects to that specified, of any qualified manufacturer is permitted with the written approval of the Professional. Approval will not be considered until after award of contract and only if submitted by the successful Contractor. Where a list of manufacturers and/or catalog numbers is provided and the phrase “or approved equal” is omitted, substitute equipment, equivalent in all respects to that specified, from one of the listed manufacturers is permitted with the written approval of the Professional.

1.03 TEST AND OBSERVATIONS

A. The complete project shall be, during and/or after construction, subject to the tests and observations as herein described and as noted on the drawings. Deficiencies found as a result of these tests and observations shall be corrected by the Contractor within a reasonable period and at no expense to the Owner.

B. The complete project shall be subject to observations and tests conducted by the Professional or for him in his presence. Upon notice, the Contractor shall furnish not to exceed two men, one to include the job foreman, and tools to assist and be directed by the Professional for a reasonable amount of time to make such tests and observations as are requested by the Professional.

C. The complete project shall be subject to observations and tests conducted by any Federal, State and/or local authority having jurisdiction. The Contractor shall make all corrections of any deficiencies required by the authority having jurisdiction to allow building occupancy.

D. The complete project shall be subject to observations and tests conducted by the Owner’s Insurance carrier. After inspection by this agency, Contractor shall make corrections of any deficiencies found adversely affecting the insurance to be carried by the Owner. Acceptance of this report or subsequent reports lie with the Professional or Owner.

1.04 RECORD DOCUMENTS

A. The contractor shall provide to the Professional with the Close-Out Documents the following:

1. Two (2) sets of blue line “as-built” prints of same scale as original drawings legibly marked in red showing all variations in the installed work from the requirements of the original contract drawings. The “as-built” drawings shall include all addenda, approved and installed change orders, field condition changes and other departures from the original plans and specifications.

2. Three (3) sets of shop drawings and other data required by the specifications reflecting the manufacturer's shop fabrication of the materials actually installed. The Division 26 shop drawings shall be separately post bound, indexed and tabbed by specification section. Faxed or copies of faxed material shall NOT be used in Close-Out Documents.

3. Operation and maintenance manuals and manufacturer’s instructions for all equipment and systems installed.

4. Copy of all reports of system, equipment or material test as required by this specification.

1.05 GUARANTEE

A. The Contractor shall guarantee to the Owner all work performed under this contract to be free from defects in workmanship and materials for a period of one year from the date of final acceptance by the Professional and the Owner except as hereinafter noted.

B. The Contractor shall correct, repair and/or replace upon notice from the Owner or his authorized representative within a reasonable period of time any defects in the work performed under this contract arising during the warranty period. This repair work shall be provided at no additional cost to the Owner.

C. Lighting luminaire lamps are hereby exempt from the one-year guarantee as follows with the exception that all lamps are to be operating upon final acceptance of the project:

1. All incandescent lamps shall be warranted for thirty (30) days after the date of final acceptance by the Owner. Lamp burn-outs occurring within this time frame shall be recorded by the Owner and will be reported to the Professional at the end of this warrantee period. Upon notice from the Professional, the Contractor shall furnish and install replacement lamps for each lamp burn-out reported.

2. All gaseous vapor discharge lamps shall be warranted for one hundred eighty (180) days after the date of final acceptance by the Owner. Lamp burn-outs occurring within this time frame shall be recorded by the Owner and will be reported to the Professional at the end of this warrantee period. Upon notice from the Professional, the Contractor shall furnish and install replacement lamps for each lamp burn-out reported.

1.06 ELECTRICAL SYSTEMS SCHEDULE

A. Provide and connect all equipment and materials for complete and operative systems as follows:

1. Secondary Electrical Service & Distribution System.
2. Power Outlets & Connections to all Motors & Equipment.
3. Lighting & Control System.
4. Programmable Lighting Control System.
5. Lightning Protection System.
6. Telecommunication System Raceways.
7. Miscellaneous Systems as shown on the drawings or stated herein.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 26 00 20 CODES & STANDARDS

PART 1 - GENERAL

1.01 EQUIPMENT/MATERIAL

A. Use only new equipment and materials of current manufacturer. Equipment/material shall be of current production from manufacturers' of long experience in the manufacture of such types of equipment/material and who are regularly engaged in the production of this type of equipment/material.

B. Equipment/materials shall be installed and connected in strict compliance with manufacturer's recommendations unless these requirements are exceeded as noted on the drawings or specified herein.

C. All equipment supplied shall have local service representation where applicable.

D. Equipment and materials shall be installed and connected in a neat and workmanlike manner.

1.02 CODES

A. Electrical equipment/material and their installation and connection shall strictly comply with the latest editions and applicable sections of the following listed codes and all applicable federal, state and local codes:

1. National Electrical Code (NEC) - NFPA 70
2. NFPA 101 - Life Safety Code
3. National Fire Protection Association (NFPA)
4. International Building Code (IBC)
5. National Electrical Safety Code (ANSI-C2)

1.03 STANDARDS

A. All equipment/material shall be manufactured in compliance with applicable National Electrical Manufacturers Association (NEMA), American National Standards Institute (ANSI) and NEC Standards and requirements.

B. All equipment/materials provided and connected shall be listed by Underwriter's Laboratory (UL) when such listings are issued for the type of equipment/materials. All equipment/material shall be installed and connected in full compliance with their UL listing.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 26 00 30 ELECTRICAL EQUIPMENT/MATERIAL SUBMITTALS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. In addition to the requirements of Section 01 33 00, the information and requirements of this section shall apply to the electrical work.

1.02 EQUIPMENT/MATERIAL

A. Equipment is specified by manufacturer's name and catalog number and is intended to establish the minimum standards of quality acceptable.

B. Where the phrase “or approved equal” is used in the Division 26 Specification, substitute equipment, equivalent in all respects to that specified, of any qualified manufacturer is permitted with the written approval of the Professional. Approval will not be considered until after award of contract and only if submitted by the successful Contractor. Where a list of manufacturers and/or catalog numbers is provided and the phrase “or approved equal” is omitted, substitute equipment, equivalent in all respects to that specified, from one of the listed manufacturers is permitted with the written approval of the Professional.

C. The manufacturer’s name and/or catalog number first mentioned in this specification is considered to be the specified equipment. The "or equal" manufacturers mentioned or other manufacturers proposed by the Contractor shall be considered as substituted equipment.

D. Substituted equipment shall meet the dimensional and functional requirements of the building as represented by the plans and specifications. All revisions to the contract precipitated by the use of substituted equipment shall be incorporated by the Contractor, after approval in writing by the Professional, and at no additional cost to the Owner.

E. The Professional's approval of the shop drawings is only for general conformance with the design concept of the Project and the information given in the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site; information that pertains solely to the fabrication process or to the means and methods of construction; coordination of work of all trades; and performing all work in a safe and satisfactory manner. Approval of the shop drawings does not modify the Contractor’s duty to comply with the Contract Documents. Any equipment or work found in the judgement of the Professional to be defective or otherwise unsuitable shall be repaired or replaced by the Contractor at no additional cost to the Owner.

F. If requested in writing by the Professional, the Contractor shall submit a scale drawing (scale as directed by the Professional) of any electrical equipment area, conduit layout or the like which in the opinion of the Professional may present difficulty regarding space allocation or clearances.

1.03 SUBMITTALS

A. After the project notice to proceed has been issued and with promptness to assure reasonable time for review with no delay to the project, the Contractor shall electronically submit to the Professional shop drawings for all equipment and material for the electrical systems for approval whether or not substituted equipment or materials.

B. The Contractor shall include with his shop drawing submittals a copy of the electrical service characteristics letter required by Section 26 04 50. Shop drawings submitted without this letter attached will not be reviewed until this letter is provided.

C. Shop drawings shall be submitted by specification section and shall be number as outlined in Section 01 33 00 with all material/equipment shop drawing cut sheets located under the appropriate specification section. All shop drawings shall be original pdf and shall be completely legible. Scanned copies and handwritten information will not be accepted.

D. Space shall be provided on the title or index page of each section of the shop drawings for the Professional's review stamp and comments. This space shall be clearly labeled as to its use and shall have a minimum size of 7" wide X 5" high.

E. All submitted equipment/material and associated options, accessories, special features, etc. shall be clearly marked and indicated on all copies of the shop drawings. Provide appropriate shop drawings on all required accessory equipment.

F. All shop drawings for all systems, equipment and materials including any required one-line drawings, diagrams, etc. shall be submitted together. Partial submittals will not be reviewed without prior consent. Special systems provided by specialized vendors or distributors may be submitted in a separate binder.

G. Provide complete shop drawings with all pertinent information for the following equipment and/or systems and all required components:

1. Switchboards.
2. Panelboards.
3. Circuit Breakers.
4. Transient Voltage Surge Suppression (TVSS) Devices.
5. Conduits, Boxes and other Raceway Systems.
6. Conductors, 600V.
7. Control/Communication Cabling.
8. Required Cable Test Reports.
9. Wiring Devices.
10. Lighting Luminaires and Accessories.
11. Luminaire Ballasts.
12. Luminaire Emergency Battery Packs.
13. Lamps.
14. Lighting Control Systems.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 26 01 00 BASIC ELECTRICAL MATERIALS & METHODS

PART 1 - GENERAL

1.01 COORDINATION

A. This Contractor shall familiarize himself with the general construction and building systems of all divisions specified in the Contract Documents. Fully coordinate the installation of all electrical equipment and materials with the general construction work and work of other divisions of the specifications prior to the start of the installation. Notify the Professional, prior to installation, of conflicts between electrical and structural, architectural, mechanical, etc. work.

B. Layout and installation of Division 26 work shall be the responsibility of this Contractor and all conflicts with other trades shall be resolved by the Contractor and approved by the Professional prior to installation.

C. Sequence, coordinate and integrate installing electrical equipment and materials for efficient flow of the work. Coordinate the installation and positioning of large equipment before closing in the building. Providing appropriate pathways, lifting devices, etc. for the installation of electrical equipment and/or materials in new or existing facilities is the responsibility of this Contractor.

D. Fully coordinate prior to installation all Utility Company services including metering facilities to the facility with the appropriate serving Utility Company. Comply with the requirements of the serving Utility Companies.

E. The electrical drawings are not to scale. Follow architectural, equipment supplier shop drawings, and manufacturer's shop and installation drawings for accuracy. Coordinate the installation of electrical devices, equipment and/or materials with the architectural drawings, features and finishes for the space where installed.

PART 2 - PRODUCTS

2.01 ELECTRICAL IDENTIFICATION

A. Conductors or wiring shall be labeled using tape markers of vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.

B. Engraved plastic labels, signs, etc. shall be melamine plastic laminated punched or drilled for mechanical fasteners and shall be properly secured to associated equipment or device. Engraved legend shall be black letters on white background. Minimum label thickness shall be 1/16 inch.

2.02 FIRE PROOFING

A. The Division 26 Contractor shall be responsible for procuring and coordinating with the Fire Proofing Contractor to provide the required fire proofing of all electrical penetrations in or through rated assemblies.

PART 3 - EXECUTION

3.01 ELECTRICAL IDENTIFICATION

A. Electrical equipment, devices, outlets, conductors, etc. shall be properly and legibly labeled as specified herein.

B. Where equipment, circuit, etc. identification requires the use of building room numbers and room names, the numbers and names used shall be the final designations issued by the Professional as they appear on the building signage. These designations may or may not be as they are indicated on the Contract Drawings. The Contractor is responsible for fully coordinating the room designations with the Professional.

3.02 ELECTRICAL EQUIPMENT & MATERIAL INSTALLATION

A. Equipment and materials shall be installed and connected in a neat and workmanlike manner.

B. Install equipment and materials level, plumb, and parallel and perpendicular to other building systems' elements and components unless otherwise indicated.

C. Install equipment to facilitate service, maintenance, and repair or replacement of components.

D. Electrical equipment and devices shall be mounted at the height specified in the appropriate sections or as indicated on the drawings. Mounting heights may be adjusted slightly to permit cutting of masonry block to the top or bottom of the block course nearest the required height. All heights shall be consistently cut above or below the block coursing so that they are the same height above the reference.

E. The mounting heights of electrical equipment and material shall reference the height above the finished floor or grade above which they are mounted. Mounting heights specified shall reference the center of the box, device, switch or circuit breaker operating handle unless indicated otherwise.

F. Electrical switchboards, panelboards, motor control centers, disconnect switches, etc. shall be installed with the proper dedicated electrical spaces and working spaces as required by the NEC.

3.03 FIRE STOPPING

A. Openings around electrical penetrations through smoke or fire rated wall, partition, floor or ceiling assemblies shall be smoke and/or fire stopped using an approved UL listed system designed for the materials encountered to maintain the smoke and/or fire rating of the assembly.

B. All fire proofing in rated walls, partitions, floors or ceiling assemblies shall be performed by a certified Fire Proofing Contractor.

3.04 CUTTING & PATCHING

A. Cut, channel, chase and/or drill floors, walls, partitions, ceilings and other surfaces required to permit electrical installations. Obtain permission in writing from the Professional and the General Contractor prior to cutting or penetrating any structural member.

B. Repair and refinish disturbed finish materials and other surfaces indoors and out-of-doors to match adjacent undisturbed surfaces and/or to existing condition prior to work performed.

C. Use experienced and skilled mechanics of the trades involved or employ appropriate sub-contractor to perform all repair and refinishing.

D. All roof penetrations shall be weatherproofed by the Division 7 Contractor. Division 26 Contractor shall be responsible for procuring and coordinating with the Division 7 Contractor to weatherproof all roof penetrations created by the Division 26 work.

3.05 CLEANING & PROTECTING

A. Properly protect equipment and installations during the construction period to ensure that components, coatings, finishes, cabinets and enclosures are without damage or deterioration at the time of acceptance by the Owner.

B. On completion of construction within an area, inspect exposed finish of outlets, devices, fixtures, equipment, etc. Remove burrs, dirt, paint spots and construction debris.

C. Provide touch-up paint on equipment finishes marred during the construction or installation process. Paint shall be as recommended by the equipment manufacturer and shall match the installed equipment finish.

END OF SECTION

SECTION 26 01 10 RACEWAYS & FITTINGS

PART 1 - GENERAL

1.01 RACEWAYS

A. All power branch circuit/feeder wiring and other systems' wiring as specified shall be in metallic conduit unless specifically noted otherwise on the drawings or herein specified.

B. Wiring gutters shall not be used unless specifically shown or noted on the drawings.

C. Rigid non-metallic conduit (RNC) may be used only where specifically shown or noted on the drawings or herein specified.

PART 2 - PRODUCTS

2.01 METALLIC RACEWAYS

A. Conduits shall be hot-dipped galvanized rigid steel (GRS) per ANSI C80.1/UL 6, intermediate conduit (IMC) per ANSI C80.6/UL 1242 or electrical metallic tubing (EMT) per ANSI C80.3/UL 797 unless specifically shown or noted otherwise on the drawings or herein specified.

B. Size conduits as shown on the drawings or where size is not shown follow the requirements of the NEC. Four-wire branch circuit homeruns shall be 3/4" trade size minimum. Homeruns shall not exceed the number of conductors shown on the drawings unless specific approval is given by the Professional.

C. Where conduit bends/elbows for power circuits are required to be long radius, the minimum bend radius shall be eight (8) times the conduit trade size for conduits 2" or greater and six (6) times the conduit trade size for conduits less than 2" unless otherwise directed by the Professional.

D. Conduit bends/elbows for communication systems shall be long radius type. The minimum bend radius shall be ten (10) times the conduit trade size for conduits 2" or greater and six (6) times the conduit trade size for conduits less than 2" unless otherwise directed by the Professional.

E. All conduit bends/elbows uses in conduit systems for electrical service entrances and feeders shall be long radius type unless available installation space is prohibited by the building's structural elements, construction type, etc.

2.02 METALLIC CONDUIT MATERIAL

A. Conduit shall be provided in accordance with the following schedule unless shown or noted otherwise on the drawings or herein specified:

1. In suspended ceiling construction or non-masonry partitions: GRS, IMC or EMT.
2. In masonry partitions: GRS, IMC or EMT.
3. In any poured concrete: GRS or IMC.
4. In exposed locations indoors: GRS, IMC or EMT.
5. In exposed locations out of doors: GRS or IMC. All conduits buried in earth shall be GRS with polyvinyl, polyethylene or asphaltum coating.

6. All feeders shall be run in GRS or IMC.
7. All electrical power conduits in excess of 1 1/4" trade size shall be GRS or IMC.

2.03 FLEXIBLE CONDUIT

A. Flexible conduit shall be steel. Use not to exceed six (6) feet of flexible metal conduit for connection to motors and/or recessed fixtures unless otherwise specified herein.

B. Flexible conduit used for connections subject to moisture under normal conditions or where specifically indicated or noted shall be liquid-tight with proper liquid-tight fittings.

C. All flexible conduit shall have properly sized bonding jumper installed within. The grounding conductor shall be sized as indicated or in accordance with the NEC.

D. All final connections to motors, transformers or other vibrating equipment shall be with flexible conduit suitable for the environment installed.

2.04 CONDUIT FITTINGS/TERMINATIONS

A. All conduit fittings shall be steel or malleable iron. Die cast fittings shall not be used.

B. GRS and IMC conduit fittings:

1. Steel or malleable iron threaded couplings, elbows and conduit bodies.
2. Bushings: Shall be the insulating type of steel or malleable iron consisting of an insulating insert molded or locked into the metallic body of the fitting. Bushing for conduits 1-1/4 inches or larger shall be the grounding type with a ground lug.
3. Locknuts: Shall be bonding type of steel or malleable iron with sharp edges for digging into the metal wall of enclosures/boxes.

C. EMT conduit fittings: Couplings and connectors shall be insulated compression type of steel or malleable iron and shall be properly secured to each conduit or box.

D. Expansion Fittings: Expansion fittings shall be as manufactured by Crouse-Hinds Type XJG with internal grounding or equal approved by the Professional.

E. Seal-Off Fittings: Fittings shall be as manufactured by Crouse-Hinds Type EYS for horizontal and vertical runs, Type EYS elbow seals or equal approved by the Professional. All seals shall be properly installed in an accessible location using "Chico X" fiber and "Chico A" sealing compound.

2.05 RIGID NON-METALLIC CONDUIT (RNC)

A. Where specifically noted and/or indicated on the drawings, wiring may be installed in polyvinyl chloride (PVC) conduit per NEMA TC-2/TC-3//UL651 or equivalent HDPE. PVC conduit shall be sunlight-resistant, electrical grade, Schedule 40 minimum or Schedule 80 where indicated on the drawings.

PART 3 - EXECUTION

3.01 INSTALLATION/ROUTING

A. All conduits shall be routed concealed above/within ceilings, wall partitions, floors, etc. unless specifically shown or noted otherwise on the drawings or stated herein.

Route conduits parallel and/or perpendicular to walls, ceilings or floors weather concealed or exposed. Homerun conduits shall be combined to form a common routing path and supported from the building structure by trapeze style hangers.

C. Conduits shall NOT be routed horizontally on the roof without specific approval from the Professional.

D. Make field bends and offsets in conduits in accordance with the NEC and so as not to reduce the internal diameter.

E. Install raceways with a minimum number of bends in the shortest practical distance, considering building construction and obstructions and other requirements of the drawings and this specification. Provide accessible junction/pull boxes per the NEC to limit distance between pull points to 100 feet or in conduit runs where total raceway bends exceed 360 degrees.

F. Branch circuit, telecommunication and other systems' conduits shall not be routed in/under floor slab unless specifically shown or noted on the drawings to be installed in that manner, the adjacent building construction methods prohibit concealed overhead routing, or the nature of the connected device/box (i.e. floor boxes) requires this type of routing.

G. Where conduits are shown or required to be concealed in concrete slabs in contact with earth, conduits 1/2" through 1" trade size shall be installed in and not under slabs. Conduits in excess of 1" trade size shall be installed under slab and shall have two coats of asphaltum paint applied or shall be coated with polyvinyl, polyethylene or other approved coatings. Where conduit symbol indicates conduit concealed in floor slab and concrete thickness is less than four (4) inches, conduits shall be installed below slab. Conduits shall be routed as required so as not to compromise the structural integrity of any concrete.

H. Protect conduit stub-ups above floor slabs, finished grade, etc. from damage during and after the construction period. Provide temporary closures to prevent entrance of moisture or debris into conduits and make certain that conduits are clear of same before installing conductors.

I. Pull into all empty conduits one nylon pull string with not less than 200 lb. tensile strength. Leave at least 12 inches of slack at each end.

3.02 SUPPORTS

A. All conduits and conduit fittings shall be properly supported in accordance with the National Electrical Code and as follows:

1. By one-hole or two-hole straps properly attached to the building elements.
2. Where embedded in concrete, by at least three (3) rounds of #14 B&S gauge galvanized wire twisted around concrete reinforcing rods.

3. For exposed work, by one-hole or two-hole malleable iron clamps held in place by machine screws in expanding lead anchors in concrete or masonry or by screws in wood.
4. By conduit clamps properly attached to bar joists.
5. By bulb “T” clamps for conduits crossing bulb “T”’s.
6. Where groups of conduits occur or for feeder conduits where applicable, by trapeze hangers adequately supported by steel rods attached to the building structure using concrete inserts, welded supports, bolted supports, etc.

B. In suspended ceiling construction, do not support conduits from ceiling support system. Conduit and box systems shall be supported independently of both the tie wires supporting the ceiling grid system and the ceiling grid system into which ceiling panels are placed.

1. Supporting means shall not be shared between electrical raceways and mechanical piping or ducts unless specifically shown or noted otherwise.

3.03 TERMINATIONS/FITTINGS

A. Couple conduits together and connect to boxes, fittings and cabinets so as to provide effective electrical continuity. Assure ground continuity on GRS feeder and branch circuits by two locknuts, one inside and one outside of all boxes, cabinets and enclosures. Do not use couplings dependent on screws bearing on conduit.

B. Provide insulating bushing where conductors #4 or larger enter junction box, enclosure, cabinet or cutout box. Bushings shall be grounding type as manufactured by OZ/Gedney type "BLG", Thomas & Betts/Steel City or equal approved by the Professional.

C. Expansion fittings in conduits shall be provided where shown on the drawings or where conduits imbedded in concrete pass through an expansion joint(s).

D. Provide seal-off fittings where shown on the drawings or as required by conditions encountered requiring seals. Seal-off fittings shall be installed where conduits are installed between areas of different temperatures where condensation may occur. These shall include, but not be limited to, refrigerators, freezers, air-handling units, environmental rooms and the building exterior. Seal-off fittings shall also be installed where conduits enter the building or a piece of equipment and there is a possibility of moisture migration thru the raceway to the equipment or into the building.

3.04 RIGID NON-METALLIC CONDUIT (RNC)

A. Installation of PVC conduit shall follow the applicable provisions of conduit installation/routing hereinbefore specified for metallic conduits and the manufacturer's recommendation unless exceeded by requirements shown on the drawings or this specification. All joints shall be made using approved and proper solvent cement to make all joints water tight.

B. Galvanized rigid steel (GRS) conduit shall be used where PVC conduit runs turn angles, rise vertically and/or are exposed.

C. PVC conduit shall not be stored nor have been stored in direct sunlight.

D. PVC boxes of equivalent dimension to those hereinafter specified under paragraph 260120 "BOXES AND FITTINGS" shall be used with PVC box connectors.

E. Where underground PVC conduits are shown and/or noted on the drawings to be used for communication systems and/or to be empty for future use, provide one #8 copper conductor in each conduit for full length of conduit for future locating purposes.

3.05 RACEWAY CONCRETE ENCASEMENT

A. Raceway concrete encasement where required by the drawings and/or this specification shall be minimum 2500 psi concrete with #6 reinforcing bars six (6) inches on center. Concrete encasement shall be such to provide a minimum of three (3) inches of concrete cover around perimeter of raceway duct bank on all sides. Concrete encasement shall be poured in a single continuous pour or all concrete pour joints shall be made utilizing a plywood vertical dam with #6 bars extending four (4) feet into each pour. Pour joint shall not occur at conduit couplings, angles, etc.

END OF SECTION

SECTION 26 01 20 BOXES AND ENCLOSURES

PART 1 - GENERAL

1.01 Provide proper outlet box at all fixtures/devices and outlet provision locations as shown on the drawings by symbols or specified herein.

1.02 Provide plates and/or covers on all boxes and outlets with or without devices. Plates shall be single, multi-gang or combination types to match corresponding devices. Securing screws shall have same finish as plate. Oversized or jumbo plates shall not be used without specific approval from the Professional.

1.03 Exterior, in-grade pullboxes shall be provided where shown on the drawings or as required for installation of the Work, by the serving Utility Company(ies) or for compliance with the NEC.

PART 2 - PRODUCTS

2.01 OUTLET BOXES

A. All outlet boxes and raised covers shall be galvanized stamped steel unless otherwise noted on the drawings or specified herein.

B. Use boxes of cast or malleable iron with threaded hubs for damp or wet locations, locations exterior to the building and in any poured concrete.

C. Outlet/junction boxes shall be as manufactured by Thomas & Betts/Steel City, Raco, Appleton or equal approved by the Professional.

D. Use outlet boxes at interior locations sized in accordance with the following schedule or in accordance with the NEC whichever dictates a larger box. Minimum conductor size to be used in determining power branch circuit box sizes shall be No.12 AWG.

1. Switch box, 3 inches by 2 inches by 2-1/2 inches - 5 conductors maximum.
2. 4 inches octagon box, 1-1/2 inches depth - 6 conductors maximum.
3. 4 inches square box, 1-1/2 inches depth - 9 conductors maximum.
4. 4 inches square box, 2-1/8 inches depth - 13 conductors maximum.
5. 4-11/16 inches square box, 2-1/8 inches depth - 18 conductors maximum.
6. 4 inches octagon concrete box, 2-1/2 inches depth - 13 conductors maximum.

2.02 JUNCTION BOXES

A. Provide junction boxes or pull boxes as required by the NEC, field conditions encountered, etc. whether or not shown on the drawings.

B. Use stamped steel boxes for indoor junction/pull boxes where the appropriate box size is available for the conduit size(s) and the number of conductors encountered. Use screw cover metallic pull boxes indoors where larger boxes are required. Use cast iron boxes out of doors.

C. Junction/pull boxes shall be as manufactured by Hoffman, Columbia, Hope or equal approved by the Professional.

2.03 PULL BOXES - EXTERIOR

A. In-grade pullboxes shall be of polymer concrete construction with solid bottom unless otherwise noted, of the size as indicated or as required by the NEC and of a minimum load rating for the box and cover for the area installed per this specification.

B. In-grade pullboxes and covers shall have a minimum AASHTO H-20 (20,800lbs) load rating.

2.04 PLATES

A. Plates on all flush mounted boxes/outlets shall be satin-finished, type 302 stainless steel (18 percent chrome, 8 percent nickel) as manufactured by Hubbell or equal in Pass & Seymour, Leviton or Arrow Hart.

B. All surface mounted outlet/junction boxes shall be provided with galvanized steel plates.

C. Weather proof receptacles installed outdoors in locations protected from the weather (roofed open porches, canopies, and the like) or in other indoor damp locations shall be provided with weather proof covers as manufactured by Hubbell or equal in Pass & Seymour, Leviton or Arrow Hart. Plates shall be Cat. No. CWP8H for non-GFI type receptacles and Cat. No. CWP26H for GFI type receptacles. Weather proof receptacles installed outdoors in locations unprotected from the weather shall be provided with "in-use" type weather proof covers as manufactured by Hubbell Cat. No. WP8MHP or equal approved by the Professional.

PART 3 - EXECUTION

3.01 OUTLET BOXES

A. Box locations shall be fully coordinated with the Professional where boxes are to be exposed or where installation affects architectural elements, structural construction or mechanical systems.

B. Close all unused knockout holes and install galvanized device cover or blank cover on surface boxes and proper device plate or blank plate as specified herein on flush boxes.

C. Location of all outlets as shown on the drawings is approximate and representative unless dimensioned or specifically noted. See Architectural drawings, details and/or shop drawings for specific outlet locations. Any outlet/box and associated conduits/conductors may be moved from the location shown on the drawings in any direction up to a distance of ten (10) feet by direction of the Professional if so directed before the outlet/box has been installed.

D. Mount boxes flush with finished surface. Provide plaster rings or square corner raised covers for tile or block walls so that fixtures/devices/plates will be perfectly flush mounted. Do not install outlet boxes back to back. Face of boxes shall not be installed more than 1/4 inch behind finished face of wall.

E. Where a single outlet box is installed in a metal or wood stud wall, the box shall be attached to the studs using a metal mounting bracket with support leg to prevent movement of box in wall at unattached side. Where two or three outlet boxes are shown and/or intended to located adjacent to each other in a metal or wood stud wall, the boxes shall be attached to the studs using a common metal mounting bracket with bracket stabilizer leg to support the middle portion of the bracket. Outlet box mounting brackets shall be as manufactured by Erico/Caddy or approved equal.

F. Outlet boxes installed in masonry walls shall be embedded in masonry grout so as to properly secure each box in place. The Division 26 Contractor is responsible for providing all materials and installing the outlet boxes as required.

3.02 JUNCTION/PULL BOXES

A. Boxes sizes shall be as indicated on the drawings, herein specified, per the NEC for the conduit sizes, conductors and situation encountered, or as directed by the Professional. Use above listed outlet box sizing schedule for stamped steel junction/pull boxes.

B. All junction or pull boxes shall be labeled indicating system being served, branch circuit or feeder circuit identification, etc. Where installed in concealed locations (i.e. above accessible ceilings) or in unfinished areas, identification shall be made on outside of box cover. Where installed exposed in finished locations, identification shall be made on inside of box cover. Fire alarm system(s) junction box where not exposed in a finished space shall have covers painted “red” in color.

C. Close all unused knockout holes in junction/pull boxes and install proper cover. Junction/pull boxes install flush or exposed in finished spaces shall be installed with the same requirements as outlet boxes.

3.03 PLATES/COVERS

A. Plates shall be properly secured to outlet box with corners in contact with finished wall and oriented parallel/perpendicular to adjacent building surfaces.

3.04 PULLBOXES - EXTERIOR

A. In-grade pull boxes shall be set flush with the finished grade. Finished grade shall be adjusted as required to allow the pullbox to set level. Provide a minimum 6 inches (or as recommended by the manufacturer) bed of gravel or crushed rock, unless the box is shown or noted on the drawings to be fully concrete encased, under the box and extending a minimum of 6 inches on all sides. Fill around box with compacted select fill that is compacted in 6 inch layers. All pull boxes shall receive a concrete collar around the top perimeter of the box to provide added support.

END OF SECTION

SECTION 26 01 30 CONDUCTORS (600V)

PART 1 - GENERAL

1.01 SUMMARY

A. Use No.12 AWG minimum power branch circuit conductor size with exceptions as noted on the drawings or as stated herein. 120 volt branch circuit homerun conductors in excess of 50 feet in length and 277 volt branch circuit homerun conductors in excess of 100 feet in length of all 20 ampere branch circuits shall be #10 AWG minimum size whether or not shown or noted on the drawings.

B. All shared neutral conductors of 20 ampere branch circuits serving receptacles shall be No.10 AWG minimum.

PART 2 - PRODUCTS

2.01 LOW-VOLTAGE POWER CONDUCTORS

A. Conductors shall be standard annealed copper rated 600 volts with mechanical strength, insulation, temperature and current carrying capacity adequate for the particular conditions under which they are used and in accordance with the following:

1. In wet or dry locations type "THHN-THWN" complying with NEMA WC 5 unless specifically shown or noted on drawings or specified herein to be other type.
2. Branch circuit conductors within three (3) inches of a ballast within the ballast compartment of fluorescent luminaires shall be recognized for use at temperatures not lower than 90℃.
3. In un-wired luminaires where required by the NEC, use approved heat-resistant wire sized for current, voltage and temperature at which luminaire operates.
4. Conductors entering the self-contained ballast compartment of gaseous vapor discharge fixtures shall be rated 600 volts, #10 AWG, stranded copper, silicone rubber insulation, glass outer-braid and 200℃. rated conductor temperature.

B. Conductor sizes #8 AWG and larger shall be of the stranded type with Class B stranding. Conductor sizes #10 AWG and smaller shall be of the solid type with the exception that all final connections to motors or other vibrating equipment shall be made with stranded conductors regardless of conductor size.

2.02 SPLICES

A. Use soldered and taped or approved mechanical splice connections on solid wire and pressure type solderless connectors well taped on stranded conductors. Conductor sizes #8 AWG and larger shall have irreversible compression type splice.

B. Use Scotch 3M or approved equal plastic tape over mechanical and soldered splices applied in thickness equal to wire insulation.

PART 3 - EXECUTION

3.01 CONNECTIONS/SPLICES

A. Tighten electrical connections and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Make splices and connections in accessible boxes, gutters or cabinets only. Conductors sizes #8 AWG and larger shall be spliced only with specific approval from the Professional.

3.02 CONDUCTOR INSTALLATION

A. 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. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage conductors or raceways.

3.03 COLOR CODING

A. Color-code 480/277 volt, 3 phase, four wire, "wye" connected secondary electrical systems service entrance, feeder and branch circuit conductors throughout the secondary electrical system as follows:

1. Phase A - Brown, Phase B - Orange, Phase C - Yellow
2. Three-way & four-way travelers - Purple w/Yellow stripe
3. Neutral - White with continuous colored stripe, Equipment Ground - Green

B. Color-code 208/120 volt, 3 phase, four wire, "wye" connected secondary electrical systems service entrance, feeder and branch circuit conductors throughout the secondary electrical system as follows:

1. Phase A - Black, Phase B - Red, Phase C - Blue
2. Three-way & four-way travelers - Purple
3. Neutral - White, Equipment Ground – Green

3.04 TESTING

A. Conductor insulation test shall be performed on all electrical service entrance conductors, switchboard/panelboard and transformer feeder conductors and branch circuit conductors No.2 AWG and larger. An insulation test shall be performed on any feeder or branch circuit as requested by the Professional for trouble shooting purposes. The "600V Conductor Insulation Test Report" found at the end of this section shall be completed with test results and shall be submitted to the Professional prior to substantial completion of the project.

B. 600 volt conductor insulation tests shall be performed using a 500 volt megger. Each conductor shall be tested with all splices made but no equipment or devices connected. Feeder/branch circuits with paralleled conductors shall have conductors tested separately prior to paralleling. The ohmic value measured shall be recorded and the results shall meet the minimum requirements as follows. Conductors not meeting these minimum requirements shall be replaced or repaired as directed by the Professional.

Conductor Size	Kilohms (min.)
No.6 AWG thru #3 AWG	100
No.2 AWG thru #3/0 AWG	50
No.4/0 AWG thru 600 MCM	25

END OF SECTION

600V CONDUCTOR INSULATION TEST REPORT

I. Testing Organization

Company Name:_____Test Date:_____

Representative:_____Telephone No.:_____

II. Project Information

Project Name:_____ W/O Job No.:_____

Project Address:_____

III. Test Results

Circuit Information		Conductor Information	Test Results (Kilohms)		
Source	Load	Number/Size	PH. A	PH. B	PH. CNeut.

(make copies of page as required)

SECTION 26 02 20 SECONDARY ELECTRICAL SERVICE SYSTEM

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. The Division 26 Contractor shall verify the electrical service location, characteristics, routing, etc. with the serving Using Agency's Physical Plant or Utility Company prior to any rough-in and/or material purchases or orders. The Contractor shall notify the Professional of any changes in the project required to meet the Using Agency's/Utility Company's requirements. Failure to adhere to this requirement shall make this Contractor responsible for all corrections and/or changes to installed/purchased equipment, materials, etc. and associated rough-ins required to comply with the Using Agency's/Utility Company requirements.

B. A pre-installation conference shall be scheduled by the Div. 26 Contractor prior to any installation of the secondary service entrance including the pad-mounted transformer. This conference will be used to discuss requirements and verify the requirements of the Contract Documents and the requirements and expectations of the Using Agency/Utility Company. Representatives from the Professional, the Using Agency's Physical Plant, the Utility Company and the Contractor shall be present.

1.02 SECONDARY ELECTRICAL SERVICE ENTRANCE

A. Electrical Secondary Service Voltage: 480/277 volts, three phase, 4 wire, 60Hz, "wye" connected at each building.

B. Electrical Service Entrance - Underground

1. Provide underground electrical service entrance to the facility(ies) as shown or noted on the drawings. Number and size of service entrance conduits shall be as indicated on the drawings and as required for the installation of the service entrance conductors in accordance with the NEC.
2. The point of connection to the Utility Company's medium voltage service facilities (i.e. riser pole, pad-mounted transformer, etc.) shall be fully coordinated with the Utility Company prior to any rough-in. Riser pole and pad-mounted transformer locations and orientations shall be verified with Utility Company prior to any associated rough-in.

C. The secondary electrical service entrance duct bank shall be of the size and type as shown on the drawings and/or herein specified. The duct bank shall be installed a minimum of 48" below the finished grade to the top of the conduit(s). All conduit bends shall be factory made, long radius type with a minimum bend radius six (6) times the conduit diameter or as required for the conductor installation to maintain manufacturers maximum pulling tensions and sidewall pressure values.

D. The electrical service entrance conduit(s) shall have the proper lengths of conductors protruding from an approved electrical service entrance fitting for the connection to the electrical service facilities.

1.03 ELECTRICAL METERING FACILITIES

A. All electrical meters shall be furnished and installed under a separate contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 26 02 30 STAND-BY/EMERGENCY ELECTRIC POWER SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

A. Provide and connect a complete stand-by/emergency electric power system consisting of new and current equipment to automatically provide emergency power via an engine generator set(s) and transfer switch(es) to selected loads in the event of normal power interruption.

B. Installation shall be in strict compliance with applicable codes including, but not limited to, NFPA 110 and NEC Articles 700, 701 and 702. System shall be installed and connected by personnel qualified in systems of this type.

C. All material, equipment and/or accessories necessary for proper operation of the system not specified or described herein shall be provided at no additional contract cost to accomplish the intended function of the system.

D. The Contractor shall be responsible for providing adequate technical supervision by factory trained representative(s) of the system manufacturer to assure proper installation and connection of the system. These personnel shall perform initial start-up, operational testing and Owner instructional training.

E. The complete stand-by/emergency power system (engine generator set, ATS, controls, etc.) shall be warrantied by the same manufacturer for one year from the date of final acceptance by the Owner and/or Professional.

F. Three (3) copies of complete operation and maintenance manuals in hardback binder(s) of the installed engine generator set, automatic transfer switch and all accessories shall be provided to the Professional with the Close-Out Documents.

G. The engine generator assembly(ies) including all specified components and accessories and its/their installation shall be UL 2200 listed.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. The engine generator shall be as manufactured by Kohler model number 80RZGD-4R9X or equal in Onan/Cummins, Caterpillar or Generac.

B. The automatic transfer switch shall be as manufactured by Kohler KCS Series or equal in Onan, Caterpillar, Russelectric or Asco.

2.02 ENGINE GENERATOR SET

A. The engine generator set shall have minimum continuous stand-by rating of 200/250 KW/KVA at .8 power factor, 3 phase, 4 wire, 60 Hz.

B. Engine generator set shall have a minimum starting XXX KVA of at the system voltage with a maximum 20% voltage dip and shall recover to +/- 0.5% of rated voltage within four seconds.

C. Exposed moving parts, parts that produce high operating temperature which are accessible to the public from the finished grade, parts that may be electrically energized and parts that may be hazardous to the public during normal operation shall be insulated, fully enclosed, guarded or fitted with other types of safety devices. The safety devices shall be installed so that proper operation of the equipment is not impaired.

2.03 ENGINE

A. The generator set engine shall be four cycle and shall be Diesel fueled with electric fuel shut-off.

B. The engine shall have an isochronous governed speed of 1800 rpm.

C. The engine shall be liquid cooled, closed loop with factory mounted radiator, fan and water pump. A block heater of proper wattage and voltage, thermostatically controlled to maintain engine coolant at 90 degrees Fahrenheit shall be provided and connected.

D. Full pressure lubrication shall be supplied by a positive displacement lube oil pump. The engine shall have air cleaner and fuel and oil filters with replaceable elements.

E. Provide and connect ten (10) ampere automatic float and equalize battery charger with alarms when remote annunciator is supplied. Engine shall have minimum 35 ampere automatic battery charging alternator with solid-state voltage regulation.

F. Starting shall be by positive engagement solenoid shift-starting motors. Provide heavy-duty battery(ies) with corrosion proof battery rack and battery cables. Battery(ies) shall be capable of delivering the minimum cold-cranking amps required at zero degrees Fahrenheit per SAE standard J-537.

2.04 GENERATOR

A. The engine generator set alternator shall be salient-pole, reconnectable self-ventilated of drip-proof construction with amortisseur rotor windings skewed for smooth voltage waveform. Unit shall be connected to provide proper system voltage. The generator shall be directly connected to the flywheel housing with a semi-flexible coupling between flywheel and rotor with maintenance free bearing.

B. Insulation material shall meet NEMA standards for Class H and be vacuum impregnated with epoxy varnish to be fungus resistant. Temperature rise of the rotor and stator shall be limited to 150 degrees Celsius.

C. The excitation system shall be of brushless construction controlled by a solid-state voltage regulator with adjustable volts-per-hertz operation capable of maintaining voltage within +/- 2% at any constant load from 0 to 100% of rating. The regulator must be sealed from the environment and isolated from the load to prevent tracking when connected to SCR loads. Frequency regulation shall be isochronous and +/- 0.25% steady state.

D. The generator shall be capable of sustaining at least 300% of rated current for at least 10 seconds under a three phase symmetrical short circuit by inherent design or by the addition of a current boost system.

E. The engine generator set shall be provided with a resettable, U.L. listed, 100% equipment rated line current sensing output circuit breaker with solid state trip and shall not automatically reset. Breaker shall be coordinated with down stream breakers to allow selective tripping of down stream breakers under a fault condition.

2.05. CONTROLS/ANNUNCIATION

A. The generating set shall have complete set-mounted, vibration isolated microprocessor-based controller rated for operation in the environment installed. Controller shall include:

1. Complete start/stop control which shall operate on closure of remote contact(s).
2. Speed sensing and a second independent starter motor disengagement system shall protect against the starter engaging with a moving flywheel. Starting system shall be designed for restarting in the event of a false engine start.
3. Overcrank protection designed to open the cranking circuit after 75 seconds if the engine fails to start.
4. Circuitry to shut down the engine when signal(s) for high coolant temperature, low oil pressure, or overspeed is received.
5. Engine cool down timer factory set to permit unloaded running of the generator set after transfer of the load to normal.
6. Three-position (Auto - Off - Test) selector switch. In the “test” position, engine shall start and run regardless of the position of the remote starting contacts. In the “automatic” position, engine shall start upon closure of remote starting contacts. In the “off” position, the engine shall not start under any condition. The “off” position shall also provide immediate emergency shutdown of the generator set.
7. Indicating lights to signal the following: Not-in-auto, overcrank, emergency stop, high engine temperature/low coolant level, overspeed, low oil pressure, battery charger malfunction, low battery voltage, low fuel, system ready, pre-alarm high engine temp., pre-alarm low oil pressure, low coolant temperature, auxiliary fault, auxiliary fault pre-alarm. A test button shall be provided for testing all indicating lights.
8. Alarm horn with silencer

B. A generator set instrument panel shall be set-mounted, vibration isolated, connected and tested by the generator set manufacturer. The instrument panel shall contain dual range volt meter, dual range ammeter, voltmeter-ammeter phase selector switch, lights to indicate high or low meter scale, frequency meter, panel illuminating lights, battery charger meter, coolant temperature gauge, oil pressure gauge, running time meter, voltage adjustment rheostat.

C. A remote alarm annunciator with audible and visual signals meeting NFPA-110 shall be provided and connected where indicated on the drawings, or if location not shown, at a location complying with NFPA-110 as approved by the Professional.

2.06 EXHAUST

A. Outdoor engine generator set(s) shall be provided with proper exhaust silencer and tail pipe coated to be temperature and rust resistant and rated for critical applications. The exhaust silencer shall be vibra-mounted to the roof of the unit’s weather housing. Exhaust silencer(s) and piping shall meet the requirements of the engine generator set manufacturer.

2.07 FUEL SUPPLY/STORAGE

A. U.L. listed sub-base fuel tank of double walled construction with normal and emergency venting. Fuel capacity shall be for a minimum of 48 hours of generator operation at 100% of rated load. Fuel tank shall be completely filled at final acceptance with proper fuel as recommended by the engine manufacturer.

B. Flexible fuel lines rated 300 degrees Fahrenheit and 100 PSI ending in pipe thread.

2.08 AUTOMATIC TRANSFER SWITCH(ES)

A. The automatic transfer switch (ATS) shall consist of a single power module and a microprocessor-based control module interconnected and coordinated with engine generator set to provide complete automatic transfer operations between the normal and stand-by power sources.

B. ATS shall be rated for the connected generator voltage and phase and ampere rating (100% continuous-duty) as indicated on the drawings 3 phase, 4 wire with solid neutral connection with proper lugs. The ATS shall have a fault current withstand rating as shown on the drawings or if rating not shown, the same rating as the KAIC rating of the normal service source panelboard in which connected. It shall be enclosed in a NEMA 1 wall mounted cabinet.

C. The transfer switch shall have a single transfer operator that is mechanically held on both sides and electrically operated with mechanical and electrical interlock(s) to prevent source-to-source connection at any time. Normally open and normally closed auxiliary contacts (rated at 10 amperes at 480V) shall be provided and connected as required for operation and interface with external systems as shown on the drawings, herein specified, or as required. A manual handle or operator shall be provided.

D. Each normal power source phase and at least one phase of the emergency source shall be monitored by an under-voltage relay with at least one of these relays being a close differential type field adjustable for 75% to 100% pickup (factory set for 95%) and 70% to 90% dropout (factory set at 85%). Anti-single phasing protection shall detect regenerative voltage as a failed source condition. Adjustments shall be made by keypad/keyboard without having to open ATS enclosure door or use of special tools. A voltage-frequency relay shall be provided to lockout transfer of the load to the generator until the generator output has reached 90% of rated voltage and frequency. Transfer switch shall accomplish “in-phase” retransfer to the line when the preferred power source returns.

E. Control module shall include programming keypad/keyboard, alpha-numeric display, key-lockable program selector switch, LED status indication and integral programmable clock and calendar. Programmed settings shall be stored in non-volatile EEPROM memory. All programmed features shall be field adjustable without opening ATS enclosure door.

F. Control module shall contain all necessary circuitry, switches, contacts, relays, etc. to perform the following: (a.) automatically and manually initiate starting of the engine generator in either loaded or unloaded mode of operation, (b.) automatically or manually initiate transfer of load, (c.) programmable plant exerciser (d.) programmable engine cool-down period.

G. Control module shall have the following adjustable time delays as a minimum: (a.) engine start delay to delay initiation of transfer for momentary source outages (range 0 to 6 sec.) (b.) transfer to emergency delay (0-5 min.) (c.) transfer back to preferred source delay (0-30 min.) (d.) engine cool down delay (0-30 min.)

H. Control module shall include pilot lights that show switch position for normal and emergency and normal and emergency power acceptable. Keypad functions shall include digital voltmeter, digital frequency meter and digital running time meter.

I. All wiring and associated conduit(s) required for interface between each ATS and engine generator set(s) shall be provided.

PART 3 - EXECUTION

3.01 INSTALLATION - OUTDOOR

A. The engine generator set(s) shall be properly mounted and secured on a concrete pad where shown on the drawings and as directed by the Professional. The concrete pad shall be 10" thick with 6" below finished grade, 4" above finished grade and a 1" chamfer on all exposed edges. The concrete equipment pad shall extend 24" beyond the equipment/housing perimeter on all sides to provide a service walkway. Concrete shall be 3000 PSI with #6 wire mesh top and bottom. Vibration isolators as recommended by the set manufacturer shall be provided between the engine generator and the heavy duty steel base or between the base and the slab.

B. Engine generator set location, orientation, etc. shall be fully coordinated with the Professional and the equipment manufacturer considering the surrounding environment and building elements to insure proper clearances for maintenance, air distribution, exhaust, etc.

C. The engine generator set shall be provided with a properly sized corrosion resistant weather-proof housing complete with lockable/removable doors properly located to allow required access to controls and components requiring maintenance or adjustment. The enclosure shall contain all set components and shall provide proper ventilation to permit operation at rated load under secured conditions.

D. Where the engine generator set is connected as a separately derived system as defined by the NEC, the engine generator set shall be grounded as a separately derived system as specified in Section 260250 and per the NEC. Where the engine generator set is not connected as a separately derived system, the power distribution system feeder ground conductor shall be bonded to the equipment.

3.02 TESTING

A. On-site testing shall conform to NFPA-110 including 4 hour load bank testing. Written verification and documentation of the requirements shall be submitted to the Professional for approval prior to final acceptance.

END OF SECTION

SECTION 26 02 50 GROUNDING & BONDING SYSTEM

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Bonding and grounding of all electrical equipment, enclosures, raceways, etc. as shown on the drawings and in strict accordance with Article 250 of the NEC.

PART 2 - PRODUCTS

2.01 GROUND RODS

A. Ground rods shall be 3/4 inch by 10'-0" copper-clad sectional, solid rods.

PART 3 - EXECUTION

3.01 WIRING DEVICES

A. Equipment grounding terminal (green) of all grounding type receptacles/devices shall be bonded to the equipment grounding conductor and to the device's enclosure with a properly sized bonding conductor (green) unless the receptacle/device is approved and listed for self-bonding.

3.02 RACEWAYS, BOXES & ENCLOSURES

A. Pull into all power branch circuit and feeder raceways one green equipment grounding conductor of the same size as the branch circuit conductors or size as noted on the drawings and bond this conductor to the box ground terminal, receptacle/device ground terminal (green), equipment grounding bus of panelboard, cabinet and/or enclosures.

B. Where conduits in excess of 1-1/4 inches trade size and all feeder conduits enter an enclosure, box, etc. provide grounding bushing or bronze ground clamps with bonding conductors sized per the NEC (No.10 AWG minimum) connected to all ground bushings/clamps and thence to equipment enclosure and/or equipment grounding bus.

C. Couple conduits together and connect to boxes, fittings and enclosures so as to provide effective electrical continuity. Assure ground continuity on GRS feeder and branch circuits by two locknuts, one inside and one outside of all boxes, cabinets and gutters. Do not use couplings dependent on screws bearing on conduit.

3.03 GROUND RODS

A. Ground rods shall be installed with top a minimum of 12 inches below the finish grade. All connections to ground rods shall be made by exothermic weld(s).

3.04 ELECTRICAL SERVICE ENTRANCE

A. Bonding and grounding of the electrical service equipment enclosures, raceways and other non-current carrying metal parts shall be in accordance with Article 250 of the NEC. All sections, cubicles and conduits associated with the electrical service entrance equipment shall be bonded together and bonded to the grounded (neutral) with a #6 AWG bare copper equipment grounding conductor.

B. The electrical service entrance equipment grounded (neutral) bus and equipment grounding bus shall be bonded together with a main bonding jumper (MBJ) of the same size as the grounding electrode conductor (GEC) herein specified. The grounded (neutral) conductor and the equipment grounding conductors shall not be bonded together at any other location in the system except at separately derived systems as defined by the NEC.

C. The grounding electrode system shall consist of driven ground rods, the incoming metallic cold water pipe where present and of the proper characteristics and the building structural steel where present. Where multiple ground rods are necessary, indicated or required, they shall be installed in a straight line or triangular pattern such that each ground rod is a minimum of six (6) feet from any adjacent ground rod or other type of grounding electrode. The connection of the grounding electrode conductor to the incoming metallic underground water pipe shall be made within five (5) feet of the pipe's point of entry into the building and shall be accessible.

D. The grounding electrode conductor (GEC) shall be bare copper sized as indicated on the drawings or per Table 250.66 of Article 250 of the NEC whichever size is largest. The grounding electrode conductor shall run continuous without splices and utilizing the most direct path from the electrical service entrance equipment's grounded (neutral) bus to each grounding electrode. The grounding electrode conductor shall be routed in electrical grade rigid PVC conduit to the point of connection to the grounding electrode system and/or to a point a minimum of 12" below the finished grade. All connections of the grounding electrode conductor to the grounding electrodes shall be made by exothermic weld(s).

E. A grounding bus bar shall be provided adjacent to the electrical service entrance equipment and at an accessible location for the purpose of grounding/bonding ancillary systems in the building/facility. The grounding bus bar shall be copper of minimum dimensions 20 inches by 4 inches by 1/4 inch with wall mounting bracket with insulators to isolate the ground bar. The ground bar shall have pre-drilled termination holes of proper size for lugs properly spaced over the entire length and width of the bar to terminate #12 through No.4 AWG copper wire. The grounding bus bar shall be connected to the grounded (neutral) bus of the electrical service entrance equipment using a bare copper conductor of same size as the grounding electrode conductor. The grounding bus bar shall be properly labeled as to its function.

F. The grounding electrode system shall consist of the proper number of grounding electrodes properly connected per the NEC to limit the resistance to ground of the grounding electrode system to a maximum of 25 ohms. The resistance to ground of the installed grounding electrode system shall be verified using a ground tester.

G. All metallic piping systems (water, natural gas, fire protection, etc.) within or attached to the building(s) and the building's structural steel shall be bonded to the grounding electrode system in accordance with Article 250 of the NEC. Where a lightning protection system is provided or exist on the building(s), the lightning protection system's grounding electrode system shall be bonded to the electrical service grounding electrode system.

3.05 SEPARATELY DERIVED SYSTEMS

A. An equipment grounding conductor shall be provided from the source equipment's ground bus to the equipment grounding bus or enclosure of all separately derived systems (i.e. dry-type transformers, engine generators, etc.).

B. The grounded (neutral) bus of each separately derived system shall be bonded to the equipment grounding bus or conductor by a main bonding jumper. The bonding of the grounded (neutral) bus and the equipment grounding bus shall occur within the equipment's enclosure at the connection terminals of each bus. The grounded (neutral) bus shall be connected to the nearest grounding electrode by a grounding electrode conductor. The grounding electrode may be the building's structural steel where effectively grounded and bonded to the electrical service entrance grounding electrode system, the incoming metallic water pipe where the connection can be made within five (5) feet of the pipes entry into the building and/or the building's electrical service grounding electrode system.

C. The grounding electrode conductor and the main bonding jumper of each separately derived system shall be bare copper sized as indicated on the drawings or per Table 250.66 of Article 250 of the NEC whichever size is largest. The grounding electrode conductor shall run continuous without splices and utilizing the most direct path from the separately derived system's grounded (neutral) bus to the grounding electrode(s). The grounding electrode conductor shall be routed in electrical grade rigid PVC conduit to the point of connection to the grounding electrode system. All connections of the grounding electrode conductor to the grounding electrodes shall be made by exothermic weld(s).

D. All metallic piping systems (water, natural gas, fire protection, etc.) located within the area served by the separately derived system shall be bonded to the separately derived system's grounding electrode system in accordance with Article 250 of the NEC.

END OF SECTION

SECTION 26 03 10 PANELBOARDS

PART 1 - GENERAL

1.01 SUMMARY

A. Commercial grade panelboards complete with feeders, circuit breakers and branch circuits as scheduled and/or shown on the drawings. Where shown on the drawings to be service entrance equipment, panelboards shall be specifically approved for that purpose and shall have all required accessories.

B. Branch circuit homerun conductors shall be connected to circuit breakers served from separate phase busses of the panelboards. Loads shall be properly balanced on each phase. Only one conductor shall be connected to a lug and/or terminal.

C. Panelboards and components shall be manufactured in accordance with applicable NEMA standards and the NEC and shall be UL listed. Installation and connection of all panelboards shall comply with the NEC and their UL listing.

D. Bonding and grounding in accordance with Section 26 02 50 "Grounding and Bonding Systems" of this specification.

PART 2 - PRODUCTS

2.01 PANELBOARDS

A. Panelboards shall be dead front construction with solderless pressure terminals. Enclosures shall be for surface or flush mounting as shown or noted on the drawings and rated NEMA 1 for dry indoor installations or NEMA 3R for outdoor or wet indoor installations. Panelboards shall be provided with trim and door with lock and catch with two (2) keys. Keys shall be common to all new building panelboards.

B. Main and neutral buses of capacity as shown on the drawings shall be completely tin and/or silver plated copper based on 1000 amps per square inch current density.

C. Provide equipment grounding bus(es) of proper ampere rating and with adequate termination points for feeder and branch circuit ground conductors. Equipment grounding bus(es) shall be properly bonded to panelboard enclosure.

D. Neutral and equipment grounding busses shall have proper number of terminals for the available panelboard circuits. Only one conductor shall be connected to a lug and/or terminal

E. Panelboards required to have feed-through lugs shall have mechanical type lugs suitable for the conductors used located at the opposite end of the bus from incoming feed lugs or main device.

F. Where panelboards are shown to be service entrance equipment, the panelboards shall be provided with a main bonding jumper (bus) between the grounded (neutral) bus and the equipment grounding bus of the panelboard. This busing shall be installed by the manufacturer.

G. Circuit breakers shall be molded case, thermal magnetic type with bolted connections and characteristics as shown on the drawings including ampere and voltage ratings, minimum interrupt rating (KAIC) and accessories as shown on the drawings or herein specified. Circuit breaker fault current interrupt capacities shall be fully rated. Series ratings are not acceptable.

H. All single pole 15 and 20 ampere circuit breakers shall be UL listed SWD for switching duty. All circuit breakers serving HVAC equipment shall be UL rated HACR. All 15 and 20 amp circuit breakers serving high magnetic (HM) or high intensity discharge (HID) loads shall be HM or HID rated, respectively.

I. Panelboards served from the secondary side of a dry-type transformer constituting a separately derived system shall be provided with a main circuit breaker sized as shown on the drawings or per the NEC if size not indicated.

J. Branch circuit breakers serving receptacles or equipment located under a kitchen range/exhaust hood equipped with at fire suppression system shall be the shunt-trip type controlled by the fire suppression system control panel. All circuitry (conduit and wiring) required for the interface of these systems shall be provided.

K. Branch circuit breakers serving elevator motors shall be the shunt-trip type controlled by the building Fire Detection and Alarm System or the Fire Protection System as shown or noted on the drawings. All circuitry (conduit and wiring) required for the interface of these systems shall be provided.

L. Branch Circuit Panelboard(s) with characteristics as shown on the drawings, herein specified, and as manufactured by General Electric Types AQ, AE, AD and/or Spectra Series or equal in Siemens, Square D Company or Cutler Hammer.

M. Distribution Panelboard(s) with characteristics as shown on the drawings, herein specified, and as manufactured by General Electric Spectra Series or equal in Siemens, Square D Company or Cutler Hammer.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Panelboards shall be securely mounted with through bolts, anchors or other approved means to building structural elements (i.e. metal/wood studs, concrete block, etc.). Contractor shall provide required cross bracing between building structural elements and/or proper mounting surface and structure if wall is of insufficient strength. All wood or other flammable mounting surfaces shall be painted with two coats of flame resistant paint. Mount panelboards with top breaker handle not more than 6'-6" above floor. Installation of flush panelboards shall not compromise the fire rating of walls.

B. Panelboard installations shall provide and maintain working space clearances and dedicated electrical equipment spaces as required by Article 110 of the NEC.

C. Flush mounted panelboards shall have a minimum of four (4) spare 3/4 inch conduits stubbed up above the nearest accessible ceiling location for future use.

D. Provide complete typewritten directory with transparent plastic cover inside of each branch circuit panelboard door. Branch circuit panelboard designation as indicated on the drawings shall be identified by 3/4 inch bakelite label, white with minimum 1/2 inch high, black engraved letters on front face if the panelboard is surface mounted or inside of door if panelboard is flush mounted. Typed copy of each branch circuit panelboard circuit directory shall be submitted with shop drawing submittal for approval.

E. Each circuit breaker in distribution panelboards shall be labeled as to load served by 1/2 inch bakelite label, white with minimum 1/4 inch high, black engraved letters. Distribution panelboard designation as indicated on drawings shall be identified by 3/4 inch bakelite label, white with minimum 1/2 inch high, black engraved letters on front face if the panelboard is surface mounted or inside of door if panelboard is flush mounted.

F. Branch circuit panelboard circuits shall be numbered in sequence vertically down the left side then vertically down the right side and all circuits shall be provided in the panelboard exactly as they are shown on the drawings. Numbering to be consecutive for double or triple section panelboards. Neutral connections shall be identified by adhesive number tags to identify with their associated branch circuit phase conductors.

G. Branch/feeder circuit breakers shall be arranged in the distribution panelboard as shown on the drawings where possible. Circuit breaker arrangement may be modified to facilitate the installation and connection of feeders or as required to comply with the distribution panelboard manufacturer's circuit breaker arrangement limitations. Whenever modifications to the circuit breaker arrangement are made, the associated distribution panelboard shop drawing shall indicated the load designation as well as the circuit breaker size on the panelboard cut sheet.

END OF SECTION

SECTION 26 03 60 SURGE SUPPRESSION DEVICES (TVSS)

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Where shown on the Drawings or herein specified, high energy transient voltage surge suppression device(s) (TVSS) shall be provided and connected per the manufacturer's recommendations and as herein specified.

PART 2 - PRODUCTS

2.01 CONSTRUCTION

A. TVSS shall be rated for the voltage of the system at the point where it is installed. TVSS shall have a minimum U.L. listed Short Circuit Current Rating (SCCR) as noted on the drawings or equal to or greater than the K.A.I.C. rating of the switchboard, panelboard, motor control center, etc. where connected. The SCCR of the TVSS shall be fully rated and shall not require the use of any upstream over-current protection to obtain this rating.

B. TVSS shall be U.L. 1449 second edition listed as a transient voltage and surge suppresser and U.L. 1283 listed as an electromagnetic interference filter. The devices shall be designed, manufactured and tested in accordance with applicable portions of NEMA LS1 and ANSI/IEEE C62.41 and C62.45 standards, latest revisions.

C. TVSS shall provide specified protection in all modes on all phases - line to neutral (L-N), line to ground (L-G) and neutral to ground (N-G) in "wye" connected systems and line to line (L-L) and line to ground (L-G) in "delta" connected systems.

D. TVSS suppression components shall have maximum continuous operating voltage (MCOV) of not less than 115% nor greater than 130% of the nominal phase to neutral operating voltage of the system where installed.

E. TVSS shall be fused with surge rated fuses and incorporate thermal cutout device(s) capable of preventing thermal runaway of internal suppression components. The surge current rating of the installed fuses shall be greater than the maximum surge current rating of the device.

F. TVSS shall have integral high frequency filtering system of -50dB at 100kHz.

G. TVSS devices shall carry a five (5) year manufacturer's warranty from the date of final acceptance of the system supported by the manufacturer's local field service division or representative.

2.02 PERFORMANCE REQUIREMENTS

A. Category "C" Locations

1. Category "C" locations shall be defined for the purpose of this specification as electrical service entrance equipment.
2. The minimum surge current capacity of the TVSS installed at Category "C" locations shall be 120 KA/mode. The single pulse surge current rating of the device shall be established and verified by device testing in accordance with NEMA LS-1. All testing shall be performed on a complete TVSS assembly as provided.

3. The U.L. listed suppressed voltage rating of the TVSS utilizing an IEEE C1/B3 combination wave shall be a maximum of:

208Y/120	700V - LL, 400V - LN, 500V - LG, 500V - NG
480Y/277	1500V - LL, 900V - LN, 1000V - LG, 800V - NG

4. The complete TVSS assembly as provided shall be life-cycle tested using repetitive sequential ANSI/IEEE C62.41 Category C3 impulses. The assembly shall not malfunction, incur damage or experience a degradation in clamping voltage of more than 10 percent for a minimum of 5000 repetitive C3 strikes.
5. TVSS installed at Category “C” locations shall be as manufactured by Current Technologies TG125 Series, or equal in APT TE/XGA Series, Siemens TPS Series, General Electric Tranquell HE Series, Cutler Hammer Visor Series or Liebert Intercepter II Series.

B. Category “B” Locations

1. Category “B” locations shall be defined for the purpose of this specification as electrical switchboards, distribution panelboards or motor control centers not used as service entrance equipment.
2. The minimum surge current capacity of the TVSS installed at Category “B” locations shall be 75 KA/mode. The single pulse surge current rating of the device shall be established and verified by device testing in accordance with NEMA LS-1. All testing shall be performed on a complete TVSS assembly as provided.
3. The U.L. listed suppressed voltage rating of the TVSS utilizing an IEEE C1/B3 combination wave shall be a maximum of:

208Y/120	LL - 700V, 400V - LN, 500V - LG, 500V - NG
480Y/277	LL - 1800, 900V - LN, 1000V - LG, 900V - NG

4. The complete TVSS assembly as provided shall be life-cycle tested using repetitive sequential ANSI/IEEE C62.41 Category C3 impulses. The assembly shall not malfunction, incur damage or experience a degradation in clamping voltage of more than 10 percent for a minimum of 4000 repetitive C3 strikes.
5. TVSS installed at Category “B” locations shall be as manufactured by Current Technologies TG80 Series, or equal in APT TE/XT160 Series, Siemens TPS Series, General Electric Tranquell ME Series, Cutler Hammer Visor Series or Liebert Intercepter II Series.

C. Category “A” Locations

1. Category A locations shall be defined for the purpose of this specification as branch circuit panelboards not used as service entrance equipment.
2. The minimum surge current capacity of the TVSS installed at Category A locations shall be 60 KA/mode. The single pulse surge current rating of the device shall be established and verified by device testing in accordance with NEMA LS-1. All testing shall be performed on a complete TVSS assembly as provided.
3. The U.L. listed suppressed voltage rating of the TVSS utilizing an IEEE C1/B3 combination wave shall be a maximum of:

208Y/120	LL - 700, 400V - LN, 500V - LG, 500V - NG
480Y/277	LL - 1800, 900V - LN, 1000V - LG, 900V - NG

4. The complete TVSS assembly as provided shall be life-cycle tested using repetitive sequential ANSI/IEEE C62.41 Category C3 impulses. The assembly shall not malfunction, incur damage or experience a degradation in clamping voltage of more than 10 percent for a minimum of 4000 repetitive C3 strikes.
5. TVSS installed at Category A locations shall be as manufactured by Current Technologies TG60 Series or equal in APT TE/XT Series, Siemens TPS Series, General Electric Tranquell ME Series, Cutler Hammer Visor Series or Liebert Intercepter II Series.

2.03 ACCESSORIES

A. Each TVSS shall be provided with LED indicator lights located on the front of the enclosure to indicate the status of the protection on each mode.

B. Each TVSS shall be provided with a minimum of one set of NO/NC dry contacts activated in the event of lost protection or reduced protection below 90% of the device rating.

C. Each TVSS device shall be provided with a surge counter.

PART 3 - EXECUTION

3.01 INSTALLATION

A. TVSS shall be parallel connected and installed where indicated and/or noted on the drawings or herein specified. TVSS shall be located adjacent to (with appropriate enclosure) connected switchboard, panelboard, motor control center or other equipment.

B. TVSS shall be located in such a manner as to minimize the required conductor lengths and to keep the conductors as straight as practically possible. The TVSS enclosure should be close-nippled to the protected equipment enclosure where possible. The grounding conductor shall be bonded to the connecting conduit on each end.

C. Where TVSS is connected to the electrical equipment using conductors, the conductors shall be minimum #6 AWG or size as recommended by the TVSS manufacturer and shall be “gently” twisted together to minimize conductor impedance.

D. TVSS shall be connected to the designated equipment via a 60A3P circuit breaker for Category “A” and “B” locations or via an 100A3P circuit breaker for Category “C” locations. The device branch circuit breaker shall be provided and installed within the protected switchboard, panelboard or motor control center.

END OF SECTION

SECTION 26 04 10 WIRING DEVICES

PART 1 - GENERAL (Not Used)

PART 2 - PRODUCTS

2.01 WALL SWITCHES (Line Voltage)

A. Wall switches shall be flush A.C. tumbler-type, back and side wired, and shall be installed to cut ungrounded conductors. Conductors shall be connected using side wired screw terminals.

B. Wall switches shall be the following heavy-duty specification grade as manufactured by Hubbell or approved equal in Pass and Seymour (P&S), Leviton or Arrow Hart. Contractor shall verify device color with Professional prior to ordering devices.

1. Single pole, 20A, 120/277V: Hubbell Cat. No. HBL1221, P&S Cat. No. PS20AC1, Leviton Cat. No. 1221-2.
2. Double pole, 20A, 120/277V: Hubbell Cat. No. HBL1222, P&S Cat. No. PS20AC2, Leviton Cat. No. 1222-2.
3. Three-way, 20A, 120/277V: Hubbell Cat. No. HBL1223, P&S Cat. No. PS20AC3, Leviton Cat. No. 1223-2.
4. Four-way, 20A, 120/277V: Hubbell Cat. No. HBL1224, P&S Cat. No. PS20AC4, Leviton Cat. No. 1224-2.
5. Single pole, key operated, 20A, 120/277V, with two keys: Hubbell Cat. No. HBL1221L, P&S Cat. No. PS20AC1-L, Leviton Cat. No. 1221-2L.

C. Wall switches connected to branch circuits of the emergency power system shall be red in color.

2.02 POWER RECEPTACLES

A. All convenience receptacles shall be specification or industrial grade as listed, straight blade type, 2 pole 3 wire grounding, back and side wired with nylon face. Conductors shall be connected using side wired screw terminals.

B. Convenience outlets and receptacles as manufactured by Hubbell, as stated or equal in Pass and Seymour (P&S), Leviton or Arrow Hart. Contractor shall verify device color with Professional prior to ordering devices.

1. Duplex grounding receptacle (HD specification grade), 20A, 125V: Hubbell Cat. No. HBL5352, P&S Cat. No. 5362, Leviton Cat. No. 5362-S.
2. Duplex grounding receptacle, ground fault interrupter type (HD specification grade), 20A, 125V: Hubbell Cat. No. GF5352, P&S Cat. No. 2091, Leviton Cat. No. 8899.
3. Duplex grounding receptacle, weatherproof, ground fault interrupter type (HD specification grade), 20A, 125V: Hubbell Cat. No. GF5352, P&S Cat. No. 2091, Arrow Hart Cat. No. GF5342, Leviton Cat. No. 6899. Plates shall be equal to Hubbell Cat. No. 5206WO or Cat. No. WP8MHP for permanent or “in-use” outdoor cord and plug connections.

4. Duplex grounding receptacle on standby generator(s), red (HD specification grade), 20A, 125V: Hubbell Cat. No. HBL5352R, P&S Cat. No. 5362RED, Leviton Cat. No. 5362-SR.
5. Duplex grounding receptacle, isolated ground type (orange), 20A, 125V (HD specification grade): Hubbell Cat. No. IG5362, P&S Cat. No. IG6300, Leviton Cat. No. 5362-IG

C. Special purpose receptacles shall have voltage, phase and ampere ratings as indicated on the drawings and of proper NEMA configuration. Each receptacle shall be HD specification grade. Special receptacles for power connection of equipment shall have proper NEMA configuration for equipment served and equipped with proper plug completely installed.

2.03 SAFETY SWITCHES

A. Safety switches shall be heavy-duty type as defined by NEMA, fusible or non-fusible as indicated on the drawings and shall be rated for the voltage of the circuit in which installed. Switches shall have the proper number of poles as indicated on the drawings or as required for the phase characteristics of the circuit in which installed. A ground lug shall be provided in all safety switches.

B. Safety switches shall have proper NEMA rated enclosure for the environment and conditions in which installed per the NEC and per the following:

1. Indoor dry locations - NEMA 1
2. Indoor wet locations - NEMA 3R
3. Kitchen areas - NEMA 4X
4. Outdoor locations - NEMA 3R
5. Corrosive indoor/outdoor locations - NEMA 4X

C. Where safety switches are indicated to be fusible, they shall have dual element, time delay fuses installed as manufactured by Bussman Fusetron Series or approved equal with proper voltage rating for the associated circuit and current size as indicated or as required for the connected equipment.

D. Safety switches shall be the following as manufactured by the Square D Company or equal in General Electric, Siemens, Cutler Hammer or Allen Bradley.

Safety switch, heavy-duty, with ground lug	H200-H300 Series
Manual motor switch, single pole	Class 2510, Type FO-1
Manual motor switch, double pole	Class 2510, Type FO-2

PART 3 - EXECUTION

3.01 WALL SWITCHES

A. Shall be ganged together under one non-sectionalized plate in gangable boxes where two or more switches occur at one point. Provide metal barrier within box between all adjacent switches served by circuit conductors of different phases or conductors of a different system.

B. Shall be mounted 48" above finished floor to center of operating handle or as noted on the drawings. Mounting heights may be adjusted slightly to permit cutting of masonry block to the top or bottom of the block course nearest the specified height. All mounting heights shall be consistently cut above or below block coursing such that switches will be the same height above the finished floor.

C. Wall switches shown at door ways shall be mounted adjacent to door ways on opposite side of door from hinges unless prohibited by wall space. Where switches must be mounted on same side of door as hinges, mount switches so as not to be located behind the opened door. First switch of single or ganged switch bank shall be mounted within 12" of door frame and/or edge of door.

3.02 RECEPTACLES

A. Convenience outlets and receptacles shall be mounted center line up 18 inches above finished floor unless shown or noted on the drawings otherwise. Convenience outlets and receptacles located at counters shall be mounted center line up 4 inches above counter top or backsplash unless shown or noted on the drawings otherwise. Mounting heights may be adjusted slightly to permit cutting of masonry block to the top or bottom of the block course maintaining the minimum specified height. All mounting heights shall be consistently cut above or below block coursing such that receptacles/outlets will be mounted the same height above the finished floor. Adjacent devices to be mounted at same height unless otherwise directed.

B. Carefully review Architectural, Furniture and Interior Design drawings for furniture, casework or millwork. Do not rough-in receptacles behind equipment, millwork, etc. except where specifically noted. Where receptacle is shown behind equipment, verify proper mounting height with the Professional prior to rough-in.

C. Where receptacles serve equipment (i.e. refrigerators, ranges, dishwashers, ice makers, etc.) intended to be installed flush with the adjacent millwork, walls, etc., receptacle locations and mounting heights shall be fully coordinated with the supplied equipment shop drawings so that neither the receptacle nor the associated cord and plug connection interferes with the correct placement of the equipment.

3.03 SAFETY SWITCHES

A. Where installed indoors, surface mount safety switches 54 inches to center of operating handle above the finished floor. Where installed out-of-doors on exterior walls, surface mount safety switches 36 inches to center of operating handle above the finished grade. Where installed out-of-doors and behind equipment screen walls, surface mount safety switches with top of switch enclosure 6 inches below top of screen wall and bottom of enclosure a minimum of 18 inches above the finished grade or slab.

B. Where power connections are made out-of-doors through safety switches and where there is no wall or proper equipment frames to which the switches may be mounted, Contractor shall furnish and install a galvanized angle iron frame independent of the equipment for the support of the switch(es). Frames shall consist of the steel frame sufficient to support all of the switches and a concrete footing not less than 12 inches deep and of sufficient width to assure that 4 inches of concrete surround all of the framing members.

C. Safety switches shall be installed such that they are readily accessible as defined by the NEC with a clear and unobstructed path thereto. Fully coordinate safety switch mounting locations prior to rough-in with other trades to insure accessibility.

D. Each safety switch shall be label on the face of the enclosure door as to the load connected. The label nomenclature shall read the same as the connected equipment label provided. The exterior label shall be suitable for the environment in which installed and shall be self-adhesive, 1/2 inch bakelite label, white with minimum 1/4 inch high, black engraved letters. On the interior side of the safety switch enclosure door, permanently label using a self-adhesive printed label the connected load designation, the serving panelboard designation and the serving branch circuit number designation.

END OF SECTION

SECTION 26 04 20 LIGHTING LUMINAIRES

PART 1 - GENERAL

1.01 SUMMARY

A. Provide and connect all luminaires as shown on the drawings by symbols and as defined in the luminaire schedule(s). Luminaires shall be provided with all necessary mounting accessories. The installation of all luminaires shall be complete, safe and in full accordance with manufacturer's recommendations and these specifications. This contractor shall provide additional 1-1/2" x 1-1/2" x 12 ga. channel bridging where necessary to mount luminaires governed by the conditions encountered.

B. The catalog numbers of recessed luminaires, where applicable, are for use in an exposed grid suspension type ceiling system. The Contractor is responsible for providing luminaires with the proper hardware and/or accessories for installation in the ceiling type encountered.

1.02 SUBSTITUTIONS

A. Substituted luminaires shall meet the performance and functional characteristics and the general appearance and dimensions (plus or minus10 percent) of the specified luminaires. Approval of submitted substitute luminaire(s) shall not eliminate the Contractor’s responsibility to provide luminaires similar in characteristics to the specified luminaire(s).

1.03 LOCATIONS

A. The lighting luminaire locations shown on the Electrical drawings are approximate and representative. Contractor shall refer to and coordinate with the Architectural reflected ceiling plans and elevation drawings for exact lighting luminaire mounting heights and locations.

1.04 RELATED SECTIONS

A. See Section 260100 “Basic Electrical Materials & Methods” for additional requirements for hazardous locations and seismic areas.

PART 2 - PRODUCTS

2.01 INTERIOR LIGHTING LUMINAIRES

A. Procure luminaires completely factory wired for proper operation in the application shown on the drawings. All luminaires shall be furnished with proper fittings and accessories for installation in the area encountered. This Contractor shall review the Architectural plans and specifications and provide luminaires compatible with the ceiling specified in each area.

B. Lighting luminaire lenses specified by catalog number and/or by descriptive reference shall be virgin acrylic plastic and shall equal or exceed IES-SPl-NEMA test for yellowing factor of not to exceed three (3) after 2000 hours exposure in a Fade-o-meter for the standard test conditions. The flat portions of all lenses shall be not less than .125 inches thick and shall weigh not less than eight (8) ounces per square foot.

C. Doors and other access means shall be smooth operating, free from light leakage under operating conditions and arranged to permit relamping without the use of tools. Arrange doors, frames, lenses, diffusers and other pieces to prevent accidental falling during relamping and when secured in operating position.

D. All three and four lamp parabolic type fluorescent troffers shall be provided with two wireway covers for proper light distribution under half-light switching regardless of whether or not the wireway is required for the ballasts provided in the fixture.

E. All luminaires containing HID lamps shall be equipped with protection to prohibit excessive UV radiation should outer globe of lamp be broken. Protection shall be in the form of extinguishing mechanisms or protective shield on base of luminaire.

2.02 EXTERIOR LUMINAIRES

A. Metal parts shall be free from burrs, sharp corners and edges and shall be manufactured of corrosion-resistant aluminum, die-cast aluminum, steel or other material as shown on the drawings or specified herein. Steel or other materials subject to corrosion or rust shall have proper corrosion-resistant and weather proof finish applied after fabrication. Plastic and other non-metallic parts shall have a high resistance to yellowing and other changes due to aging, exposure to heat and ultraviolet radiation.

B. Housings shall be rigidly formed, weather- and light-tight enclosures. Doors and other access means shall be smooth operating, free from light leakage under operating conditions and arranged to permit relamping without the use of tools. Arrange doors, frames, lenses, diffusers and other pieces to prevent accidental falling during relamping and when secured in operating position.

C. All exposed hardware, screws and other fasteners shall be manufactured of stainless steel.

2.03 LED LUMINAIRES

A. All LED luminaires shall be tested in accordance with IESNA-LM-79. Provide LM-79 test results for the total luminous flux, electrical power, efficacy and chromaticity on luminaire cut sheets . All LED light sources' lumen maintenance shall be tested in accordance with IESNA-LM-80. Provide LM-80 test results on luminaire cut sheets.

B. All LED luminaires shall carry a minimum 5 year warranty on the entire luminaire and its components.

C. All LED luminaires shall be listed on the Qualified Products List (QPL) of the DesignLights Consortium.

D. LED luminaires shall be provided with proper driver and interconnecting wiring for proper operation with the supplied control device(s). Coordination of luminaire components and lighting control components is the responsibility of the Contractor.

2.04 EMERGENCY BATTERY PACKS

A. Provide emergency battery packs for LED luminaires as required by the drawings. Battery packs for troffers and surface mounted luminaires shall be installed by the luminaire manufacturer within the luminaire housing unless otherwise noted on the drawings. Installation of all battery packs shall maintain accessibility from below regardless of ceiling type in which mounted. Battery packs shall be sealed, maintenance-free, high temperature nickel-cadmium type and provide minimum lighting lumen output of 1400 for ninety (90) minutes after interruption of normal power to the luminaire. Battery packs shall be as manufactured by Bodine or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION (INTERIOR LUMINAIRES)

A. Luminaires mounted level, plumb and square with ceiling and walls with bottom edge above finished floor as indicated on the drawings unless specifically noted otherwise. Luminaires shall be properly secured according to manufacturer's recommendations.

B. Luminaire mounting shall be rigid and independent of the ceiling tile(s) and shall be supported from the major structural elements of the ceiling system. Luminaires mounted to concrete shall be anchored with concrete inserts or other means of similar strength as approved by the Professional.

C. Mounting of recessed luminaires shall be in accordance with Article 410 of the NEC. Luminaires installed in suspended ceiling systems shall be securely fastened to the ceiling framing members by mechanical means. Recessed fluorescent luminaires requiring a ceiling opening in excess of nine (9) square feet shall be supported independent of the ceiling system.

D. All recessed luminaires in accessible ceilings shall be connected with 1/2 inch flexible conduit from accessible junction box with sufficient length to allow luminaire to be relocated to any adjacent ceiling panel without disconnecting. 3/8 inch flexible conduit may be used if furnished with the luminaire by the manufacturer. All recessed luminaires in non-accessible ceilings, unless otherwise indicated, shall be pre-wired from the factory with junction box for terminating branch circuit conduit.

E. Recessed luminaires shall be installed to properly coordinate with and maintain the fire rating of the ceiling in which installed. Where fire rating installation requires covering over luminaire housing, ballast(s) of proper temperature rating as recommended by the manufacturer shall be furnished.

F. Surface luminaires mounted on combustible ceilings or low density acoustical tile ceilings shall be UL approved for such mounting. Surface luminaires mounted on LAT ceilings shall be supported from and properly secured to the ceiling framing members and connected via flexible conduit similar to recessed luminaires. Where surface luminaires are served by exposed raceway, luminaires shall have surface conduit collar furnished by the luminaire manufacturer.

G. The lighting luminaire locations shown on the Electrical drawings are approximate and representative. The Contractor shall review the Architectural reflected ceiling plans, elevation drawings, etc. for exact locations and mounting heights of lighting luminaires and for other elements which may effect luminaire mounting and/or operation. Mounting heights of all wall mounted luminaires shall be fully coordinated with the Professional prior to rough-in.

3.02 INSTALLTION (EXTERIOR LIGHTING LUMINAIRES)

A. Luminaires shall be mounted level, plumb and square with exterior elements of the building. Mounting heights indicated on the drawings are to bottom of luminaire above the finished floor unless specifically noted otherwise. Luminaires shall be secured according to the manufacturer's recommendations.

B. The lighting luminaire locations shown on the Electrical drawings is approximate and representative. The Contractor shall review the Architectural reflected ceiling plans, elevation drawings, etc. for exact locations and mounting heights of lighting luminaires and for other elements which may effect luminaire mounting and/or operation. Mounting heights of all wall mounted luminaires shall be fully coordinated with the Professional prior to rough-in.

C. Luminaire installation shall not allow water to penetrate luminaire housing or electrical outlet box. Gaskets and other weather proofing shall be provided and installed as required.

D. Enclosed exterior mounted luminaires shall be properly sealed to prevent insects from entering the luminaire housing.

E. Luminaires with adjustable mounting brackets shall be properly adjusted per the Professional's direction. Once the luminaire adjustments have been approved by the Professional, properly tighten and secure adjustments to prevent movement. Adjustment of luminaires may require after hours labor.

F. Mounting of ground mounted luminaires shall include concrete bases as detailed on the drawings or if detail not shown as specified herein. Bases shall be of minimum 3000 p.s.i. concrete and provide a minimum of 3 inches of concrete coverage on all sides of luminaire stanchion or other support(s) as specified. A concrete pad on finished grade 4 inches thick shall be provided at each luminaire with a minimum dimension of 18" square with luminaire centered or as required to maintain a minimum 12 inches clear from edge of pad to luminaire.

END OF SECTION

SECTION 26 04 30 LIGHTING CONTROL SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

A. The lighting control system shall provide time-based, sensor-based and manual lighting control as indicated on the Drawings.

B. Room/space lighting control devices shall be interconnected together into stand-alone lighting control zones enabling digital communication devices to allow proper operation and control of the associated room/space lighting as indicated on the drawings. Stand-alone lighting control zones shall be interconnected using network bridges such that the lighting control systems functions as a complete network system.

C. Gateway devices shall be provided (minimum one per floor) to allow time-of-day scheduling and programming and interface and access from building LAN. Gateway devices shall be connected and interfaced to building LAN via a Cat. 6 UTP cable.

D. A BacNet IP Interface Device shall be provided and connect to allow future connection and interface of Lighting Control System with Building Automation System (BAS).

E. The system may be wireless, wired or hybrid wireless/wired architectures.

1.02 QUALITY ASSURANCE

A. All System components shall be UL listed or other acceptable national testing organization.

1.03 WARRANTY

A. All System devices shall be warrantied for a minimum of 5 years.

PART 2 - PRODUCTS

2.01 MATERIALS

A. System devices shall be intelligent and communicate digitally over low-voltage wiring or wirelessly.

B. Lighting control zones shall consist of one or more intelligent lighting control devices, be capable of stand-alone operation, and be capable of being connected to a higher level network backbone.

C. Lighting control zones shall be capable of automatically configuring itself for default operation without any start-up labor required.

D. Power for lighting control zone devices shall come from one of the resident devices in the zone. If none of the indicated devices for a zone are capable of providing power or do not provide sufficient power, required additional devices capable of providing power shall be provided and connect in the associated zone.

E. All switching and/or dimming for a specific lighting control zone shall take place within devices located in the zone itself to facilitate System robustness and minimize wiring requirements.

2.07 SYSTEM COMPONENTS

A. Lighting Control System components shall be as manufactured by Sensor Switch nLight Network Control System or equal in Lutron or Hubbell.

B. Occupancy Sensors

1. Shall sense the presence of human activity within the associated space and fully control the on/off/enable function of the lighting in that space.
2. Sensors shall be dual-technology type utilizing passive infrared (PIR) technology to turn lights on from an off state. The second technology shall not utilize motion to detect occupancy.
3. Sensors shall have the capability to detect when it is not receiving valid communication and provide a visual indication. Sensors shall be capable of configuration via integral means.
4. Sensors shall be able to function together will other sensors in order to provide expanded coverage areas by simply daisy-chain wiring the sensors together using low-voltage cabling.
5. Sensors shall be equipped with an override function for 100 hour burn-in of lamps. This feature shall be available at any time for lamp replacements.
6. Sensors shall be the following:

a.	Wall-box, line-voltage:	Cat. No. nWSX PDT
b.	Wall-box, low-voltage:	Cat. No. nWSX-LV-PDT
c.	Ceiling Mount, dual-technology, 360 degree:	Cat. No. nCM PDT
d.	Wall-Corner Mount, dual-technology,120 degree:	Cat. No. nWV PDT16

C. Power (Relay) Packs

1. Power packs shall incorporate one or more Class 1 16A relays, contribute low voltage power to the associated lighting control zone and shall be rated for connection to a 20A lighting branch circuit. Power packs shall accept 120 or 277 Vac, be plenum rated, and provide Class 2 power to the associated lighting control zone.
2. Power packs shall have the capability to detect when it is not receiving valid communication and provide a visual indication. Sensors shall be capable of configuration via integral means.
3. Emergency power packs shall sense loss of power at the normal power panelboard serving the area via a provided sensing circuit and shall automatically switch “ON” the emergency lighting circuit upon loss of normal power regardless of control commands.
4. Dimming power packs and emergency dimming power packs shall have the same switching and control features as standard power packs and emergency power packs and shall provide the control for automatic or manual 0-10V dimming of connected lighting luminaires.

a.	Power/Relay Pack:	Cat. No. nPP16
b.	Emergency Power/Relay Pack:	Cat. No. nPP16-ER
c.	Dimming Power/Relay Pack:	Cat. No. nPP16-D
d.	Dimming Emergency Power/Relay Pack:	Cat. No. nPP16-D-ER

D. Relay Panels

1. Relay panels shall have a minimum of 4 normally closed latching 20A relays capable of switching 120/277 Vac and four 0-10V dimming outputs for control of connected lighting circuits.
2. Relay panels shall power itself via an integral power supply.
3. Relay panels shall be capable of being interconnected via low-voltage cabling to any lighting control zone or System network.

a. Relay panel: Cat. No. nPANEL 4.

E. Wall Switches

1. Wall switch devices shall be recessed in a single-gang switch box, shall have mechanical pushbuttons and provide LED user feedback.
2. Wall switch devices shall be connected to the associated lighting control zone via low-voltage wiring.
3. L.V. Wall Stations shall be the following:

a. Single On/Off pushbuttons (SLV2): Cat. No. nPODM
b. On-Low/On-High/Off pushbuttons (SLV3): Cat. No. nPODM
c. Dual On/Off pushbuttons (SLV4): Cat. No. nPODM 2P
d. Quad presets, On/Off, w/dimming raise-lower (SLVD): Cat. No. nPODM-4P-DX
e. Dual On/Off, w/dual dimming raise-lower (SLVD2): Cat. No. nPODM-2P-DX
f. Quad On/Off (SLV8): Cat. No. nPODM-4P
g. Graphic Wall Station (SLVG): Cat. No. nPOD-GRX

F. DayLighting Sensors

1. Ceiling mount device providing automatic dimming photocell control and adjustable lighting level set point.

. a. Daylight Sensor: Cat. No. nCM-ADCX

G. Network Bridge Device

1. Bridge, 8-port Cat. No. nBRG-8

H. Network Gateway Device

1. TCP/IP device that provides time-based control of lighting control system network and ethernet interface for lighting control system software with graphic user interface device and power supply.

a. Gateway controller & graphic interface: Cat. No. nGWY2

I, BACNet Interface Device

1. IP device that allows Building Automation System to communicate and control the Lighting Control System via standard BACNet/IP protocol.

a. BACNet Interface Device: Cat. No. nBACNET

I. SYSTEM DESIGN

1. Successful lighting control system manufacturer shall provide complete system design including device layout, specific device selection for proper operation in the room/space indicated, interconnecting wiring, etc.
2. Lighting control system network shall be designed by interconnecting individual lighting control zones using bridge devices. One bridge device shall be used for connection of a maximum of four lighting control zones.
3. System device layout and wiring drawings shall be submitted with the system component shop drawings for approval by the Professional.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Devices located in/on walls or partitions shall be mounted in/on properly sized outlet boxes. A minimum 3/4" conduit shall be routed from each outlet box to above the accessible ceiling in the associated zone or to the next device outlet box where inaccessible ceilings exist.

B. All line voltage wiring shall be routed in conduit per the Division 26 specifications. Low-voltage communication wiring may be routed exposed above accessible ceilings when properly supported per EIA/TIA requirements. Where low-voltage wiring crosses ceiling areas open to overhead structure or otherwise visible from below in public spaces, it shall be routed in conduit that is routed tight to the overhead structure.

C. Non-user-interface control devices (bridges, power/relay packs, etc.) shall be mounted in/on proper outlet box above accessible ceilings. Where accessible ceilings are not available in the area of the installation, devices shall be mounted in properly sized recessed junction box.

D. All devices shall be installed and connected per the manufacturer’s recommendations.

END OF SECTION

SECTION 26 04 50 EQUIPMENT ELECTRICAL SERVICES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Provide and connect proper branch circuit(s) and final connection(s) to all equipment requiring electrical service(s). Equipment electrical service connections shall be as indicated on the drawings and/or as recommended by the equipment manufacturer. Branch circuit and final connection conduits shall be in accordance with SECTION 260110 "RACEWAYS AND FITTINGS".

B. Review architectural drawings and specifications and provide adequate electrical services for and make proper connections to all equipment furnished by the General Contractor requiring electrical service.

C. Carefully review plumbing and HVAC drawings and Division 23 & 24 of the specifications for mechanical equipment requiring electrical services. Provide adequate electrical services for and make proper connections to all such mechanical equipment requiring electrical service.

D. Electrical services and connections to equipment shall follow the equipment manufacturer's recommended method. Where the equipment furnished exceeds the circuit capacity or requires different characteristics than that shown on the drawings, this information shall be brought to the attention of the Professional prior to the branch circuit or connection rough-in.

E. The Division 26 Contractor shall immediately upon notice to proceed and after verification of service with the serving Utility Company notify in writing the General Contractor, the Division 23 & 24 Contractor(s) and all other affected Contractors the characteristics of the electrical service(s) of the facility(ies) including voltage and phase. A copy of this notification shall be submitted to the Professional with the project electrical shop drawings.

F. The equipment electrical service connection locations shown on the drawings are approximate and representative. Verify and coordinate actual electrical service rough-in locations, requirements, etc. with the Contractor providing the equipment and the associated manufacturer’s shop drawings.

1.02 MAINTENANCE DISCONNECTS

A. All power connections to equipment shall include a maintenance disconnect of the type indicated or if not specifically indicated as recommended by the equipment manufacturer in compliance with the NEC.

B. Maintenance disconnect switches for equipment shall be located adjacent to the associated equipment and readily accessible as defined by the NEC. Location of disconnect switches shall be fully coordinated with the equipment provider, the supplied equipment shop drawings and the adjacent building elements so as not to interfere with the correct placement and operation of the equipment. Maintenance disconnect switches shall be provided with lock-out provisions.

C. On multi-motor equipment connections (i.e. condensing units, roof-top HVAC units, etc.), the Division 26 Contractor shall verify with the Division 23 & 24 Contractor(s) and obtain in writing the manufacturer's requirements for the equipment overcurrent devices. Provide HACR rated branch circuit breaker for each load in the serving panelboard of size as required by the manufacturer of the connected equipment. Where fuses or HACR breakers are permitted for overcurrent protection, utilize the serving HACR breaker for overcurrent protection and provide non-fused maintenance disconnect switch. Where fuses are required by the equipment manufacturer for overcurrent protection, provide fusible disconnect switch with fuse sizes as recommended by the manufacturer of the connected equipment. Obtain written approval from Division 23 & 24 Contractors of overcurrent device size and method before energizing equipment.

D. See Section 260410 “Wiring Devices” for additional requirements for Safety Switches.

1.03 HVAC EQUIPMENT ELECTRICAL SERVICES

A. Electrical service connections to ventilating fans shall include manual motor switch installed and connected where directed. Where fans are furnished with speed control devices, the Division 26 Contractor shall install the control device where directed and connect through it in addition to the manual motor switch. Where fans control or are controlled by other equipment such as timers, motorized louvers, firestats, EMCS control panels, etc., the Division 26 Contractor shall coordinate with the supplying Contractor and make connection to the fan through or with this device as required for proper operation.

B. Electrical service connections to HVAC equipment to include branch circuit wiring to the line side of line voltage control device such as magnetic starter, contactor, VFD, etc. and from load side of control device through motor terminals or equipment connection lugs. The control devices shall be furnished by the Division 23 & 24 Contractor and installed where directed by the Division 26 Contractor. Control devices which are integral pre-wired parts of equipment require connection to the line side of the control device only by the Division 26 Contractor unless otherwise indicated. All additional wiring including control wiring shall be furnished and installed by the Division 23 & 24 Contractor. Line voltage thermostats and other temperature control devices regardless of voltage shall be furnished, installed, wired and connected by the Division 23 & 24 Contractor.

1.04 OTHER EQUIPMENT ELECTRICAL SERVICES

A. The Division 26 Contractor shall provide proper branch circuit, disconnect device and final connection to all equipment requiring electrical service furnished under other Divisions of the specifications.

B. Set disconnect switch or other approved device if disconnect switch not shown adjacent to equipment and make final connection to the equipment as required in accordance with SECTION 260110 "RACEWAYS AND FITTINGS". Connection to include power wiring to the line side of the equipment controller or to the power connection location as applicable.

C. Division 26 Contractor shall obtain approved rough-in drawings for each item of equipment requiring connection and follow the manufacturer's recommendation as to the location and the method of connections.

D. Additional power connection requirements to be provided for specific systems are as follows:

1. Elevators. The electrical services and connections shall comply with the applicable codes and standards. The Division 16 Contractor shall fully coordinate the electrical requirements and installation with the Elevator Contractor prior to rough-in. Electrical requirements for each Elevator shall include:

   a. Power branch circuit and connection with proper fused disconnect switch to each elevator motor.
   b. Power branch circuit and connection with disconnect switch to each elevator controller.
   c. Power branch circuit and connection with disconnect switch to each elevator pit sump pump.
   d. Proper lighting luminaire, switch and GFI type power receptacle with appropriate branch circuitry located in each elevator pit as directed.
   e. Proper GFI type receptacle with appropriate branch circuitry in each elevator equipment room as directed.
   f. 3/4 inch conduit from each elevator controller to the nearest telephone backboard or termination point.
   g. Where a Stand-by/Emergency Power System is provided or exist, the disconnect switch for each elevator motor shall have auxiliary contacts and shall have a 3/4" conduit between each elevator controller and the Emergency Power System ATS or other control device.
   h. Where the facility is provided with or has a Fire Protection (Sprinkler) System, each elevator motor branch circuit breaker shall be a “shunt-trip” type and shall be properly interfaced, connected and controlled by the Fire Detection and Alarm System.

2. Motorized Doors/Screens/Shades. Power connection locations shown on the drawings are approximate and representative. Verify exact power connection locations with equipment supplier prior to rough-in. Branch circuit connection shall include proper disconnect switch located adjacent to equipment as directed. Division 26 Contractor shall install remote operator station(s) furnished with the equipment and shall provide necessary conduit(s) from equipment to remote operator station(s). Operator station(s) shall be installed where directed by the Professional and/or the equipment supplier. Verify all electrical service requirements with equipment shop drawings prior to rough-in.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 26 05 10 TELECOMMUNICATION RACEWAY SYSTEM

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Applicable requirements listed in Sections 26 01 10 “Raceways and Fittings” and 26 01 20 “Boxes and Fittings” shall apply. All telecommunication raceway installations shall comply with the applicable requirements of the ANSI/EIA/TIA standards.

B. Raceway system including conduits, boxes, plates and backboards as shown on the Drawings by symbols and as specified herein.

C. Provide bushing on all conduits.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Work Area Outlets. Outlet boxes shall be 4 inches square by 2-1/2 inches deep with appropriate depth single gang raised cover unless noted otherwise on the drawings or required for the number of receptacles installed.

B. Conduits serving work area outlets shall be 3/4 inch unless noted otherwise on the drawings and shall be routed to termination points as dictated by the drawing symbol(s) or notes. Conduit homeruns serving outlet boxes in rooms/spaces with accessible ceilings shall have in-line junction box mounted above the accessible ceiling to allow access to raceway for systems terminating within the space.

C. Backboards shall be 3/4 inch plywood minimum AC grade sized as shown on the drawings or 8'-0” X 4'-0” if size not indicated mounted with the long dimension vertical. Plywood backboards shall be void free and either fire-rated or treated on both sides with two coats of fire-resistant black enamel paint. Where required by local codes, cover plywood backboard w/sheet rock.

PART 3 - EXECUTION

3.01 INSTALLTION (OUTLETS)

A. Mount outlet boxes with center at same height as adjacent receptacles, as noted on the drawings or at eighteen (18) inches to centerline above the finished floor. Telecommunication outlets shall be mounted within 12 inches of adjacent power receptacle where shown on the drawings. Do not mount outlet boxes back-to-back.

3.02 INSTALLATION (HORIZONTAL RACEWAY SYSTEM)

A. Telecommunication system conduits and rough-in provisions shall not be less than six (6) inches from any source of alternating current unless separated by a grounded metallic partition.

B. Conduit routing shall follow most direct route possible to the designated termination point(s) within constraints of Section 260110 with no more than two (2) 90 degree bends between pull points and/or junction boxes. For conduit runs greater than 100 feet, provide junction box(es) sized per NEC such that no conduit segment exceeds 100 feet.

C. Conduit bend radius shall be minimum 6 times the internal diameter for conduits with internal diameters 2 inches or less and 10 times the internal diameter for conduits with internal diameters greater than 2 inches.

D. Provide a nylon pull string with a minimum test rating of 200 lbs. in all empty conduits.

3.03 INSTALLATION (TELECOMMUNICATION ROOMS)

A. Provide telecommunication backboards as shown on the drawings or as a minimum one per telecommunication room.

B. A grounding bus bar meeting the requirements of EIA/TIA 607 shall be provided in each telecommunication room or backboard location. The grounding bus bar shall be copper of minimum dimensions 20 inches by 4 inches by 1/4 inch with wall mounting bracket with insulators to isolate the ground bar. The ground bar shall have pre-drilled termination holes of proper size to terminate No.12 through No.4 AWG copper wire properly spaced over the entire length and width of the bar. The grounding bus bar shall be properly bonded to its associated grounding conductor using a properly sized mechanical lug.

C. A No.6 grounding conductor in 1 inch conduit or size as shown on the drawings shall be provided from the electrical service entrance equipment ground bus to each telecommunication room ground bus bar. The grounding conductor may be installed “daisy-chained” from backboard to backboard or radially from service entrance equipment. A grounding type bushing shall be used at each end of the conduit and shall be properly bonded to the ground conductor at all wire exit points. Grounding conductor splices, if required, shall be made with irreversible compression type splices.

D. Provide a minimum of two double duplex grounding receptacles or number as shown on the drawings on dedicated branch circuit(s) at each telecommunication system backboard. The telecommunication room receptacle branch circuits shall be routed through a branch circuit junction box mounted at the overhead structure or above the accessible ceiling where present within the telecommunication room to allow for future receptacle additions. Receptacle(s) shall be mounted at the specified height or as directed by the Professional or Owner and arranged so as not to be mounted behind conduits or cabling.

E. Service entrance, backbone and work area outlet conduits shall be stubbed into the telecommunication room in an accessible location using the minimum number of bends and offsets possible. Conduits entering from the floor slab or overhead structure shall be stubbed into the space 4 inches above the slab or below the bottom of the overhead structure.

3.04 INSTALLATION (TELECOMMUNICATION SERVICE ENTRANCE.)

A. Verify the telecommunication service connection point and all requirements with the serving Telephone Company and/or campus/base Physical Plant prior to any rough-in.

B. The telecommunication service entrance raceways shall be routed underground from the service connection point as shown or noted on the drawings or as required by the serving Utility Company or Using Agency to the telecommunication service entrance facilities within the building. The service entrance raceways shall be of the size and number as shown or noted on the drawings. The service entrance raceways shall be physically separated from any underground power duct bank(s) by a minimum of 24 inches. All bends shall be long radius type unless specifically noted otherwise.

END OF SECTION

SECTION 28 00 10 GENERAL PROVISIONS - FIRE DETECTION AND ALARM SYSTEM

PART 1 - GENERAL

1.01 GOVERNING CLAUSE

A. For the sake of brevity, these specifications may omit phrases such as “Contractor shall provide”, “unless otherwise indicated or specified”, etc., but these phrases are nevertheless implied. Mention of materials and operations requires the Contractor to furnish, install and connect such materials and perform such operations to provide a complete and operating system to the satisfaction of the Professional.

1.02 GENERAL CONDITIONS

A. The General Conditions, Supplementary General Conditions, Information to Bidders, General Requirements, Addenda, Alternates and other pertinent documents issued by the Professional are a part of these specifications and shall be complied with in every respect.

B. Notwithstanding any reference in the specifications to any equipment, material or type of construction by name, make or catalog number, such reference shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition. Where the phrase “or approved equal” is used in the Division 28 Specification, substitute equipment, equivalent in all respects to that specified, of any qualified manufacturer is permitted with the written approval of the Professional. Approval will not be considered until after award of contract and only if submitted by the successful Contractor. Where a list of manufacturers and/or catalog numbers is provided and the phrase “or approved equal” is omitted, substitute equipment, equivalent in all respects to that specified, from one of the listed manufacturers is permitted with the written approval of the Professional.

1.03 TEST AND OBSERVATIONS

A. The complete project shall be, during and/or after construction, subject to the tests and observations as herein described and as noted on the drawings. Deficiencies found as a result of these tests and observations shall be corrected by the Contractor within a reasonable period and at no expense to the Owner.

B. The complete project shall be subject to observations and tests conducted by the Professional or for him in his presence. Upon notice, the Contractor shall furnish not to exceed two men, one to include the job foreman, and tools to assist and be directed by the Professional for a reasonable amount of time to make such tests and observations as are requested by the Professional.

C. The complete project shall be subject to observations and tests conducted by any Federal, State and/or local authority having jurisdiction. The Contractor shall make all corrections of any deficiencies required by the authority having jurisdiction to allow building occupancy.

D. The complete project shall be subject to observations and tests conducted by the Owner’s Insurance carrier. After inspection by this agency, Contractor shall make corrections of any deficiencies found adversely affecting the insurance to be carried by the Owner. Acceptance of this report or subsequent reports lie with the Professional or Owner.

1.04 RECORD DOCUMENTS

A. The contractor shall provide to the Professional with the Close-Out Documents the following:

1. Two (2) sets of blue line “as-built” prints of same scale as original drawings legibly marked in red showing all variations in the installed work from the requirements of the original contract drawings. The “as-built” drawings shall include all addenda, approved and installed change orders, field condition changes and other departures from the original plans and specifications.
2. Three (3) sets of shop drawings and other data required by the specifications reflecting the manufacturer's shop fabrication of the materials actually installed. The Division 26 shop drawings shall be separately post bound, indexed and tabbed by specification section. Faxed or copies of faxed material shall NOT be used in Close-Out Documents.
3. Operation and maintenance manuals and manufacturer’s instructions for all equipment and systems installed.
4. Copy of all reports of system, equipment or material test as required by this specification.

1.05 GUARANTEE

A. The Contractor shall guarantee to the Owner all work performed under this contract to be free from defects in workmanship and materials for a period of one year from the date of final acceptance by the Professional and the Owner except as hereinafter noted.

B. The Contractor shall correct, repair and/or replace upon notice from the Owner or his authorized representative within a reasonable period of time any defects in the work performed under this contract arising during the warranty period. This repair work shall be provided at no additional cost to the Owner.

C. Lighting luminaire lamps are hereby exempt from the one-year guarantee as follows with the exception that all lamps are to be operating upon final acceptance of the project:

1. All incandescent lamps shall be warranted for thirty (30) days after the date of final acceptance by the Owner. Lamp burn-outs occurring within this time frame shall be recorded by the Owner and will be reported to the Professional at the end of this warrantee period. Upon notice from the Professional, the Contractor shall furnish and install replacement lamps for each lamp burn-out reported.
2. All gaseous vapor discharge lamps shall be warranted for one hundred eighty (180) days after the date of final acceptance by the Owner. Lamp burn-outs occurring within this time frame shall be recorded by the Owner and will be reported to the Professional at the end of this warrantee period. Upon notice from the Professional, the Contractor shall furnish and install replacement lamps for each lamp burn-out reported.

1.06 ELECTRICAL SYSTEMS SCHEDULE

A. Provide and connect all equipment and materials for complete and operative systems as follows:

1. Fire Detection & Alarm System
2. Miscellaneous Systems as shown on the drawings or stated herein.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 28 00 30 EQUIPMENT / MATERIAL SUBMITTALS- FIRE DETECTION AND ALARM SYSTEM

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. In addition to the requirements of Section 01 33 00, the information and requirements of this section shall apply to the electrical work.

1.02 EQUIPMENT/MATERIAL

A. Equipment is specified by manufacturer's name and catalog number and is intended to establish the minimum standards of quality acceptable.

B. Where the phrase “or approved equal” is used in the Division 26 Specification, substitute equipment, equivalent in all respects to that specified, of any qualified manufacturer is permitted with the written approval of the Professional. Approval will not be considered until after award of contract and only if submitted by the successful Contractor. Where a list of manufacturers and/or catalog numbers is provided and the phrase “or approved equal” is omitted, substitute equipment, equivalent in all respects to that specified, from one of the listed manufacturers is permitted with the written approval of the Professional.

C. The manufacturer’s name and/or catalog number first mentioned in this specification is considered to be the specified equipment. The "or equal" manufacturers mentioned or other manufacturers proposed by the Contractor shall be considered as substituted equipment.

D. Substituted equipment shall meet the dimensional and functional requirements of the building as represented by the plans and specifications. All revisions to the contract precipitated by the use of substituted equipment shall be incorporated by the Contractor, after approval in writing by the Professional, and at no additional cost to the Owner.

E. The Professional's approval of the shop drawings is only for general conformance with the design concept of the Project and the information given in the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site; information that pertains solely to the fabrication process or to the means and methods of construction; coordination of work of all trades; and performing all work in a safe and satisfactory manner. Approval of the shop drawings does not modify the Contractor’s duty to comply with the Contract Documents. Any equipment or work found in the judgement of the Professional to be defective or otherwise unsuitable shall be repaired or replaced by the Contractor at no additional cost to the Owner.

F. If requested in writing by the Professional, the Contractor shall submit a scale drawing (scale as directed by the Professional) of any electrical equipment area, conduit layout or the like which in the opinion of the Professional may present difficulty regarding space allocation or clearances.

1.03 SUBMITTALS

A. After the project notice to proceed has been issued and with promptness to assure reasonable time for review with no delay to the project, the Contractor shall electronically submit to the Professional shop drawings for all equipment and material for the electrical systems for approval whether or not substituted equipment or materials.

B. The Contractor shall include with his shop drawing submittals a copy of the electrical service characteristics letter required by Section 26 04 50. Shop drawings submitted without this letter attached will not be reviewed until this letter is provided.

C. Shop drawings shall be submitted by specification section and shall be number as outlined in Section 01 33 00 with all material/equipment shop drawing cut sheets located under the appropriate specification section. All shop drawings shall be original pdf and shall be completely legible. Scanned copies and handwritten information will not be accepted.

D. Space shall be provided on the title or index page of each section of the shop drawings for the Professional's review stamp and comments. This space shall be clearly labeled as to its use and shall have a minimum size of 7" wide X 5" high.

E. All submitted equipment/material and associated options, accessories, special features, etc. shall be clearly marked and indicated on all copies of the shop drawings. Provide appropriate shop drawings on all required accessory equipment.

F. All shop drawings for all systems, equipment and materials including any required one-line drawings, diagrams, etc. shall be submitted together. Partial submittals will not be reviewed without prior consent. Special systems provided by specialized vendors or distributors may be submitted in a separate binder.

G. Provide complete shop drawings with all pertinent information for the following equipment and/or systems and all required components:

1. Fire Detection & Alarm System

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 28 01 10 FIRE DETECTION AND ALARM SYSTEM

PART 1 - GENERAL

1.01 CODES AND STANDARDS

A. Provide all equipment, accessories, material and labor required to install and connect in accordance with these specifications and applicable drawings for fully operational Fire Detection and Alarm System(s) to the complete satisfaction of the Professional. All material and/or equipment necessary for the proper operation of the System(s) not specified or described herein shall be deemed part of the specifications and shall be provided by the Division 28 Contractor.

B. The Fire Detection and Alarm System(s) and its/their installation shall comply with the latest revisions all applicable codes and standards including NFPA, IBC, SBC, NEC and the Americans with Disabilities Act (ADA).

C. Each component of the system shall be listed under the appropriate category(ies) by Underwriters' Laboratories, Inc. (UL). The complete system installation shall conform to the applicable sections of NFPA-72, NEC 760, Local Code requirements and to the individual component's UL listings. All components and control panel(s) shall be by the same manufacturer.

D. The requirements of Section 280010 "SAFETY/SECURITY SYSTEMS" and other applicable sections of this Specification shall apply and shall be fully complied with.

E. System installation including all wiring connections, splices and terminations at all devices, panels, components, junction points, etc. and testing of installed wiring shall be performed by factory trained and certified personnel of the System manufacturer and/or NICET Level 2 certified personnel.

1.02 SCOPE OF WORK

A. Provide and connect Fire Detection and Alarm System(s), hereinafter referred to as the "System" in this section of the specifications, consisting of non-coded, analog addressable, microprocessor based control panel(s), remote annunciator(s), addressable alarm initiating devices, visual and audio/visual alarm devices and a fully supervised wiring system for a complete and operational Fire Detection and Alarm System(s) conforming to NFPA 72, the drawings and this specification.

1.03 CONTRACTOR QUALIFICATIONS

A. The Fire Detection and Alarm System Contractor, hereinafter referred to as the "Contractor" in this section of the specifications, shall be an experienced company with local representation regularly engaged in the design and installation of fire detection and alarm systems of similar size and complexity as required for this project and have the following minimum qualifications:

1. Personnel factory trained and certified in the design of the System to be provided.
2. Personnel factory trained and certified to install and connect the System components to be provided.
3. Personnel knowledgeable in local, state, province and national codes and regulations.

4. Possess required licenses/permits to perform required installations in the jurisdiction in which the project is located.
5. Operating as a business under the same name currently being used for a minimum of five (5) years.

B. Provide with the System(s) shop drawings a copy of all certifications and registrations of the Contractor's personnel that will be involved with the design and/or installation of the System(s).

C. At the request of the Professional, the System Contractor shall provide in writing references of a minimum of three successfully completed projects of similar size and complexity as this project which have been completed by this Contractor in the three year period preceding this project's bid date. References shall include project name, location, Owner's contact person and telephone number.

1.04 BASIC SYSTEM OPERATION

A. ALARM INITIATION

1. Actuation of any initiation device or interface device shall cause the following actions:
   a. Activate general alarms (audible and visual).
   b. Display individual initiating device address and description at control panel(s) and remote annunciator(s).
   c. Provide activation signals and interfaces to other systems as herein specified.
   d. Transmit signal over telephone lines to central fire reporting station via communicator.
   e. Record the event in the historical log.

B. The System shall monitor the connected devices and associated circuitry and shall initiate a supervisory or trouble notification as required by NFPA 72 for the wiring classification specified. A supervisory or trouble signal shall initiate the associated audible and visual alarms at the associated FACP and remote annunciator(s) and shall record the event in the historical log.

PART 2 - PRODUCTS

2.01 CONTROL PANEL(S)

A. The Fire Alarm System Control Panel(s) (FACP) shall be configured and contain all hardware, software and power to supervise, monitor and control all the devices connected plus an additional 25% spare capacity. The control panel(s) shall have a minimum expandable point capacity as the specified equipment or as required for the connected devices including spare capacities which ever is greater.

B. FACP(s) shall contain power supply(ies) of size and number as required for proper system operation for the number of devices and components connected plus 25% spare capacity. Activation or operation of any device(s) shall not interfere with the normal operation, subsequent activation and/or alarm operation of any other connected component due to system design, wiring or power limitations.

C. Each FACP shall audibly and visually annunciate all alarm, supervisory and trouble conditions on the System. Visual annunciation shall be by liquid crystal display (LCD) with minimum 80 characters.

D. Each FACP shall be fully enclosed in a lockable steel enclosure properly sized to accommodate all components and to maintain proper field wiring spaces. If more than one enclosure is required, the second enclosure shall match the first and shall be located directly adjacent to the first enclosure.

E. Main control panel shall be equipped with a drill switch which when activated shall cause only the general alarm audible and visual signals to activate but no other general alarm functions shall be affected.

F. FACP shall be provided with alarm silence, trouble/supervisory silence and alarm reset selector switches. Visual alarm indications shall not be canceled by the operation of an audible alarm silencing means. Cancellation of visual alarm indications shall be by Reset of the System only.

G. Each main control panel shall be provided with an internal dual line digital alarm communicator transmitter (DACT) module and it shall be connected to the nearest active telephone system termination point using 24 gauge, 4 pair, category 5e UTP cables routed in 3/4" conduit. The digital communicator shall be capable of transmitting point I.D. information on every connected device.

H. Operating software shall include the following features as a minimum: smoke sensor alarm verification, “walk test”, event historical log with date and time indications, operator “password” access levels (minimum four) and addressable device custom labeling.

I. System(s) operational programming shall be provided by certified factory-trained technician(s) and shall be customized for the facility(ies) in which the system(s) is/are installed per this specifications and applicable codes. Addressable device display labels shall be programmed for plain language readout per the direction of the Owner/Professional. Device display labels shall include associated room numbers in which the device is located and the room numbers shall be taken from the final room number designations issued by the Owner/Professional.

2.02 SYSTEM POWER

A. Provide and connect a dedicated power branch circuit to each FACP or other System component(s) requiring power. The serving power branch circuit breaker(s) shall be clearly labeled using red lettering “Fire Alarm Circuit” and the associated circuit breaker(s) shall have a red identifying mark. The serving power branch circuit breaker(s) shall be equipped with a listed circuit breaker lock to prevent tampering. The associated serving power branch circuit panelboard designation, circuit number and panelboard room location shall be identified on the inside of the enclosure door of each FACP or other System component. The normal power source(s) to the system(s) shall be supervised so that any power failure must be audibly and visibly indicated at the control panel and the remote annunciator(s). A green "power on" LED shall be displayed continuously while incoming power is present.

B. Standby battery(ies) shall be sealed, maintenance free type complete with metered charger(s) and shall be provided and connected as required to operate the complete System plus required spare capacities for 24 hours with 5 minutes of alarm operation at the end of this period. Standby batteries shall be located in the same cabinet as the associated FACP or immediately adjacent to the FACP cabinet in a separate cabinet.

C. The System(s) shall automatically transfer to stand-by battery operation upon failure of the normal power source. All battery charging and recharging operations shall be automatic. Battery charger(s) shall be rated for recovery of batteries from full discharge to full charge in 24 hours or less.

D. The System batteries shall be supervised so that a low battery condition or disconnection of the battery shall be audibly and visibly indicated at the control unit and the annunciator. If a “LOW BATTERY” condition is left unattended a second stage “DEPLETED BATTERY” trouble condition shall be audibly and visibly reported at the control unit indicating the batteries are below the listed system operating voltage. Systems that completely shut down and fail to indicate a “DEPLETED BATTERY” condition shall be unacceptable.

E. Provide with the shop drawings complete battery calculations for both the alarm and supervisory power requirements for the System(s).

2.03 REMOTE ANNUNCIATOR(S)

A. Shall be provided and connected where shown on the drawings or at the facility’s main entrance where directed by the Professional if location not shown.

B. Shall contain minimum 80 character LCD display. Displayed information shall include point address, point status (alarm, trouble, etc.), alarm type (smoke detector, manual station, etc.), number of system alarms, supervisory conditions and troubles, and a custom device location label. Alarm, supervisory and trouble conditions shall be indicated by dedicated LEDs and an audible signal. “Alarm Silence” and “System Reset” switches shall be provided.

C. All switches and control functions on the annunciator shall be controlled by an “enable” key switch with the key removable in the “disable” position only.

2.04 ALARM DEVICES

A. Audible/visual and visual alarm devices shall be provided and connected throughout the facility(ies) located as shown on the drawings and as required to produce audible and visual alarms in accordance with NFPA 72, ADA and the Contract Documents.

B. Visual alarm devices provided in rooms (with the exception of corridors/hallways) whose effective rectangular (length X width) dimensions (measured from the longest points) exceed 20'L X 20'W shall have a light output of 110 candela. Visual alarm devices in corridors and other spaces shall have a light output of 15/75 candela unless noted otherwise on the drawings.

C. Unless shown or noted otherwise, visual alarm devices shall be semi-flush, vertically wall mounted devices with red housing and white “FIRE” lettering on three sides utilizing a xenon flash tube with polycarbonate lens.

D. Unless shown or noted otherwise, audible/visual alarm devices shall be semi-flush, horizontally wall mounted devices with red housing and white “FIRE” lettering on three sides utilizing a xenon flash tube with polycarbonate lens.

E. When the FACP is provided with Voice Alarm, audible alarm devices shall be of the proper type and with proper output rating to produce alarm tones and voice alarm messages unless specifically shown or noted otherwise on the drawings or herein specified.

F. When multiple alarm strobes and/or their reflections can be seen from one location, the strobe flash rates shall be synchronized.

2.05 PULL STATIONS

A. Shall be semi-flush mounted, double action, non-coded addressable manual stations. Housings and levers shall be high-impact Lexan or cast metal with a red housing finish color. Reset of station shall be by key or wrench. Stations which require the replacement of any portion of the device after activation are not permitted.

2.06 SMOKE SENSORS

A. Shall be analog photoelectric type, addressable and shall be provided as shown or noted on the drawings and/or as specified herein.

B. Detectors shall have 30-mesh insect screens, LED power indicator and functional test switch (magnetically operated). Detectors requiring control interface with external systems (i.e. air handling units, etc.) shall be provided with all required NC & NO contacts or zone addressable control module(s) which shall be used for interface with other Sections of these Specifications. The operation of each contact shall be programmable at the control panel.

2.07 THERMAL SENSORS

A. Shall be analog, fixed temperature and rate-of-rise sensing, 135 degree unless noted otherwise, addressable and shall be provided as shown or noted on the drawings and/or as specified herein.

B. Sensors requiring control interface with external systems shall be provided with all required NC & NO contacts or addressable control module(s) which shall be used for interface with other Sections of these Specifications. The operation of each contact shall be programmable at the control panel.

2.08 DUCT-MOUNTED SMOKE SENSORS

A. Shall be analog, addressable photoelectric type smoke sensors with duct housings, sampling tubes, etc. and shall be provided and properly installed at air handling duct systems as specified herein.

B. Each duct detector shall be provided with a remote alarm and test station installed as directed by the Professional or as shown on the drawings.

C. The sensors shall be provided with all required NC & NO contacts or zone addressable control module which shall be used by the Mechanical Contractor for air handling unit shut down. The operation of each contact shall be programmable within the System operational program. Programmable sensor base(s) and/or proper addressable control module(s) shall be provided as required. Interface wiring and connection requirements for air handling unit shut down shall be the responsibility of the Mechanical Contractor.

2.09 CONTROL/MONITOR MODULES

A. Control/monitor modules shall be provided as shown and/or noted on the drawings and/or as required for system interfaces as specified herein.

B. Control/monitor modules shall be individually addressable and shall be capable of configuration for latching or momentary contact operation. The operation and function of each contact shall be separately programmable at the FACP.

C. Control/monitor modules shall have the minimum number of interface contacts or contact monitoring circuits to perform the function or operation specified or required. Where the number of interfaces exceeds the available number of contacts in a single module, multiple modules shall be provided as required.

2.10 SYSTEM MANUFACTURERS

A. The Basis of Design Fire Detection and Alarm System(s) shall be as manufactured by Simplex/Grinnell 4010ES Series with compatible peripheral devices per this specification and with accessory components as required for proper system operation per this specification and associated Codes and Standards. Quantities shall be as shown on the drawings, as defined in this specification and/or as required for proper System(s) operation per the drawings and this specification. All cables and conductors shall be as recommended by the System manufacturer. All back boxes, junction boxes, etc. shall be as recommended by the System manufacturer for the installation situation encountered.

B. The fire detection and alarm system shall have the operational functions as specified herein and shall be equal to the specified equipment in all respects. The following listed manufacturers are approved for consideration for this project. Other System manufacturers must obtain prior written approval from the Professional for substitution and submission for this project.

Approved System Manufacturers:

1. Simplex/Grinnell
2. Siemens (Cerberus/Pyrotronics)
3. Edwards Systems Technology (EST)
4. Notifier
5. Fire Control Instruments, Inc. (FCI)
6. Bosch

C. The supplying vendor of the System shall be located within 100 miles of the campus and shall have a maintenance and repair staff and adequate local spare parts inventory.

D. A service contract offering continued factory authorized service after the contract provided one (1) year parts and service warranty of the installed system shall offered in writing and be made available if requested by the Owner.

PART 3 - EXECUTION

3.01 CONTROL PANELS

A. Control panels shall be wall-mounted per the manufacturer’s recommendation where indicated on the drawings.

B. All wiring shall be installed in a neat and workmanlike manner with conductors routed parallel or perpendicular to sides and/or back of the enclosure and properly tie wrapped and bundled. All wiring shall be properly labeled.

C. A System smoke sensor as specified herein shall be provided and connected in each room/space where a FACP is located whether or not the device(s) is/are shown on the drawings. Where conditions of the room/space dictate for proper operation, a thermal detector may be substituted for the smoke sensor with approval by the Professional.

3.02 ALARM DEVICES

A. Alarm devices indicated to be wall-mounted shall be mounted center line up 80" above the finished floor unless otherwise shown or noted on the drawings or herein specified.

B. Alarm devices indicated to be ceiling-mounted shall be mounted on the ceiling.

3.03 INITIATING DEVICES

A. Pull Stations:

1. Shall be provided and connected at all exterior exit doors and in each corridor where required to limit spacing between devices to 200 feet
2. Shall be mounted centerline up 48" above the finished floor unless otherwise shown or noted on the drawings or herein specified. Where shown at exit door ways, pull stations shall be mounted within 5 feet of the edge of the door.

B. Smoke Sensors:

1. Smoke sensors shall be ceiling mounted unless otherwise shown or noted on the drawings or herein specified. Ceiling mounted sensors shall not be less than 4 inches from a sidewall to the near edge. Wall mounted sensors shall be mounted at least 4 inches but not more than 12 inches below the ceiling.
2. Smoke sensor locations shown on the drawings are approximate and representative. Sensors shall be located as required for proper operation, as recommended by the manufacturer, in compliance with NFPA 72 and to provide optimum coverage of the space installed. Sensors shall not be located in direct air flow or within 36 inches of an air supply diffuser.
3. Smoke sensors shall not be installed until after construction clean up or shall be provided with the proper covers to prevent the migration of debris into the sensor.

C. Thermal Sensors:

1. Thermal sensors shall be ceiling mounted unless otherwise shown or noted on the drawings or herein specified. Ceiling mounted sensors shall not be less than 4 inches from a sidewall to the near edge. Wall mounted sensors shall be mounted at least 4 inches but not more than 12 inches below the ceiling.
2. Thermal sensor locations shown on the drawings are approximate and representative. Sensors shall be located as required for proper operation, as recommended by the manufacturer, in compliance with NFPA 72 and to provide optimum coverage of the space installed. Sensors shall not be located in direct air flow or within 36 inches of an air supply diffuser.

D. Duct-Mounted Smoke Sensors:

1. Shall be installed in supply/return duct(s) of air handling systems as indicated on the drawings.

E. Control Modules:

1. Mount device within 36 inches of monitored equipment.

3.04 SYSTEM INTERFACES

A. Air Handling Units:

1. Duct mounted smoke sensors as specified herein and required accessories shall be provided, connected and properly installed at air handling duct systems in the main supply duct on the downstream side of filters and/or in the return duct prior to exhausting from the building or the introduction of outside air of air handling units as designated on the drawings.
2. Division 28 Contractor shall review Mechanical drawings and specifications for air handling unit locations, areas served, duct work routing, etc.

B. Fire Protection Systems

1. Proper addressable alarm initiating devices with required associated equipment shall be provided and connections shall be made to monitor each required component of the fire protection (sprinkler) system including wiring supervision. Monitoring devices and associated connections shall be provided for all flow indicating switches, post indicator valves (PIVs), wall indicator valves (WIVs) and OS&Y valves.
2. Operation of flow indicating switch(es) shall cause a general alarm and closing of PIVs/WIVs or OS&Y valve shall initiate a supervisory signal. Each flow switch and supervisory indication shall have a separate address.
3. Proper control/monitoring modules shall be provided and interfaced with each fire pump controller to monitor the controller operating conditions as required by NFPA 20. Fully coordinate requirements and connections with the Fire Protection System contractor.

3.05 System(s) components and device locations shown on the drawings are approximate and representative and are intended to establish the type of protection, monitoring or alarm notification required for the associated room, space and/or area. The final and actual number of devices, their coverage and/or output rating and their locations shall be determined by the System manufacturer to provide full coverage of the intended function of the area in accordance with NFPA 72. Locations of components and devices shall be fully coordinated with the architectural finishes encountered, other equipment and building structural elements. Additional devices required for proper operation of the System shall be shown on the submitted System one-line drawings.

3.06 INSTALLATION

A. System wiring shall be installed in conduit. Conduit and wiring though not shown on drawings shall be provided by the Contractor to accomplish the intent of the System as shown on the drawings by symbols, as specified herein and as required to comply with governing codes and standards.

B. System wiring and equipment installation shall be in accordance with good engineering practices as established by the EIA/TIA and the NEC and with the manufacturer's recommendations. All wiring terminations, splices and junctions shall be made using proper compression type connectors or terminal strips. Wire nut type connectors of any kind shall not be used on System wiring.

C. System wiring shall the following class and style designations as defined by NFPA 72 and shall initiate the proper signal per NFPA 72 at the FACP(s) and remote annunciators: Initiating Device Circuits (IDC) - Class B, Style A; Signaling Line Circuits (SLC) - Class B, Style 0.5; Notification Appliance Circuits (NAC) - Class B, Style W.

D. The System and associated components shall be protected against transient over voltages in accordance with the applicable requirements of ANSI/IEEE C62.41 by proper devices installed on incoming power circuits and all circuits routed outdoors or terminated on devices located outdoors.

E. Rough-in requirements (conduit, boxes, etc.) for all components, devices, etc. shall be as recommended by the System manufacturer and per applicable codes for the situation encountered.

F. The component/device quantities, locations, etc. shown on the drawings and/or specified herein are intended to indicate the type of devices and associated sensing requirements in each room/space. The actual quantity, spacing, locations, etc. of devices and components shall be the responsibility of the System provider per his System's design requirements and limitations, applicable codes and standards, and the contract documents.

3.07 TESTING & DEMONSTRATION

A. See Section 280010 "Safety/Security Systems" for additional testing and demonstration requirements.

B. The installed and/or modified Fire Detection and Alarm System(s) and all associated devices and connections shall be tested in accord with the manufacturer's recommendations, applicable codes and standards, and testing guidelines as herein specified. Testing shall be performed by an independent, third-party Company qualified to test the system involved. Testing Company qualifications shall be submitted to the Professional for approval prior to the beginning of testing.

C. A full test report as outlined in this specification shall be submitted to the Professional in writing prior to substantial completion. Where System(s) operations involve other Divisions of the Specifications, the affected Professional shall verify by signed written statement that the operation performed by the System(s) specified herein was correct and complete. Retesting as necessary to achieve a complete report(s) with no deficiencies shall be required. The Professional will perform random component testing at Substantial Completion at his discretion. Should any part of the System(s) not perform correctly, a complete re-test of the entire System(s) can be required with no additional or increase in Cost to the Owner. If more than one re-check of the System(s) by the Professional is required to verify proper System(s) operation, the Contractor will be billed for the time and expense of the Professional.

D. A System Record of Completion as required and published in NFPA 72 shall be completed by the installing Contractor and submitted to the Owner and a copy of the report shall be included with the Close-Out Documents.

FIRE ALARM SYSTEM INSPECTION/TEST REPORT ON FOLLOWING PAGES

END OF SECTION

FIRE ALARM SYSTEM INSPECTION/TEST REPORT

I. Testing Organization

Company Name:_____ Test Date:_____

Representative:_____ Title:_____

Telephone Number:_____ Fax Number:_____

		YES	NO
1	Prior to starting this test, has the Testing Organization been approved by the Professional?		

II. Project Information

Project Name:_____ W/O Job No.:_____

Project Address:_____

III. System Information

Fire Alarm System Manufacturer:_____

Model No.:_____ Serial No.:_____

Installed Software and Revision:_____

IV. Test Requirements

The system shall be tested by a representative of the testing organization and all test results shall be reported as witnessed by him. A negative answer to any of the following questions shall be explained in sufficient detail on a separate typed document.

A. General.

		YES	NO
1	Installed Fire Alarm and Detection System(s) and all associated equipment, devices, etc. are as submitted in the approved Shop Drawings?		
2	All devices, equipment, etc. have been installed correctly per the manufacturer's recommendations and the Contract Documents?		
3	All devices, equipment, etc. have been installed at the approximate locations and mounting heights as shown in the Contract Documents?		
4	After silencing of audible alarm, all visual alarm devices continued to operate until the System was reset?		
5	All wiring has been tested for shorts, grounds and open circuits?		
6	All alarm and initiating devices have been tested for proper operation and have been made to properly operate at least twice? Properly complete attached initiating test for each initiating and supervision device.		
7	Alarm and trouble indication is properly annunciated at control panel(s) and remote annunciator(s) for all connected initiating devices by address, description and location?		
8	Initiating device descriptions and locations as indicated at control panel(s) and remote annunciators(s) adequately describe and located the devices within the building?		
9	Installed battery back-up properly provides power to maintain proper system operation when the normal power source is de-energized?		
10	The installed automatic dialer properly operates?		
11	All single station smoke detectors have been tested for proper operation and have been made to properly operate at least twice?		

B. Interface with HVAC System(s).

A representative of the Division 24 Professional shall witness all functions of the HVAC system(s) which are initiated by and interfaced with the Fire Alarm System(s). The Division 24 Professional shall provide a signed statement of proper system operation as outlined in the Contract Documents and a copy of this statement shall be attached to this report when submitted for approval.

		YES	NO
1	All duct mounted smoke detectors have been installed per the manufacturer's recommendations and per the Contract Drawings?		
2	Upon smoke detection by the duct mounted smoke detectors in each duct system, the proper air handling unit equipment shut down to the satisfaction of the Division 24 Professional?		

C. Interface with Fire Protection System(s).

A representative of the Division 22 Professional shall witness all functions of the Fire Protection System(s) which are supervised by and interfaced with the Fire Alarm System(s). The Division 22 Professional shall provide a signed statement of proper system operation as outlined in the Contract Documents and a copy of this statement shall be attached to this report when submitted for approval.

		YES	NO
1	Fire Alarm System connections have been made to all Fire Protection System supervisory devices (PIV, tamper switches, flow switches, etc.) and the Fire Alarm System recognizes each device connection?		
2	Operation of PIV or tamper switches causes a trouble signal at the Fire Alarm System and was properly annunciated at the control panel(s) and the remote annunciator(s)?		
3	Operation of the flow switch(es) causes a general alarm of the Fire Alarm System and was properly annunciated at the control panel(s) and the remote annunciator(s)?		
4	The proper time delay between each flow switch(es) activation and initiation of the Fire Alarm System general alarm was observed?		

D. Interface with Elevator Control System(s).

A representative of the Division 14 Professional shall witness all functions of the Elevator Control System(s) which are initiated by and interfaced with the Fire Alarm System(s). The Division 14 Professional shall provide a signed statement of proper system operation as outlined in the Contract Documents and a copy of this statement shall be attached to this report when submitted for approval.

		YES	NO
1	Smoke detectors are installed in each elevator lobby, in the elevator equipment room(s) and at the top of the elevator shaft(s)?		
2	Heat detectors are installed in the elevator equipment room(s) and at the top of the elevator shaft(s)?		
3	If the building has a fire protection system (sprinkler system), the Fire Alarm System initiates the shunt-trip of the circuit breakers serving the elevator equipment prior to water flow?		
4	Upon detection of smoke in the elevator lobby on any floor of the facility the Fire Alarm System provides the proper signal to the Elevator controller(s).		

E. Interface with Security System(s).

		YES	NO
1	When a general alarm and/or trouble signal is initiated at the Fire Alarm System, the proper signal was initiated at the Security System Control Panel?		

INITIATING AND SUPERVISORY DEVICE TEST LOG
(make copies as required)

Device Address	Device Type	Device Location	Visual Check	Functional Check	Pass	Fail
			( )	( )	( )	( )
			( )	( )	( )	( )
			( )	( )	( )	( )
			( )	( )	( )	( )
			( )	( )	( )	( )
			( )	( )	( )	( )
			( )	( )	( )	( )
			( )	( )	( )	( )
			( )	( )	( )	( )
			( )	( )	( )	( )
			( )	( )	( )	( )
			( )	( )	( )	( )
			( )	( )	( )	( )
			( )	( )	( )	( )

Comments:_____

_____

_____

The above test report for the Fire Alarm and Detection System(s) is true and accurate to the best of my knowledge and per my system(s) testing and inspection, and the Fire Alarm and Detection System(s) appears to be properly operating per the Contract Documents for this project.

Signature: _____Date: _____

Print Name: _____Title: _____

End of Fire Alarm System Test Report

SECTION 28 23 00 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 equipment described in this specification will be provided and installed by the MDOT Security Vendor thru a separate contract. However, the Contractor is responsible for providing and installing the required conduit for the communications/power cabling and for providing and installing the required power at each location. In addition, the Contractor is responsible for coordinating with the MDOT security vendor throughout all phases of the project to ensure the security components are installed in the appropriate sequence and timeline to not delay the overall project.

C. The MDOT Security Vendor that should be coordinated with for this work is shown below:

Lackey's Electrical, Inc.
532 S. Green Street
Tupelo, MS. 38804
Phone: (662) 841-2846 Fax: (662) 841-2706

1. NOTE: The Contractor shall coordinate with the MDOT security vendor throughout all phases of the project to ensure correct conduit and power are installed at appropriate locations.

D. 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

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
      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.
      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. Coordination Drawings and Approvals: Prior to any conduit installation, the Contractor shall coordinate with the security vendor and submit shop drawings showings locations for all security conduit routing and power location points and power requirements at each location. These drawings shall include approval signatures from both the Contractor and the security Vendor to demonstrate required coordination has occurred. The drawings shall show each component, all interconnecting wiring with wire size and conduit size, numbering of all terminal strips, all pull or junction boxes, zones where applicable, and any other information which is deemed necessary. The diagram shall be done with drawing instruments so as to be neat, legible and all lettering upper case. CAD drawings may also be used.

B. Product Data (from Security Vendor): 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

C. Shop Drawings (from Security Vendor): Submit nine (9) copies of each submittal.

1. Diagrams of cable layout with system labeling schedule.
2. Wiring diagrams.

D. From Security Vendor: Field quality-control test report showing all cameras and digital video recorders / devices are installed / tested and are functioning correctly.

E. 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 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 Drawing
      2) Product Data
      3) Installation Manuals
      4) Operating Manuals
      5) Maintenance/Service Manuals

1.06 QUALITY ASSURANCE (applies to MDOT Security Vendor)

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, Article100, 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 MDOTor 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 and Security Vendor 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 coordinate with security vendor to conduct a final inspection, and pre-test all equipment and system features. Security vendor shall correct any deficiencies discovered as the result of the inspection and pre-test.

B. Contractor and Security Vendor 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 that all Work is complete and has been pre-tested, and that all corrections have been made.

C. During Acceptance test, the Security Vendor 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. Security Vendor 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.

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

2.01 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.

2.02 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: one third 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 Camera: (All Exterior Installations)

1. Assembled and tested as a manufactured unit, containing a dome assembly, color camera, motorized pan and tilt, zoom lens, and receiver/driver.
   a. Horizontal Resolution: 540 lines.
   b. Signal-to-Noise Ratio: Not less than 50 dB, with the camera AGC off.With AGC, manually selectable on or off.
   c. Sensitivity: Camera indicated shall be combination day/night cameras.
   d. 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.
   e. Manually selectable modes for backlight compensation or normal lighting.
   f. Pan and Tilt: Direct-drive motor, 360-degree rotation angle. Pan-and-tilt speed shall be variable controlled by operator. Movement from preset positions shall be not less than 300 degrees per second.
   g. Preset positioning: minimum 8 user-definable scenes, each allowing 16-character titles. Controls shall include the following:
      1) In "sequence mode," camera shall continuously sequence through preset positions, with dwell time and sequencing under operator control.
      2) Motion detection shall be available at each camera position.
      3) 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.

h. White Balance: Auto-tracing white balance, with manually settable fixed balance option.
i. Software: Shall include the vendor supplied software necessary to control the Pan, Tilt, 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 B Pelco model PP350 or equal
2. Parapet rooftop mount B Pelco model PP351 or equal
3. Wall mount B Pelco model WM2000 or equal
4. Corner mount adaptor for WM2000 B Pelco model CM100 or equal.

2.03 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 twenty percent safety factor.

2.04 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

2.05 DIGITAL VIDEO RECORDS

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.

2.06 LCD MONITOR

A. Type: Flat panel LCD

B. Size: 19 inches minimum

C. Input: VGA

D. Resolution: Supports up to one thousand two hundred eighty by one thousand twenty-four for SXGA input

E. Brightness: Adjustable to 300 cd/m5

F. Minimum Contrast Ratio: 500:1

G. Maximum Response Time: 12 ms

H. Industrial rated for 24 hour times 7 days a week operation

I. Power: 120 V ac at 50 Watts

2.07 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.

2.08 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 one and one half inches 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 indicted.

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 form 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 one and one half 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 recoding 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 lighting 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 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 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 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).
2. Section 01 45 29 – Testing Laboratory Services – MDOT.

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 subbase course and hot-mix asphalt paving.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

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

E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for 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. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

J. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

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. Perform excavation Work in compliance with applicable requirements of governing authorities having jurisdiction.

B. 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.

C. 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.

D. 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.

E. Work on Non-Tested Areas: Placing permanent construction over fill that has not been tested and approved may require removal of permanent Work, recompacting 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. It shall have a liquid limit less than 46, a PI range of 6 to 16, and may have 100% passing the 200 seive.

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: Inspection and 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. Preinstallation Conference: Conduct conference 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.

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 diligent. 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, and other conditions affecting performance of termite control.

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..

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.

1. Post warning signs in areas of application warning workers that soil poisoning has been applied. Remove signs when areas treated are safe.

C. Application: Mix soil treatment termiticide solution to a uniform consistency.. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around building construction. Distribute treatment evenly.

END OF SECTION

SECTION 41 22 00 CRANES AND HOISTS

PART 1 GENERAL

1.01 SUMMARY

A. Crane vendor to provide one (1) complete 10-ton capacity and one (1) complete 5 ton capacity, top running single girder cranes, 240’ runway system consisting of runway beams, columns, crane rail, and runway electrification, installation with rental equipment, separate load test / start-up, test weights and freight to job site. Cranes are to be manufactured by Deshazo Crane Company or approved equal.

1.02 RESPONSIBILITIES

A. Crane vendor will furnish on this order:

1. Material necessary for complete installation of above-mentioned cranes and runway system
2. Complete controls
3. Equipment operating instructions
4. Drawings and parts as required for complete system
5. Runway beams and columns, including structural design
6. Crane Rail
7. Runway electrification
8. Runway end stops
9. Installation of complete system in coordination with construction schedule.

B. Contractor will furnish materials and labor for the following:

1. Electric power service up to the level of the crane runway
2. Anchor bolts and foundations

C. Operating Conditions

1. Equipment will be installed indoors
2. Equipment will be operated in standard ambient temperatures
3. Electrical power characteristics: Power for operating equipment will be supplied by a 460 Volt 3 Phase, 60 hertz circuit

1.03 WARRANTY

A. Vendor shall guarantee material and workmanship of equipment installed under these specifications for a period of two (2) years, unless otherwise stated, after Date of Completion as determined by MDOT.

B. Include maintenance and service required for the (2) year warranty period.

1.04 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 for the runway beams, supports, crane rails and all crane components.

1.05 CLOSEOUT SUBMITTALS

A. Provide 3 copies of Operation and Maintenance manuals with one (1) electronic copy

PART 2 PRODUCTS

2.01 GENERAL

A. Crane, Trolley, and Hoist:

1. Crane Capacity: One (1) 10-ton and One (1) 5-ton
2. Main Hook capacity: One (1) 10-ton and One (1) 5-ton
3. Crane Span- 57’-0”+-
4. Total lift: Approx. 12-13’
5. Operating speeds:
   a. Bridge: 100 FPM - Variable
   b. Trolley: 80/20 FPM - Two (2) Speed
   c. Hoist: 20/3.3 FPM - Two (2) Speed

B. Type of control for pendant:

1. Primary point of control will be radio controls. Radio controls shall have two (2) transmitters and one (1) receiver for each crane
2. Secondary point of control shall be a Pendant suspended from an independent trolley track.
3. Pendant shall hang 4 ft. above floor
4. Radio control and pendent shall be rated for NEMA 12

C. Type of service:

1. Crane - CMAA Crane Service Class C
2. Hoist - HST- H4

D. Heights:

1. Operating floor to hook in high position - 0’-0” minimum
2. Operating floor to underside of building structural steel - 0’-0”
3. Operating floor to high point of crane - 0’-0”

E. Runway:

1. Length of runways - 1 @ 240’
2. Capacity of runway - 15 Tons
3. Column/bay spacing - 22’-0” max.
4. Number of cranes per bay spacing - Two (2)
5. Size of runway beams, columns, and runway rails shall be specified by the crane manufacturer

2.02 CRANE RUNWAYS

A. Crane runway beams, runway rails, crane runway stops shall be provided by the Crane Manufacturer. Runway shall be designed with sufficient strength and rigidity to prevent undue lateral or vertical deflection for wheel loading of the crane. Runway rails shall be installed straight, parallel, and level, at the same elevation and center-to-center distance as specified by CMAA. Rails shall be standard ASCE sections as specified by Crane Manufacturer.

2.03 BRIDGE

A. Bridge shall consist of a single girder fabricated of structural steel sections. Sections shall be braced for rigidity and securely fastened to the end trucks to maintain proper alignment.

B. End trucks shall consist of structural sections bolted to bridge beam. Long wheel base shall be provided for proper weight distribution. Each end truck shall be supplied with large diameter, heat treated, double-flanged, steel wheels.

C. End truck wheels shall be fixed or rotating axle type, equipped with anti-friction bearings. Substantial guards shall be provided in front of each wheel. These shall project below top of runway rail. Safety lugs shall be furnished on each end truck to prevent excess drop in case of axle failure.

D. The bridge shall be motor-driven through suitable gear reducers. Gearing shall be enclosed and operate in an oil bath. An electro-mechanical brake shall be supplied on the motor drive.

E. Rubber bumpers shall be furnished on bridge end trucks.

F. Bridge to have direction arrows painted under bridge girder.

2.04 TROLLEY

A. Monorail type trolleys shall be furnished to support equipment and operate on bridge girder.

B. Hardened tread wheels with anti-friction bearing shall be provided.

C. Trolley shall be motor-driven through a suitable gear reducer. An electric brake shall be furnished on this drive. Drive shall be shock free on starting and stopping.

D. Trolley frame shall be welded or cast steel construction. It shall be of rigid construction designed to transmit imposed load to bridge girder without undue deflection.

E. Safety lugs shall be furnished on each trolley.

2.05 HOIST

A. A low head room wire rope hoisting machine of proper capacity shall be mounted on trolley. It shall consist of motor, gear reducer, hoist drum, sheaves, load block, hook, and hoisting rope. Electric brake or mechanical load brake shall be supplied on hoist.

B. Motor shall be designed specifically for hoisting duty. Electric brake shall be of suitable size to promptly stop the motor rotation in either direction, and hold the load.

C. Brake shall be of the disc type and capable of holding and controlling lower speed of load under all conditions.

D. Precision cut, full depth teeth, heat treated forged steel gears shall be used in the gear reducer. These gears shall be provided with oil bath lubrication and enclosed in a drip proof case.

E. Hoist drum and sheaves shall be of large diameter to permit maximum rope life. Drum flanges shall be guarded so that rope cannot wedge between drum and hoist frame.

F. A paddle or weight-operated type upper limit switch shall be provided to protect against hoisting beyond safe limits or travel. This switch shall be connected to open a main line contactor. Switch system must be designed in such a manner that switch operator mechanism cannot be over traveled and allow switch to become inoperative.

G. A loading limit control device shall be provided to prevent over stressing system. This device shall de-energize hoist motor and immobilize up-circuit when an over capacity lift is attempted. This switch must be set to overcome dynamic loading conditions but not exceed 125% rated capacity.

H. Geared upper and lower limit switches shall be furnished to restrict motion beyond normal operating travel. These switch contacts shall be connected in respective motor control circuits.

I. Hoisting rope shall be steel, of suitable diameter, with a factor safety of at least five. Connection to drum shall be made adequately and shall be easily detachable for replacement.

J. Load block shall be of enclosed type and equipped with swivel type safety latch hook.

2.06 MOTORS

A. Motors shall be totally enclosed, non-ventilated induction type. They shall be 460 volts, 3 phase.

2.07 CONTROL STATION

A. Pendant type button push-button station shall be provided to control motions of bridge, trolley, and hoist.

B. Push-button station shall be suspended on a chain or cable, from track mounted on bridge, to position 4’-0” above operating floor level from bottom of station. It shall move along bridge independent of trolley.

C. Push-button enclosure shall be of lightweight construction in accordance with vendor’s standard.

D. Push-button station shall consist of lightweight enclosure and cover with button guards.

2.08 CURRENT CONDITIONS

A. A four-bar, enclosed type conductor system, Conductix or approved equal, shall be provided along full length of runway. Three of these conductors will be used to supply electric power to crane. Remaining conductor will be used for equipment grounding.

B. A flat, neoprene insulated, festooned flexible cable shall be provided along bridge to supply electric power to hoist and trolley. Three of these conductors will be used to supply electric power. Remaining conductor will be used for equipment grounding. Cable shall be connected to terminating box at one end of bridge.

2.09 CRANE CONTROL

A. Speed control shall be provided for travel and hoisting motions as outlined in these specifications.

B. Trolley and Hoist motions shall be controlled by across-the-line, reversing type motor starters.

C. Control circuit voltage shall not exceed 120 volts. This voltage shall be supplied from dry type transformer of proper capacity.

D. Fuse or circuit breaker protection shall be furnished for each individual crane motor.

E. Forward and reverse motor contactors must be interlocked mechanically and electrically to prevent motor damage if operator pushes direction buttons simultaneously.

2.10 ELECTRICAL WIRING

A. Electrical equipment shall be mounted in NEMA type 12 enclosures.

B. Conduits shall be terminated at enclosures and boxes in drilled holes or knockouts.

C. Grounding system shall be furnished to effectively maintain enclosures of electrical equipment such as motors, brakes, starters, push button stations, boxes, etc. at zero potential.

2.11 EQUIPMENT DESIGN SAFETY

A. Equipment furnished to vendor’s standard design, which incorporates weldments, is to be welded in accordance with appropriate codes and standard of American Welding Society.

B. Equipment non-standard design to fulfill special requirements shall, in addition, meet the following:

1. Critical welds, the failure of which would cause potential accidents or injuries to personnel, are to be executed with special attention as outlined in this specification.
2. An audit is to be made by vendor to determine those welds to be in the critical category. Such welds are to be given special attention by the vendor to insure adequate quality control.

2.12 PAINTING

A. Surfaces of structural parts of crane shall be finished in accordance with vendor’s standard practice.

B. Surfaces of electrical and mechanical parts shall be finished in accordance with vendor’s standard practice.

PART 3 - EXECUTION

3.01 INSPECTION AND TESTS

A. Inspection by Contractor and Owner during fabrication shall be permitted by vendor upon request. These inspections shall be performed to determine general adherence to these specifications and, in particular, to determine quality of welding and painting provided.

B. Final acceptance will be made after entire installation has been completed and a satisfactory trial has been made. Tests required to prove ability of crane shall be made by crane manufacturer.

3.02 GENERAL

A. Other requirements not set forth in these specifications, but necessary for safe and reliable operation of the equipment, shall be included.

B. Crane manufacturer must have 10 years of verified experience of manufacturing and installation of overhead cranes.

END OF SECTION

-MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-258-11 **CODE: (SP)**

DATE: 07/20/12

SUBJECT: Bollards

PROJECT: BWO-6211-18(003) / 502889301 &
LWO-6017-18(006) / 502889302 – Forrest County

Section 907-258, Bollards, is hereby added to and made a part of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction.

SECTION 907-258 -- BOLLARDS

907-258.01--Description. This work shall consist of furnishing and installing steel bollards in accordance with the requirements in the plans and this special provision.

907-258.01.1--Submittals.

Product Data. The Contractor shall submit to the Engineer five (5) copies of manufacturer's product data, including installation instructions and standard colors and finishes.

Shop Drawings. The Contractor shall submit to the Engineer five (5) copies of bollard manufacturer's shop drawings, indicating materials, dimensions, tolerances, welding, fasteners, hardware, mounting, finish, and accessories and quantities for each condition.

Warranty. The Contractor shall submit to the Engineer five (5) copies of manufacturer's standard warranty.

907-258-01.2--Quality Assurance. If welding is performed, the Contractor shall certify that each welder has satisfactorily passed AWS welding test for welding processes involved and, if pertinent, has undergone for welding.

1. “Manual of Steel Construction,” American Institute of Steel Construction.
2. AWS D1.1, "Structural Welding Code--Steel."
3. AWS D1.3, "Structural Welding Code--Sheet Steel."
4. AWS D1.6, "Structural Welding Code--Stainless Steel."
5. SSPC SP-3, “Surface Preparation Specification No.3, Power Tool Cleaning,” Steel Structures Painting Council.
6. SSPC PA-1, “Painting Application Specification,” Steel Structures Painting Council.
7. “Handbook on Bolt, Nut and Rivet Standards,” Industrial Fasteners Institute.

Subcontractor/installer of bollards shall have a minimum 5-year experience in the fabrication and installation of work similar in size and scope of the work of this section.

907-258.01.3--Field Measurements. The Contractor shall make measurements in the field to verify or supplement dimensions shown on the drawings and shall be responsible for proper measurements and fit of all items.

907-258.01.4--Delivery, Storage and Handling. Material shall be delivered to the site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name, manufacturer, and location of installation. Upon delivery, the packages shall be immediately inspected to ensure all products are complete and undamaged.

Store Materials shall be stored in a clean, dry area indoors in accordance with manufacturer's instructions. The temporary protective coverings shall be left in place.

The Contractor shall use all means necessary to protect the materials before, during and after installation.

In the event of damage, repairs and necessary replacements shall immediately be made.

907-258.02--Materials. Materials for the bollards shall meet the requirements of the Standard Specifications, this special provision, and the plans. Special attention is brought to the following plan sheets:

Working Number C4.1, Building "H" Site Dimension Plan,
Working Number C4.2, Building "K" Site Dimension Plan, and
Working Number C13.0, Striping and Signage and Miscellaneous Details.

907-258.02.1--General Materials and Standards. Carbon Steel shall meet the following test requirements.

Pipe .....ASTM A 53, Schedule 40.
Tubing.....ASTM A 500 or A 513.
Sheet.....ASTM A 570.
Round Bar and Flat Bar .....ASTM A 36.

Concrete for footings shall meet the requirements of Section 804 of the Standard Specification.

907-258.03--Construction Requirements.

907-258.03.1--Examination. The Contractor shall examine the surfaces and subsurface conditions of areas to receive site furnishings. The surfaces to receive site furnishings shall be clean, flat, and level. The Engineer shall be notified if conditions that would adversely affect installation or subsequent utilization of Bollards if found. The Contracor shall not install bollards with unsatisfactory conditions.

907-258.03.2--Installation.

Bollards shall be installed in accordance with manufacturer's instructions at locations indicated on the plans. The bollards shall be level, plumb, square, accurately aligned, centered correctly located, and without warp. Allowable tolerances shall be ¼ of an inch in any direction. Failure to meet this requirement shall be cause for rejection of work.

Non-corrosive, tamper resistant hardware and fasteners in accordance with manufacturer's instructions shall be used, unless otherwise indicated on plans.

Minor damages to finish shall be repaired in accordance with manufacturer's instructions and as approved by Engineer. If damaged components cannot be successfully repaired, as determined by Engineer, they shall be replaced.

Concrete footings and bases shall be installed as specified and as shown on plans.

907-258.03.3--Cleaning and Touchup Painting. After removing the temporary protective coverings, the bollards shall be cleaned in accordance with manufacturer's instructions. Harsh cleaning materials or methods that would damage finish shall not be used.

Field welds shall be cleaned and touchup painted as directed by the Engineer.

907-258.03.4--Protection.
The Contractor shall be responsible for protecting the bollards after installation. If damage occurs, the bollards shall be cleaned, repaired or replaced, as approved by Engineer.

907-258.04--Measurement And Payment. Bollards shall be measured per each.

907-258.05--Basis of Payment. Bollards, measured as prescribed above, shall be paid for at the contract unit price per each, which price shall be full compensation for furnishing and placing all materials, for all painting, for anchoring/mounting systems, concrete, subgrade preparation, excavation, disposal, forms, any repair work, and for all labor, equipment, tools and incidentals necessary to complete the work.

Payment will be made under:

907-258-K: Bollard, Type - 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

SPECIAL PROVISION NO. 907-504-4 **CODE: (SP)**

DATE: 04/14/2010

SUBJECT: Ultra-Thin and Thin Portland Cement Concrete Pavement

Section 907-504, Thin Portland Cement Concrete Pavement, 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 907-504 - THIN PORTLAND CEMENT CONCRETE PAVEMENT

907-504.01--Description. This work consists of ultra-thin and thin pavement composed of Portland cement concrete, without steel reinforcement, constructed in accordance with these specifications and in reasonably close conformity with the lines, grades, thicknesses, and cross sections shown on the plans or established by the Engineer.

Ultra-thin pavements are defined as pavements less than four inches in thickness.

Thin pavements are defined as pavements greater than or equal to four inches in thickness.

907-504.02--Materials. Materials shall meet the applicable requirements of Division 700 and the following Subsections:

Portland Cement	701.01 and 701.02
Blended Cement	701.01 and 701.04
Fine Aggregate	703.01 and 703.02
Coarse Aggregate	703.01 and 703.03
Curing Materials	713.01
Admixtures	713.02
Water	714.01
Calcium Chloride	714.02
Fly Ash	714.05
Ground Granulated Blast Furnace Slag (GGBFS)	714.06

907-504.02.1--Composition of Concrete. Chemical admixtures of either Types MR, F, or G, with Types A or D as required, in accordance with Subsection 713.02 shall be used in the concrete mixture.

If fly ash or GGBFS are used as a replacement for Portland cement in accordance with the maximum values allowed in Subsection 701.02, then chemical admixtures of Types C or E in accordance with Subsection 713.02 or calcium chloride in accordance with Subsection 714.02 may be used. The maximum amount of calcium chloride which may be used is 1.0% by weight of the total cementitious materials.

Each different combination of admixtures shall be considered a different mixture design, each requiring separate review and approval.

Synthetic structural fibers meeting the requirements of 907-711, shall be used in the concrete mixture added at the rate required on the Department's Approved Products List for the specific synthetic structural fiber used.

907-504.02.1.1--Portland Cement Concrete Mixture Design. The concrete mixture design shall be submitted by the Contractor to the Engineer for approval prior to production in accordance with the submittal requirements of the Department's *Concrete Field Manual* and in accordance with the requirements for Laboratory Trial batches in Subsection 804.02.10.1.2, with the exception that the mixture shall meet the requirements of the "Master Proportion Table for Portland Cement Concrete Design" listed in Table 1 of this Subsection.

Table 1
MASTER PROPORTION TABLE FOR PORTLAND CEMENT CONCRETE DESIGN

Design Property	Requirements
Coarse Aggregate Size No.	
For Ultra-thin Pavements	67
For Thin Pavements	57
Maximum Water / Cementitious Ratio*	0.40
Maximum Slump, inches	4**
Total Air Content, %	3 - 6
Minimum Compressive Strength, psi	
For Opening to Traffic	2500 in 18 hours
For Acceptance	3500

* 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 701.02. Other hydraulic cements may be used in accordance with the specifications listed in Section 701.

** The slump may be increased up to 6 inches with an approved Type MR mid-range water reducer or up to 8 inches with an approved Type F or G high range water reducer, in accordance with Subsection 713.02. Minus slump requirements shall meet those set forth in Table 3 of AASHTO Designation: M157 specification.

Additionally, prior to production the Contractor shall field verify production of the mixture in accordance with Subsection 907-504.02.1.3 and submit this documentation with the proportioning information required in Subsection 907-504.02.1.2.

If the maturity method is used to estimate the compressive strength for early opening to traffic, the Contractor shall also submit strength/maturity documentation developed in accordance with

Subsection 907-504.02.2.5.2 for the mixture prior to production of concrete.

907-504.02.1.2--Proportioning of Concrete Mixture Design. Proportioning of Portland cement concrete shall meet the requirements of Subsection 804.02.10.1.2.

907-504.02.1.3--Field Verification of Concrete Mixture Design. The Contractor shall furnish the Engineer documentation indicating that the mixture meets requirements in Table 1 within the tolerances specified in the field verification requirements of Subsection 804.02.10.3. This documentation must indicate that the mixture achieves the requirements in Table 1 for:

- the compressive strengths required for acceptance within 28 days; and
- the compressive strengths required for early opening to traffic within the time specified by the Engineer.

Because the mixture is being field verified by the Contractor prior to submittal of the mixture for review, the requirement in Subsection 804.02.10.3 that the mixture be proven to meet the field verification requirements within three attempts does not apply.

907-504.02.2--Basis of Acceptance. The Contractor shall furnish the concrete necessary for test specimens. Department personnel meeting the certification requirements of Subsection 804.02.9 shall be responsible for all concrete testing in accordance with the tests required in Subsection 804, Table 5: DEPARTMENT'S MINIMUM REQUIREMENTS FOR QUALITY ASSURANCE, Section B: Plastic Concrete. These tests shall be performed on the first load delivered and placed each day and then a minimum of once for each subsequent 50 cubic yards delivered and placed per day.

907-504.02.2.1--Slump. Slump of plastic concrete shall meet the requirements of Table 1: MASTER PROPORTION TABLE FOR PORTLAND CEMENT CONCRETE DESIGN. A check test shall be made on another portion of the sample before rejection of any load.

907-504.02.2.2--Air. Total air content of concrete shall be within the specified range for the class of concrete listed in Table 1: MASTER PROPORTION TABLE FOR PORTLAND CEMENT CONCRETE DESIGN. A check test shall be made on another portion of the sample before rejection of any load.

907-504.02.2.3--Yield. Perform a yield check in accordance each 400 cubic yards in accordance with AASTHO Designation: T121. If the yield of the concrete mixture design is more than plus or minus 3% of the designed volume, the mixture shall be adjusted by a Class III Certified Technician representing the Contractor to yield the correct volume plus or minus 3%.

907-504.02.2.4--Temperature. For mixtures containing fly ash or GGBFS in accordance with the requirements in 907-504.02.1, the maximum plastic concrete acceptance temperature shall be 95°F. Plastic concrete containing fly ash or GGBFS in accordance with the requirements in 907-504.02.1 with a plastic concrete acceptance temperature exceeding 95°F shall be rejected and not used in Department work. For all other mixtures the maximum plastic concrete acceptance

temperature shall be 90°F. Plastic concrete for all other mixtures with a plastic concrete acceptance temperature more than 90°F shall be rejected and not used in Department work.

Plastic concrete with an acceptance temperature less than the minimum temperature in Subsection 804.03.16.1 shall be rejected and not used in Department work.

907-504.02.2.5--Compressive Strength.

907-504.02.2.5.1--Strength Testing for Acceptance. Compressive strength cylinders cast for acceptance of the pavement shall meet the minimum acceptance strength requirement listed in Table 1. These cylinders shall be standard cured in accordance with the requirements in AASHTO Designation: T23, Section 10.1 and its subsequent paragraphs.

907-504.02.2.5.2--Strength Testing for Opening to Traffic.
Use of Cylinders. In addition to compressive strength testing for acceptance of the pavement, compressive strength testing shall be performed to accommodate traffic movements. Compressive strength cylinders cast for early opening of the pavement to traffic shall meet the minimum opening to traffic strength requirement listed in Table 1. These cylinders shall be field cured next to the pavement until time of test specified by the Engineer in accordance with the requirements in AASHTO Designation: T23, Section 10.2 and its subsequent paragraphs.

Use of Maturity Method. In lieu of using concrete strength cylinders to determine when concrete pavement can be opened to traffic, if the Contractor has previously developed the strength/maturity relationship for the mix, an approved maturity meter may be used to determine concrete strengths. A maturity meter probe shall be inserted into the last concrete placed that represents the pavement area to be tested. The maximum amount of concrete which may be represented by a maturity meter probe is 50 cubic yards. The pavement may be opened to traffic when maturity meter reading indicates that the required in place strength is obtained.

Procedures for using the maturity meter and developing the strength/maturity relationship shall follow the requirements of AASHTO Designation: T325. Validation of the maturity curves shall be made at least once for every 500 cubic yards produced of each concrete mixture used. Validation of the maturity curve shall be considered acceptable when the results of compressive strength tests are within 10% of the predicted value determined by the maturity curve. If the 10% requirement is not met, a new maturity curve shall be developed.

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. Training and maintaining a list of approved maturity technicians shall be the responsibility of the Mississippi Concrete Industries Association.

907-504.03--Construction Requirements. Prior to the removal of any existing pavement, the Contractor shall submit a Work Plan to the Engineer for approval. The Contractor shall submit this plan to the Engineer a minimum of 14 days prior to the removal of the existing pavement. This plan shall include, but not be limited to, the following:

- the proposed procedures for concrete placement, screeding, consolidation, finishing and surface texturing, curing method, and jointing;
- a list or description of the equipment proposed for use to accomplish the proposed procedures including the quantities of each piece of equipment;
- a list or description of the materials, such as curing materials or corrugated strips used during joint installation, proposed for use to accomplish the proposed procedures including the quantities of each material; and
- a scale drawing of the areas of work with the locations of all joints.

907-504.03.1--Removal of Existing Pavement. Existing HMA pavement to be removed and replaced with thin or ultra-thin concrete pavement shall be removed by milling per Section 406. Prior to the milling operation, saw cuts shall be made to the neat lines, grades and depths, and in the locations shown on the drawings.

Additionally, areas where traffic is expected to cross the transition from the HMA pavement to the thin or ultra-thin concrete pavement and vice versa shall meet the grades and depths shown in Figure 1. For areas where the flow of traffic is longitudinal with respect to the pavement, the transition areas shall meet the requirements for a Longitudinal Transition shown in Figure 1. For areas where the flow of traffic is transverse with respect to the pavement, the transition areas shall meet the requirements for a Transverse Transition shown in Figure 1. Saw cuts and milling shall meet the requirements of this Subsection to the required neat lines, grades, and depths required in Figure 1.

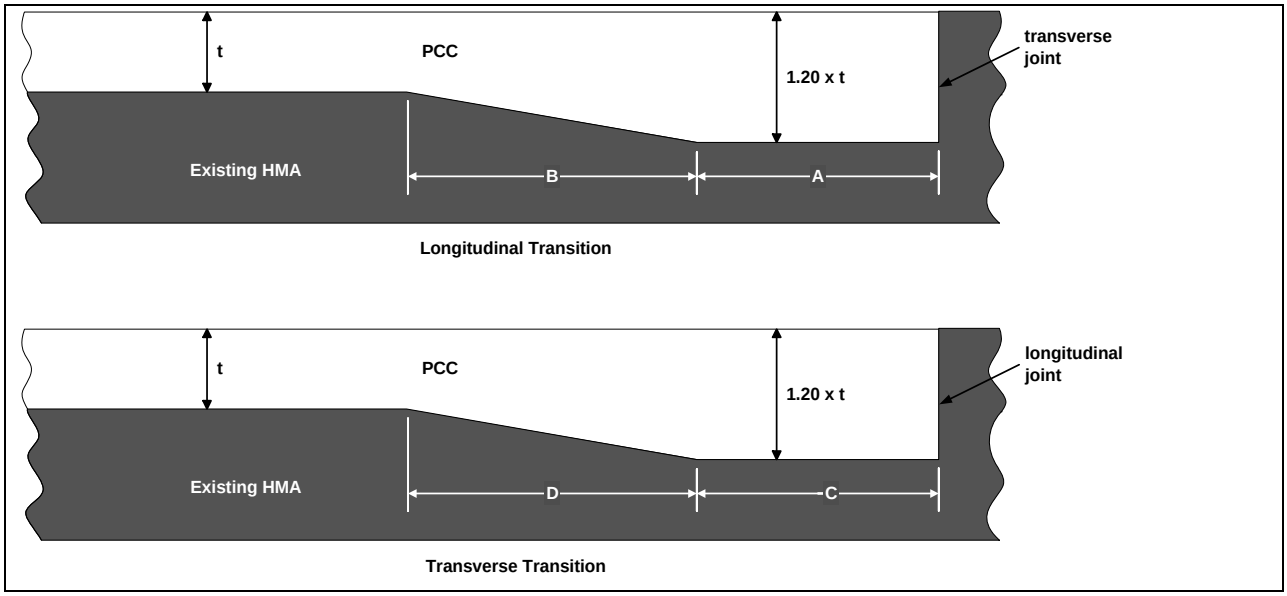


Figure 1

Dimension *A* in Figure 1 shall be no less than the transverse joint spacing required for the thickness, *t*, of the thin or ultra-thin concrete pavement per Table 2. Dimension *B* shall be either 0, 1, or 2 times the transverse joint spacing required for the thickness, *t*, of the thin or ultra-thin concrete pavement per Table 2.

Dimension *C* in Figure 1 shall be no less than the longitudinal joint spacing required for the

thickness, *t*, of the thin or ultra-thin concrete pavement per Table 2. Dimension *D* shall be either 0, 1, or 2 times the longitudinal joint spacing required for the thickness, *t*, of the thin or ultra-thin concrete pavement per Table 2.

If there is sufficient thickness of the existing HMA as determined by the Engineer, with approval by the Engineer and at no additional expense to the Department the Contractor may remove more than *t* from the entire area to be replaced with thin or ultra-thin concrete pavement. Additionally, if the Contractor elects to remove 1.20 x *t* or more over the entire area to be replaced with thin or ultra-thin concrete pavement, this shall be in lieu of Dimension *B* and Dimension *D*.

907-504.03.2--Preparation of Grade. The foundation upon which the concrete pavement is to be placed shall be prepared within the tolerances set out in Subsection 321.03.

907-504.03.3--Setting Forms. The requirements for setting forms shall meet the requirements of Subsection 501.03.8 and its subsequent paragraphs.

907-504.03.4--Base Preparation. Prior to placement of concrete, the milled HMA surface shall be thoroughly swept to remove all loose HMA material or dirt particles so as to ensure development of proper bond between the concrete inlay and the existing HMA surface. Additionally, the base shall meet the requirements of Subsection 501.03.9 and it subsequent paragraphs.

907-504.03.5--Placing, Spreading, and Finishing. Concrete pavement shall be formed and constructed to the neat lines, grades, cross section, and thicknesses shown on the drawings. Concrete shall be placed and spread in an approved manner so as to distribute the concrete uniformly without segregation. Additional placement requirements are provided in Subsection 501.03.13 and its subsequent paragraphs.

Final finishing of the concrete pavement surface shall be in accordance with Subsection 501.03.17 and its subsequent paragraphs.

Under no circumstances shall water be used as a finishing aid or worked into the concrete surface. This includes water added by fogging, spraying, and/or pouring.

The surface of the concrete pavement shall be transverse tined in accordance with Subsection 501.03.18.4.

907-504.03.6--Joints. All joints shall be created by sawing using equipment meeting the requirements of Subsection 907-504.03.7.2. Sawing of the joints shall commence as soon as the concrete has hardened sufficiently to support the weight of the saw. The spacing and depth of all of joints shall meet the requirements of "Joint Spacing Requirements for Various Pavement Thicknesses" shown in Table 2. The maximum width of the joint shall be 0.125 inch.

Table 2
JOINT SPACING REQUIREMENTS FOR VARIOUS PAVEMENT THICKNESSES

Minimum Pavement Thickness	Maximum Joint Spacing Requirement	Minimum Joint Depth (installation timing)	
(in)	(Transverse x Longitudinal)	(within 2 hours of finishing)	(more than 2 hours after finishing)
3	3 ft x 3 ft	1 in	1 in
4	4 ft x 4 ft	1 in	1 in
5	5 ft x 6 ft	1 in	1-1/4 in
6	5 ft x 6 ft	1 in	1-1/2 in

Because the use of "early entry" dry cut saws is required, corrugated plastic filler strips shall be used at the intersection of all saw cuts, and at locations where the wheels of the early entry saw cross a previously cut joint, to prevent future spalling at the corners of the intersection. The joints shall not be sealed but shall be cleaned of all deleterious material after sawing by using compressed air. Air compressors used to clean the joints shall meet the requirements of Subsection 413.03.1. Pavement thickness and other details shall be as specified in the plans or contract documents.

907-504.03.6.1--Timing of Sawing. The Contractor shall inspect the concrete within 90 minutes after the completion of curing at each location to determine if the concrete is sufficiently hardened to support the weight of the saw. If the concrete has not sufficiently hardened to support the weight of the saw, the Contractor shall inspect the concrete at least every 30 minutes after each subsequent inspection to determine if the concrete is sufficiently hardened to support the weight of the saw. Sawing shall not begin or shall be discontinued if there is any raveling of the joints or marring of the surface of the concrete during installation of the joints. If sawing is discontinued due to the concrete not being able to support the weight of the saw or due to raveling of joints, the Contractor shall inspect the concrete at least every 30 minutes to determine if the concrete has sufficiently hardened. FHWA Publication No. HIF-07-004 (Integrated Materials and Construction Practices for Concrete Pavement: A State-of-the-Practice Manual) shall be used as a guide for determining the timing of joint installation. Information about this Publication may be found at the following web site:

http://www.fhwa.dot.gov/pavement/pub_listing.cfm.

For successful installation of joints, the Contractor may need to inspect the concrete at more frequent time intervals than those listed above and with the understanding that concrete placed later in the day may be sufficiently hard for joint installation prior to concrete placed earlier in the day. If joints are not installed in a sufficient amount of time such that concrete cracks at locations other than the installed joints, the Contractor shall repair the pavement to the satisfaction of the Engineer.

907-504.03.7--Equipment.

907-504.03.7.1--Concrete Production and Transportation. Equipment and processes used for concrete production shall meet the requirements of Subsection 804.02.11 with automatic systems for recording batch weights and compensating for the moisture in the fine aggregate. Additionally, the requirements of AASHTO Designation: M157, Sections 8, 9, 10, and 11 shall be followed. Following AASHTO Designation: M157, Section 11.7, on arrival to the job site of a mixer truck, a maximum of 1½ gallons of water per cubic yard shall be allowed to be added to bring the slump within the required limits; water shall not be added at a later time. Batch ticket information shall meet the requirements of Subsection 804.02.12.3.

907-504.03.7.1.1--Limitations of Mixing. Except in emergencies, no concrete shall be mixed or placed when the natural light will be insufficient for finishing. In case of an emergency, the Engineer may permit finishing during periods of insufficient light provided adequate and approved lighting is furnished by the Contractor.

Concrete shall not be placed on a frozen foundation, nor shall frozen aggregate be used in the concrete.

907-504.03.7.1.2--Cold or Hot Weather Concreting. During periods of cold or expected cold weather, the limitations for beginning a concrete pour and the limitations for temperature control of the mixture and its components shall be in accordance with the provisions of Subsection 804.03.16.1.

During periods of hot weather or arid atmospheric conditions the provisions of Subsection 804.03.16.2 shall be applicable.

907-504.03.7.2--Concrete Saw. The concrete pavement joints shall be cut utilizing only an "early entry" dry cut saw, approved by the Engineer. Other type saws may be used for other sawing applications, provided the saw meets the requirements of Subsection 501.03.6.1. Proper, approved sawing equipment and sufficient labor shall be present on the site prior to each day's placement of concrete. Placement shall not commence until said equipment and labor are on site.

907-504.03.7.3--Other Equipment. Other equipment and tools necessary for handling materials and performing all parts of the work shall be approved by the Engineer as to design, capacity, and mechanical condition, and meeting the requirements of Subsections 501.03.5, 501.03.6, and 501.03.20.1, and their subsequent paragraphs.

907-504.03.7.4--Prohibited Equipment. The following equipment shall not be used or allowed on the project: bull floats or equipment used to dispense water, including fogging, spraying, and/or pouring. Water dispensing equipment attached to mixer trucks is not included in this list of prohibited equipment provided this equipment is only used to dispense water into a mixer truck in accordance with Subsection 907-504.03.7.1.

907-504.03.8--Surface Test. It is the intent of these specifications that the finished surface will have good riding qualities.

Any membrane curing damaged during the surface testing operation shall be repaired by the Contractor at no additional expense to the Department.

Any corrective work to the pavement surface necessitated to ensure that the applicable surface test limits are not exceeded shall be in accordance of Subsection 907-504.03.8.3.

907-504.03.8.1--Projects Containing More Than 10,000 SY. Profiles of the pavement surface will be established, evaluated and the pavement surface corrected, as necessary, so that the final surface variances shall not exceed a profile index of 65 inches per mile per segment. Shoulders, tapers, and areas in horizontal curves having a radius of less than 1000 feet at the centerline and within the superelevation transition of such curves are excluded from a test with the profilograph.

Determination of the profile index will be in accordance with test methods established by the Department.

A California profilograph meeting the requirements as set out in Section 401 shall be furnished and operated by the Contractor under supervision of the Engineer to provide recorded data to establish the profile index and identify locations requiring correction. Surface profile shall be obtained in the wheel path of each travel lane.

For the purpose of determining pavement smoothness and contract price adjustment for rideability, the pavement will be subdivided into sections of 528 feet. Where a segment less than 528 feet occurs at the end of a section, it will be combined with the preceding 528-foot segment for calculation of the profile index.

A profile index will be determined for each segment as inches per mile in excess of the "Zero" blanking band which is simply referred to as the "Profile Index". From the profilogram of each segment, the scallops above and below the "Zero" blanking band are totaled in tenths of an inch. The totaled count of tenths is converted to inches per mile to establish a smoothness profile index for that segment.

In addition to the above requirements for the profile index, all areas represented by high points having deviations in excess of 0.4 inch in 25 feet shall be removed by the Contractor utilizing grinding methods and equipment specified. Deviations in excess of 0.4 inch will be determined from the profilogram in accordance with Department test methods.

After correcting individual deviations in excess of 0.4 inch in 25 feet, corrective action shall be made to reduce the profile index to 65 inches per mile per segment or less.

On those segments where corrections are made, the pavement will be surface tested again to verify that corrections have produced a profile index of 65 inches per mile per segment or less.

907-504.03.8.2--Projects Containing Less Than Or Equal To 10,000 SY. Each continuous full or partial lane width of concrete pavement shall have a uniform surface and be in reasonably close conformity with the line, grade, and cross section shown on the drawings.

After a continuous full or partial lane width of concrete pavement is completed, the surface of the plastic concrete shall be tested for uniformity using a Contractor furnished and operated 10-foot straightedge. There shall be no deviations from the straightedge greater than 0.25 inch in 10 feet in either the longitudinal or the transverse directions. Pavement not in compliance with the requirement shall be corrected.

Additionally, individual bumps or depressions in the pavement surface exceeding 0.40 inch, when measured from a chord length of 25 feet shall be corrected.

907-504.03.8.3--Corrective Work for Smoothness. Corrective work shall be done at no additional cost to the Department. Corrective work shall consist of diamond grinding in accordance with Subsection 501.03.19.1 and its subsequent paragraphs. Concrete removal by grinding shall be limited such that the thickness of the pavement after grinding shall not be less than plan thickness minus 0.25 inch. Final pavement thicknesses, after any surface corrections, which are thinner than plan thickness minus 0.25 inch shall subject the area represented by such deviation to the provisions of Subsection 907-504.05.2.

All areas which are corrected shall be retested to ensure conformance to the applicable surface test requirements.

No reestablishment of transverse tining shall be required after surface corrections are made by diamond grinding.

All corrective work to ensure compliance with the applicable surface test requirements shall be completed prior to determining pavement thickness.

The Contractor shall be responsible for all traffic control associated with the testing and/or correction of the concrete pavement.

907-504.03.9--Curing and Protection. Curing and protection of the pavement shall be in accordance with Subsection 501.03.20 and its subsequent paragraphs with the exception listed in Subsection 907-504.03.9.1.

Additionally, the amount of time between discharge of concrete at any location and the completion of the method of curing of that same location shall not exceed 45 minutes.

907-504.03.9.1--White Pigmented Membrane. Curing compound shall be applied per Subsections 501.03.20.1 and at a rate of one gallon to not more than 125 square feet. If the time period between floating and texturing of the concrete exceeds 30 minutes, the concrete shall be kept damp by fogging with a monomolecular film type evaporative retarder to prevent rapid evaporation of the surface. As a rule of thumb, the color of a pavement covered with the required amount of curing compound 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 (5) feet away horizontally if standing on the same grade as the pavement.

907-504.03.10--Removing Forms. Removal of forms shall be in accordance with Subsection 501.03.21.

907-504.03.11--Opening to Traffic. The Engineer will decide when the pavement may be opened to traffic. No traffic will be allowed on the completed pavement until the concrete has attained a compressive strength of 2500 psi. Prior to opening to traffic, the pavement shall be cleaned.

907-504.03.12--Pavement Thickness Determination. For the purpose of determining pavement thickness, the pavement will be subdivided into separate sections of 1000 linear feet in each traffic lane excluding turn-outs and ramps, extending from one end of the pavement to the other end. The last section in each traffic lane will be the length remaining unless the length of that section is less than 500 feet. If the length of the last section is less than 500 feet, include it with the previous section for determination of thickness.

One core will be taken at random by the Department from each section. The thickness of the sections will be determined as provided for in Subsection 907-504.05.1. Based on the thickness of each section, an adjusted unit price as provided in Subsection 907-504.05 and its subsequent paragraphs will be paid for each section represented.

Holes remaining in the pavement after coring shall be completely filled by the Contractor, at not additional cost to the Department, with concrete of the same quality as used to construct the pavement.

907-504.04--Method of Measurement. Concrete pavement will be measured by the square yard complete in place and accepted. The width for measurement will be the plan width, including widening where called for, or as otherwise authorized in writing by the Engineer. The length will be measured horizontally in accordance with Section 109.

Payment for removal of existing HMA pavement, required to be removed and replaced with concrete pavement, is addressed under Pay Items 406-A, Cold Milling of Bituminous Pavement, All Depths and 503-C, Saw Cut (Equal to depth of concrete pavement), and shall include saw cutting, milling, and all handwork necessary to ensure removal of HMA to the neat saw cut lines.

907-504.05--Basis of Payment.

907-504.05.1--General. Concrete pavement will be paid for at the contract unit price per square yard, adjusted when applicable for sections of pavement found deficient in thickness by more than 0.25 inch and not more than 0.50 inch, which shall be full compensation for concrete pavement placement, fiber reinforcement, finishing and curing, concrete volume, saw cutting of joints, and for all labor, equipment, tools, materials, all traffic control, and incidentals necessary for the construction of the concrete pavement.

In calculating the thickness of the pavement, measurements which are in excess of the plan thickness by more than 0.25 inch will be considered as the plan thickness plus 0.25 inch. Additionally, measurements which are less than the plan thickness by more than 0.50 inch,

excluding exploratory cores, will be considered as the plan thickness minus 0.50 inch. When the measured thickness of a core is less than the plan thickness by more than 0.50 inch, the actual thickness of the pavement in this area will be determined by taking exploratory cores at not less than 10 foot intervals parallel to the centerline in each direction from the affected location until in each direction a core is found which is not deficient by more than 0.50 inch.

Areas found deficient in thickness by more than 0.50 inch will be evaluated by the Engineer; and if in the judgment of the Engineer, the deficient areas warrant removal, they shall be removed and replaced with pavement of the thickness shown on the plans without cost to the Department. If the Engineer determines that the deficient areas do not warrant removal, the pavement may be left in place with no payment to the Contractor, or may be removed and replaced at the Contractor's option. Exploratory cores for deficient thickness will not be used in averages for areas for adjusted unit price.

Each area or section of pavement removed shall be at least 10 feet in length and at least the full width of the lane involved. When it is necessary to remove and replace a section of pavement, any remaining portion of the slab adjacent to the joints that is less than 6 feet in length shall also be removed and replaced. The new surface shall be textured as specified in the contract.

Concrete that fails to develop a 28-day compressive strength of 3500 psi shall be removed and replaced, or accepted at a reduced price, if an Engineering study indicates that the concrete is satisfactory to remain in place.

Payment will be made under:

907-504-A: ___" Fiber Reinforced Concrete Pavement - per square yard

907-504.05.2--Price Adjustments for Thickness. When the average pavement thickness, determined in accordance with Subsection 907-504.03.12, is deficient by more than 0.25 inch but not more than 0.50 inch, payment will be made at an adjusted price as specified in the following table:

CONCRETE PAVEMENT DEFICIENCY

Thickness Deficiency Inches	Proportional Part of Contract Price Allowed
0.00 to 0.25	100 percent
0.26 to 0.50	75 percent
>0.50	Remove and Replace At No Additional Cost to the Department or Receive No Payment

Any applicable price adjustment due to thickness deficiency applies to the full width of the deficient lane or shoulder.

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. 907-604-8 **CODE: (SP)**

DATE: 02/13/2013

SUBJECT: Manholes, Inlets And Catch Basins

PROJECT: BWO-6211-18(003) / 502889301 &
LWO-6017-18(006) / 502889302 – Forrest County

Section 604, Manholes, Inlets, and Catch Basins, of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows.

907-604.02--Materials. After the last paragraph of Subsection 604.02 on page 367, add the following.

Precast sanitary sewer manholes shall conform to the requirements of ASTM C478 and shall be cast with Kor-N-Seal I boot as manufactured by Fernco or an approved equal for connecting sanitary sewer pipes to manholes. After installation of the pipe, the pipe shall be grouted in place with a non-shrink grout by filling the inside of the boot with grout from inside the manhole.

Prior to installation, two coats of coal tar epoxy shall be applied to the inside of all precast sanitary sewer manhole sections, unless a 100% solids polymer system is otherwise required. After installation coal tar epoxy shall be reapplied to areas where it has been chipped, marred, etc.

Sanitary sewer manholes shall be furnished with "Ram-Nek" or approved equal gaskets. All joints in the manholes shall be wrapped tightly with Infi-Shield External Gator Wrap or approved equal. The wrap shall be overlapped a minimum of six inches (6”).

Each section shall have not more than two holes for the purpose of handling. These holes shall be plugged with a non-shrink grout immediately after installation and covered with a minimum 9” x 9” patch of “Gator Wrap” or approved equal.

All sanitary sewer manholes that have a sanitary sewer force main entering it, or other manholes as directed by the Engineer, shall be lined with a 100% solids polymer lining after installation. The lining shall be reapplied to areas where it has been chipped, marred, etc. prior to final acceptance.

All of the cold joints on boxes, inlets, etc. that are poured in lifts shall be wrapped tightly with a three foot (3') band of geotextile filter fabric. Filter fabric shall be over-lapped three feet (3’). The Contractor shall secure the filter fabric to the box, inlet, etc. to hold it in place throughout the backfilling operation.

Geotextile fabric shall be non-woven, needle punched, and weigh a minimum of eight ounces (8 oz.) per square yard, as manufactured by Terratex Construction Fabrics, “NO8”, or approved equal.

All inlets and boxes deeper than three feet (3') will require reinforced copolymer polypropylene plastic steps at 12" O.C. conforming to ASTM C478. Reinforced copolymer polypropylene plastic steps shall be built into the walls of the precast sanitary sewer manhole sections at 12" O.C. conforming to ASTM C478. Steps in all boxes, inlets and manholes shall be installed in a straight alignment so as to form a continuous ladder. Spacing from top of inlet, manhole, or box shall be no more than two feet (2') unless approved otherwise by Engineer.

Pre-cast storm drain structures shall not be used. All storm drain structures (e.g. inlets, catch basins, manholes, junction boxes, etc.) shall be cast-in-place.

"Size II Stabilizer Aggregate" for bedding shall be in accordance with Section 907-304, Granular Courses.

907-604.03--Construction Requirements.

907-604.03.2--Concrete Masonry. After the last paragraph in Subsection 604.03.2 on page 368, add the following.

A precast concrete adjusting ring may be used on precast concrete manholes upon approval of the Engineer. The adjusting ring shall be set on a one-inch (1") mortar bed to connect the ring to the manhole. The connection shall be constructed to be smooth, neat, and watertight on the inside and the outside of the manhole.

907-604.03.5--Inlet and Outlet Pipes. After the last paragraph in Subsection 604.03.5 on page 368, add the following.

Concrete invert channels shall be poured in all manholes, boxes, inlets, etc. in the field by the Contractor and shall be smooth and accurately shaped to a semi-circular bottom conforming to the inside of the adjacent pipe section. Inverts shall extend up at least half of the diameter of the pipe. Changes in direction of flow of entering branches shall have a true curve of as large a radius as the size of the structure will permit. All flow shall be blocked off during the time that the invert is being worked on. No debris shall be allowed to enter the structure.

Inlet and outlet pipes shall be placed in existing structures by cutting through the walls and reshaping the inverts. The Contractor shall use a non-shrink grout to install a Fernco concrete manhole adapter around the pipes so as to prevent leakage and to refinish the part of the structure worked on.

Where in any sanitary sewer manhole the vertical distance from the flow line of the outgoing sewer to the invert of the incoming sewer exceed two feet (2'), drop pipe shall be built for the incoming sewers. Drop sizes will be as directed by the City.

The Contractor shall stub an eighteen inch (18") long piece of six inch (6") diameter perforated SDR-26 pipe through the sidewall of all drainage structures as directed by the City Engineer. The entire length of the perforated pipe stub-out shall be wrapped in eight ounce (8 oz.) geotextile fabric. The perforated pipe shall be installed in such a manner that silt is prevented from entering

the open end of the stub-out and the perforations. The holes in the perforated pipe shall be one-half inch (1/2") in diameter.

907-604.03.06--Castings, Gratings, and Fittings. After the last paragraph in Subsection 604.03.6 on page 368, add the following.

All castings shall meet AASHTO M306, latest revision.

907-604.03.07--Precast Manholes. Delete Subsection 604.03.7 in its entirety.

907-604.03.8--Excavation and Backfill. Delete the last sentence of Subsection 604.03.8 on page 369, and substitute the following.

All backfill placed around manholes, inlets, catch basins, junction boxes, conflict boxes, and any other structure shall be placed in 6 to 8-inch lifts and compacted to 95% density in accordance with ASTM D 1557. The Contractor shall take density tests around all four (4) sides of all structures to assure proper compaction.

After Subsection 604.03.9 on page 369, add the following.

907-604.03.10--100% Solids Polymer Liner. 100% Solids Polymer Liner system shall be applied to manholes as indicated on the drawings or in accordance with this specification and in accordance with the manufacturer's written instructions. Materials shall be in accordance with the CCI Spectrum SpectraShield Liner System, or approved equal. Application contractor shall be approved and certified by the lining manufacturer. Installed lining shall be warranted by the contractor and manufacturer for a period of not less than ten (10) years. Total final dry film thickness shall be 500 mils.

907-604.04--Method of Measurement. Delete the second, sixth, and seventh paragraphs of Subsection 604.04 on page 369 & 370, and substitute the following.

Castings, gratings and ductile iron fittings, measured as prescribed above, will be computed in pounds from the dimensions and weights shown on the plans and submittals.

"Size II Stabilizer Aggregate" for bedding, measured as prescribed above, shall be measured and paid in accordance with Section 907-304-1, "Granular Courses".

Backfill, filter fabric, "Gator Wrap", steps, concrete for drop manholes, grout, inverts, and coal tar epoxy liner, will not be measured for separate payment. The cost thereof shall be absorbed in the unit prices bid for other items.

The perforated pipe stubbed out of all drainage structures, including geotextile fabric, will not be measured for separate payment. The cost thereof shall be absorbed in the unit price bid for other items.

SDR-26 sewer pipe and fittings, measured as prescribed above, shall be paid in accordance with section 907-610-1, "Sanitary Sewer Lines and Appurtenances."

Sanitary sewer manholes, measured as prescribed above, will be measured by the number of units as specified for depth intervals of zero to six foot (0-6'), six to eight foot (6-8'), eight to ten foot (8-10'), and progressing on two-foot intervals. The invert of the lowest inlet pipe to the finished grade at the top of the casting will determine the overall depth of the manhole. This measurement must exceed the higher end of the depth interval by seven inches (7") in order for the manhole to be counted in the next incremental depth category.

100% Solids Polymer Liner System shall be measured by square feet for which the system is applied. The cost shall include any corrections or additions.

Fittings will not be measured for separate payment, unless stated otherwise herein. Their cost shall be absorbed in the unit price bid for other items.

907-604.05--Basis of Payment. After the second paragraph of Subsection 604.05 on page 370, add the following.

Sanitary sewer manholes will be paid for at the contract unit price per each, complete in place. These prices shall be full compensation for completing the work specified.

100% Solids Polymer Liner System will be paid for at the contract unit price of square feet complete in place. These prices shall be full compensation for completing the work specified.

Ductile iron fittings will be paid for at the contract unit price per pound, which shall be full compensation for completing the work. Standard or full size ductile iron fitting weights (in accordance with AWWA C110) were used to calculate the quantity listed in the bid proposal.

SDR-26 sewer pipe and fittings shall be paid in accordance with 907-610, Sanitary Sewer Lines and Appurtenances.

Add the following to the list of pay items on page 370.

907-604-A:	Castings	- per pound
907-604-B:	Gratings	- per pound
907-604-C:	___' Dia. Precast Concrete Manhole (Depth)	-per each
907-604-D:	Ductile Iron Fittings	- per pound
907-604-E:	100% Solids Polymer Liner	-per square foot

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-607-3 **CODE: (SP)**

DATE: 08/03/2005

SUBJECT: Ornamental Iron Fence

PROJECT: BWO-6211-18(003) / 502889301 &
LWO-6017-18(006) / 502889302 – Forrest County

Section 907-607, Fences and Cattle Guards, of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction as modified by this special provision, is applicable to Ornamental Iron Fence Only.

907-607.01--Description. This work shall consist of providing and installing ornamental iron fencing in place, in accordance with these Specifications and in reasonable close conformity with the location, lines, grades, configurations, dimension and other requirements shown on the plans or established.

907-607.02--Materials.

907-607.02.1--General. Unless otherwise stipulated, the materials used in this construction, in addition to the general requirements of these Specifications and the plans shall conform to the provisions and requirements prescribed in the sections of the Standard Specifications for the several items which constitute the complete structure.

All items will require approval by the Engineer from the manufacturer. The Contractor shall submit eight (8) copies of manufacturer's product data or shop drawings for approval prior to ordering manufactured items. Other items may require testing as directed by the Engineer.

907-607.02.2--Ornamental Iron Fence. The iron fence shall be the Majestic Style, 3-Rail Panel, Aegis II fence, black in color, as manufactured by Ameristar, Merchants Metals, Payne Fence Products, or approved equal. The fence shall be furnished complete, with support posts averaging 10 feet on center, post caps, and hardware, all in the same color, as manufactured by the fence panel manufacturer.

Gate shall be manufactured from the same materials as the fence, and shall be equipped with "non-lift" hinges and gate latch, in the same color and material as the fence. Gate latch shall be capable of being locked with a padlock. Locking gate with a chain is unacceptable.

Concrete for support post footings, unless otherwise specified shall be Class "B" conforming to Section 804 of the Standard Specifications.

907-607.03--Construction Requirements.

907-607.03.1--General. The method of construction, unless otherwise stipulated, shall conform to the provisions and requirements where applicable, prescribed in the standard specifications with the additions shown hereafter. All work shall be performed in a good workmanlike manner, to the satisfaction of the Engineer.

907-607.03.2--Ornamental Iron Fence and Gates. The ornamental iron fence and gates, including concrete footings for posts, shall be constructed plumb, to the lines as shown on the drawings, following the existing grade, in strict accordance with the manufacturer's written instructions, and as directed by the Engineer.

907-607.04--Method of Measurement. Ornamental Iron Fence, constructed and complete in accordance with the requirements of the contract, and accepted will be measured per linear foot.

Ornamental Iron Gate, constructed and complete in accordance with the requirements of the contract, and accepted will be measured per each.

Separate measurement for excavation and other individual items will not be made, it being understood that the cost thereof is included in one contract price per complete items.

907-607.05--Basis of Payment. Ornamental Iron Fence and Gates, measured as prescribed above, shall be paid for at the contract unit price per linear foot or each, which price shall be full compensation for furnishing all materials and supplies, for performing all work necessary, and for all equipment, tools, labor, and incidentals necessary to complete the work.

Payment will be made under:

907-607-AA: Ornamental Iron Fence - per linear foot

907-607-BB: Ornamental Iron Gate, Size - per each

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-618-13 **CODE: (SP)**

DATE: 06/03/2014

SUBJECT: Temporary Construction Signs

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--Construction Requirements.

907-618.03.2--Barricades, Signs, and Flaggers. Delete the second paragraph of Subsection 618.03.2 on page 414, and substitute the following.

Flaggers shall be stationed at such points as may be deemed necessary.

Temporary construction signs shall be removed as their use becomes inapplicable. However, placing temporary signs and their supports flat on the ground outside the shoulder break line will be allowed.

907-618.05--Basis of Payment. Delete the first two pay items listed on page 418, and substitute the following.

907-618-A: Maintenance of Traffic - lump sum

907-618-B: Additional Construction Signs - per square foot

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, Color - per linear foot

907-626-H: Thermoplastic* Legend, White - per linear foot or square foot

* Indicate Double Drop if applicable

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SUPPLEMENT TO SPECIAL PROVISION NO. 907-701-5

DATE: 09/17/2014

SUBJECT: Hydraulic Cement

In the last paragraph of Subsection 907-701.04.1.1 on page 3, change “AASHTO Designation: M 240, Table 3” to “AASHTO Designation: M 240, Table 4”.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-701-5 **CODE: (SP)**

DATE: 08/20/2014

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 l65°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. 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_4) in soil, % by mass	Sulfate (SO_4)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 III cement conforming to AASHTO Designation: M85 with a maximum 8% tricalcium aluminate (C_3A) 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.

**** 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. 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 IS – Portland blast-furnace slag cement
Type IP – Portland-pozzolan cement
Type IL – Portland-limestone cement

Blended cement Types IS and IP 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 3 and the "(MS)" suffix shall be added to the type designation.

907-701.04.1.2--Alkali Content. All blended cement shall be made with clinker that would result in cement meeting the requirements of Subsection 907-701.02.1.2 when used in the production of AASHTO Designation: M 85, Type I or Type II cement.

907-701.04.2--Replacement by Other Cementitious Materials. The maximum replacement of blended cement Type IL by weight is 35% for fly ash or 50% for GGBFS. Replacement contents below 20% fly ash or 45% 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 blended cement by fly ash or GGBFS. 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 Types IS and IP.

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 3.

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

SUPPLEMENT TO SPECIAL PROVISION NO. 907-703-12

DATE: 01/29/2015

SUBJECT: Aggregates

In the title of Subsection 907-703.06 on page 2, delete “Hot Mix”.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-703-12 **CODE: (IS)**

DATE: 10/28/2014

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 table in Subsection 703.03.2.4 on page 611 and substitute the following.

Table of Sizes and Gradation of Coarse Aggregate for Portland Cement Concrete

Square Mesh Sieves	Percent Passing by Weight						
	Size No. 467	Size No. 57	Size No. 67	Size No. 7	Size No. 78	Size No. 8	Size No. 89
2 inch	100						
l½ inch	95-100	100					
1 inch		80-100	100				
3/4 inch	35-70		80-100	100	100	100	
1/2 inch		25-60		90-100	90-100	95 100	100
3/8 inch	10-30		20-55	40-70	40-75	75-100	85 100
No. 4	0-5	0-10	0-10	0-15	5-25	5-30	20-40
No. 8		0-5	0-5	0-5	0-10	0-10	0-10
No. 16					0-5	0-5	0-5

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".

Delete Subsection 703.19 on page 624, and substitute the following.

907-703.19--Lightweight Aggregate for Concrete.

907-703.19.1--Lightweight Aggregate for Structural Concrete. Lightweight aggregate for structural concrete shall meet the requirements of AASHTO Designation: M 195.

907-703.19.2--Lightweight Aggregate for Internal Curing of Concrete. Lightweight aggregate for internal curing of concrete shall meet the requirements of ASTM Designation: C 1761. The lightweight aggregate shall meet the gradation requirements listed in Table 1 for either "9.5 mm to 2.36 mm (3/8 in. to No. 8)" Coarse aggregate, "9.5 mm to 0 (3/8 in. to 0)" Combined fine and coarse aggregate, or "4.75 mm to 0 (No. 4 to 0)" Fine aggregate. The fineness modulus of the lightweight aggregate shall not be less than 2.70.

907-703.20--Aggregate for Stabilizer.

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				100		
2 1/2 inch	90-100			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. 907-711-4 **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. 907-713-6 **CODE: (SP)**

DATE: 03/17/2016

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.

907-713.02.4--Waterproofing Admixture. This product is used as a waterproofing admixture for cast in place concrete bridge decks and bridge deck topping.

The Contractor shall submit manufacturer's product data and installation methods for each type of the products required to demonstrate the product complies with specifications.

The materials shall be installed in accordance with manufacturer's instructions.

The waterproofing admixture shall be one of the following, or an approved equal.

- Xypex Admix
- Everdure Caltite
- Hycrete W1000

The dosage rate for the above admixtures shall be as follows:

- Xypex Admix shall be 15 pounds per cubic yard.
- Everdure Caltite shall be a minimum of 1.5% by weight of cement.
- Hycrete W1000 shall be a minimum one (1) gallon per cubic yard.

Any retardation of set that occurs will depend upon the concrete mix design and the dosage rate of the admixture.

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 alkalies 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 ±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 place 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. 907-720-2 **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. 907-804-19

DATE: 03/22/2016

SUBJECT: Concrete Bridges and Structures

Delete the second and third paragraphs of Subsection 907.804.03.16.2 on page 37, and substitute the following.

For bridge decks when the ambient temperature is above 90°F, the forms, reinforcing steel, steel beam flanges, and other surfaces which will come in contact with the concrete shall be cooled to below 90°F by means of a water spray or other approved methods. Additionally, when the atmospheric temperature is predicted to be 90°F or above based on the latest information available from the National Weather Service any time during the day of placement or day after placement, the time of placement shall not begin until 5:00 p.m. on the day of placement and shall be completed by 6:00 a.m. the following day.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-804-19 **CODE: (SP)**

DATE: 11/10/2015

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 deleted and replaced as follows.

SECTION 907-804--CONCRETE BRIDGES AND STRUCTURES

907-804.01--Description. This work consists of constructing concrete bridges and structures in accordance with these specifications and in reasonably close conformity with the dimensions, designs, lines, and grades indicated on the plans or established.

Construction of box bridges shall be in accordance with Sections 601 and 602.

907-804.02--Materials.

907-804.02.1--General. Concrete produced and controlled from this specification shall be accepted upon proper certification of concrete production through an approved quality control program and verification by job site acceptance criteria. The Contractor shall develop and implement a quality control program which shall be used to maintain the required properties of concrete. 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. For projects less than or equal to 200 cubic yards, refer to the requirements of TMD-20-05-00-000 "Sampling and Testing of Small Quantities of Miscellaneous Materials" for mixture design and testing requirements.

The materials for concrete bridges and structures, when sampled and tested in accordance with Subsection 700.03, shall meet the requirements of the following Subsections:

Portland Cement	701.01 and 701.02
Blended Cement	907-701.01 and 907-701.04
Admixtures	713.02
Fly Ash	714.05
Ground Granulated Blast Furnace Slag (GGBFS)	907-714.06
Silica Fume	907-714.07.2
Water	714.01.1 and 714.01.2
Fine Aggregate	703.02
Coarse Aggregate	703.03
Lightweight Aggregate	907-703.19
Curing Materials	713.01

Joint Materials	707.01, 707.02, and 707.07
Structural Steel Joints and Bearing Devices	717.01
Bearing Pads	714.10
Wire Rope or Wire Cable for Prestressed Concrete	700.01 and 711.03
Sprayed Finish for Concrete Surface	714.12
Reinforcing Steel	711.02

907-804.02.2--Use, Care, and Handling. The use, care, and handling of materials shall conform to the applicable requirements of Subsection 501.03.10 and the specific requirements of Subsections 907-804.02.4 and 907-804.02.5. Unless otherwise authorized, only fine aggregate or coarse aggregate of one type and from the same source shall be used in the construction of any one unit of a structure. Should the Contractor, with written permission of the Engineer, elect to substitute high early strength cement for cement of the type specified, the Contractor will not receive additional compensation for the substitution.

907-804.02.3--Blank.

907-804.02.4--Care and Storage of Concrete Aggregates. The handling and storage of aggregates shall be such as to prevent segregation or contamination with foreign materials. The Engineer may require that aggregates be stored on separate platforms at satisfactory locations.

When specified, coarse aggregates shall be separated into two or more sizes in order to secure greater uniformity of the concrete mixture. Different sizes of aggregate shall be stored in separate stock piles sufficiently removed from each other to prevent the material at the edges of the piles from becoming intermixed.

907-804.02.5--Storage of Cementitious Materials. All cementitious materials shall be stored in suitable weather-proof buildings or bins. These buildings or bins shall be placed in locations approved by the Engineer. Provision for storage shall be ample, and the shipments of cementitious materials as received shall be stored separately or other provisions made to the satisfaction of the Engineer for easy access for the identification, inspection, and sampling of each shipment as deemed desirable. Stored cementitious materials shall meet the test requirements at any time after storage when a retest is ordered by the Engineer.

On small jobs, open storage consisting of a raised platform and ample waterproof covering may be permitted by written authorization from the Engineer.

When specified, the Contractor shall keep accurate records of deliveries of cementitious materials and of their use in the work. Copies of these records shall be supplied in the form required by the Engineer.

907-804.02.6--Classification and Uses of Concrete. When a specific class of concrete is not specified on the plans or in the contract documents, the structure or parts thereof shall be constructed with the class of concrete as directed by the Engineer.

The classes and their uses are as follows:

(1) Class AA - Concrete for bridge construction and concrete exposed to seawater.
(2) Class A - Concrete shown as Class A shall herein be classified as and required to meet the performance criteria of Class AA.
(3) Class B - General use, heavily reinforced sections, cast-in-place concrete piles, and conventional concrete piles.
(4) Class C - Massive sections or lightly reinforced sections.
(5) Class D - Massive unreinforced sections and riprap.
(6) Class F - Concrete for prestressed members.
(7) Class FX - Extra strength concrete for prestressed members, as shown on plans.
(8) Class S - For all seal concrete deposited under water.
(9) Class DS - Drilled Shaft

907-804.02.7--Blank.

907-804.02.8--Laboratory Accreditation. The Contractor shall be responsible for furnishing the laboratory used to perform concrete quality control tests. The laboratory may be the Contractor's facility, the concrete producer's facility, or a certified independent testing laboratory.

Only laboratories certified by the Mississippi Department of Transportation are qualified to perform material testing. Certification by AASHTO Accreditation Program (AAP) will be acceptable if the laboratory is listed in the latest AAP publication and maintains accreditation to completion of concrete work.

The Contractor's laboratory designated for quality control testing shall have equipment necessary to test aggregates and concrete for the test methods listed in Table 1.

Table 1

AASHTO: R 39	Making and Curing Concrete Test Specimens in the Laboratory
AASHTO: R 60	Sampling Freshly Mixed Concrete
AASHTO: T 2	Sampling Aggregates
AASHTO: T 19	Bulk Density ("Unit Weight") and Voids in Aggregates
AASHTO: T 22	Compressive Strength of Cylindrical Concrete Specimens
AASHTO: T 23	Making and Curing Concrete Test Specimens in the Field
AASHTO: T 27	Sieve Analysis of Fine and Coarse Aggregates
AASHTO: T 84	Specific Gravity and Absorption of Fine Aggregate
AASHTO: T 85	Specific Gravity and Absorption of Coarse Aggregate
AASHTO: T 119	Slump of Hydraulic Cement Concrete
AASHTO: T 121	Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
AASHTO: T 152	Air Content of Freshly Mixed Concrete by Pressure Method *
AASHTO: T 196	Air Content of Freshly Mixed Concrete by the Volumetric Method *
AASHTO: T 231	Capping Cylindrical Concrete Specimens
AASHTO: T 248	Reducing Field Samples of Aggregate to Testing Size
AASHTO: T 255	Total Evaporable Moisture Content of Aggregate by Drying

AASHTO: T 325	Standard Method of Test for Estimating the Strength of Concrete in Transportation Construction by Maturity Tests **
ASTM: C 1064	Standard Test Method for Temperature of Freshly Mixed Hydraulic Cement Concrete
ASTM: C 1074	Standard Practice for Estimating Concrete Strength by the Maturity Method **

* Equipment necessary for either pressure or volumetric air content.
** Equipment necessary for estimating concrete strength following the maturity method.

Testing equipment shall have been inspected by the Department or through the AASHTO Accreditation Program. Testing equipment calibration files shall be made available upon request by the Department.

907-804.02.9--Testing Personnel. Technicians testing portland cement concrete, for either acceptance or production control purposes, shall be certified by an accepted certification program. Recertification is required for each Class after five years. Certification requirements are listed in Table 2.

Table 2

Concrete Technician's Tasks	Test Method Required	Certification Required**
Sampling or Testing of Plastic Concrete	AASHTO Designation: R 60, T 23, T 119, T 121, 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 a 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 certification
Interpretation and Application of Maturity Meter Readings	AASHTO Designation: T 325 and ASTM Designation: C 1074	MDOT Class III certification or Two hours maturity method training

* Technicians making concrete test specimens for meeting the requirements of Subsection 907-804.02.10.1.2 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.

Specific requirements for each level of certification are in the latest edition of the Department's *Concrete Field Manual*. Current MDOT Class I, MDOT Class II, and/or MDOT Class III certifications shall be acceptable until those certifications expire. Upon expiration of a current certification, recertification with the certifications listed in Table 2 shall be required. Technicians 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 Mixture Design. At least 10 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*. Materials shall be from approved sources meeting the requirements of the Standard Specifications. Proportions for the mixture designs shall be for the class concrete required by the contract plans and shall meet the requirements of the "Master Proportion Table for Structural Concrete Design" listed in Table 3. The concrete producer shall assign a permanent unique mixture number to each mixture design. Each mixture design shall be field verified as required in Subsection 907-804.02.10.3. Acceptable field verification data shall be required for final approval of a mixture design.

All concrete mixture designs will be reviewed by the Materials Division prior to use. Concrete mixture designs disapproved will be returned to the Contractor with a statement explaining the disapproval.

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.

Table 3
MASTER PROPORTION TABLE FOR STRUCTURAL CONCRETE DESIGN

Class	Coarse Aggregate Size No.*	Maximum Water/ Cementitious** Ratio	Specified Compressive Strength (f'_c) psi	Maximum Permitted Slump*** inches	Nominal Total Air Content**** %
AA*****	57 or 67	0.45**	4000	3***	4.5****
B	57 or 67	0.50	3500	4	4.5
C	57 or 67	0.55	3000	4	4.5
D	57 or 67	0.70	2000	4	4.5
F	67	0.40	5000	3	******
FX	67	(As per mixture design)	(As shown on plans)	3	******
S	57 or 67	0.45	3000	8	4.5
DS	67	0.45	4000	***	******

* Maximum size aggregate shall conform to the concrete mixture design for the specified aggregate. Other smaller coarse aggregate sizes meeting the requirements of Subsection 907-703.03.2.4 may also be used in conjunction with the coarse aggregate sizes listed. Lightweight aggregate (LWA) meeting the requirements of Subsection 907-703.19.2 may also be used as a partial replacement for fine aggregate.

** The replacement limits of portland cement by weight by other cementitious materials (such as fly ash, GGBFS, 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.

For Class AA concrete for concrete bridge decks, the water / cementitious ratio range shall be 0.43 – 0.45 and the maximum cementitious material content shall be 550 pounds per cubic yard. The "maximum cementitious material content" refers to the total weight of Portland cement, blended hydraulic cement, GGBFS, silica fume, and fly ash.

*** Unless otherwise specified, minus slump requirements shall meet those set forth in Table 3 of AASHTO Designation: M157.

For Class AA concrete for concrete bridge decks the maximum permitted slump may be increased to five (5) inches. Also, for each additional pound of fibers per cubic yard added in excess of the requirement in Note *****, an additional inch of slump will be allowed up to a maximum permitted slump of eight (8) inches.

For Class AA not used in bridge decks and all other Classes of concrete, the maximum permitted slump may be increased to eight (8) inches.

For Class DS concrete for drilled shafts the slump range shall be 8 inches ±1 inch.

**** The tolerance on total air content shall be ±1.5%. For Class AA concrete for concrete bridge decks, the nominal total air content may be increased to 6.5%.

***** For Class AA concrete for concrete bridge decks, an approved synthetic structural fiber meeting the requirements of Special Provision 907-711, Synthetic Structural Fiber Reinforcement, shall be incorporated into the mixture at 1.25 times the approved dosage rate.

****** Entrained air is not required except for concrete exposed to seawater. For concrete not exposed to seawater, the total air content shall not exceed 6.0%. For concrete exposed to seawater, the nominal total air content shall be 4.5%.

At least one water-reducing admixture or water-reducing/set-retarding admixture shall be used in all classes of concrete in accordance with the manufacturer's recommended dosage range. 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. Mixture designs containing accelerating admixtures will not be approved. Any combinations of admixtures shall be approved by the Engineer before their use.

907-804.02.10.1--Proportioning of Portland Cement Concrete Mixture Design. Proportioning of portland cement concrete shall be based on an existing mixture of which the producer has field experience and documentation or based on a recently batched laboratory mixture tested according to the required specifications.

907-804.02.10.1.1--Proportioning on the Basis of Previous Field Experience of Trial Mixtures. 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. The record of tests from which the standard deviation is calculated shall:

a) Represent similar materials and conditions to those expected. Changes in materials and proportions within the test record shall not have been more closely restricted than those for the proposed work.

b) Represent concrete produced to meet a specified strength.

c) Consist of 10 consecutive tests, average of two cylinders per test, tested at 28 days.

The standard deviation, s , shall be calculated as:

$$s = \left[\sum \left(X_i - \overline{X}\right)^2 \div \left(N - 1\right)\right]^{1/2}$$

where:

X_i = the strength result of an individual test
$\overline{X}$ = the average of individual tests in the series
N = number of tests in the series

When the concrete production facility does not have a record of tests for calculation of standard deviation, as required in the above formula, the requirements of Subsection 907-804.02.10.1.2 shall govern.

The required average compressive strength (f'_{cr}) used as the basis for selection of concrete proportions shall conform to the inequality listed below, while using a standard deviation, s, calculated as shown above.

$$\overline{X} \geq f'_{cr}$$

where:

$$f'_{cr} = f'_c + 1.43s$$

where:

f'_c = specified compressive strength of concrete, psi
f'_{cr} = required average compressive strength of concrete, psi
s = standard deviation, psi

1.43 represents the Lower Quality Index necessary to assure that 93% of compressive strength tests are above f'_c.

907-804.02.10.1.2--Proportioning on the Basis of Laboratory Trial Mixtures. When an acceptable record of field test results is not available, concrete proportions shall be established based on laboratory trial mixtures meeting the following restrictions:

a) The combination of materials shall be those intended for use in the proposed work.

b) Trial mixtures having proportions and consistencies suitable for the proposed work shall be made using the ACI 211.1 as a guide to proportion the mixture design.

c) Trial mixtures shall be designed to produce a slump within ±3/4 inch of the maximum permitted, and for air-entrained concrete, ±0.5 percent of the maximum total air content. The temperature of freshly mixed concrete in trial mixtures shall be reported.

d) For each proposed mixture, at least three compressive test cylinders shall be made and cured in accordance with AASHTO Designation: R 39. Each change of water-cement 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.

e) The required average strength of laboratory trial mixes shall exceed f'_c by 1200 psi for concrete mixture designs less than 5000 psi and by 1400 psi for concrete mixture designs of 5000 psi or more.

f) The laboratory trial batch mixtures shall have been made within the previous 12 months before being submitted for approval and shall not have been previously used on Department projects.

907-804.02.10.2--Documentation of Average Strength. Documentation that the proposed concrete proportions will produce an average strength equal to or greater than the required average shall consist of the strength test records from field tests or results from laboratory trial mixtures.

907-804.02.10.3--Field Verification of Concrete Mixture Design. Concrete mixture designs will only be tentatively approved pending field verification. The requirements for yield, slump, or total air content shall be successfully met within the first three (3) production days. Mixture designs may be transferred to other projects without additional field verification testing, once the mixture design has passed the field verification process.

The Contractor's Certified Quality Control Technicians shall test each concrete mixture design upon the first placement of the mix. Aggregates and concrete tests during the first placement shall be as follows.

Aggregates	Concrete
Bulk Specific Gravity	Water Content
Moisture	Slump
Gradation	Air Content
	Unit Weight
	Yield

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.

The mixture shall be adjusted and retested, if necessary, on subsequent placements until the above mentioned properties are met.

If the requirements for yield, slump, or total air content are not met within the first three (3) production days, subsequent field verification testing shall not be permitted on Department projects, and the mixture design shall not be used until the requirements listed above are met. Any mixture design adjustments, changes in the mixture proportions, are to be made by a Class III Certified Technician representing the Contractor. After the mixture design has been verified and adjustments made, verification test results will be reviewed by the Engineer.

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 Materials Division 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 (4) 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.

907-804.02.10.4--Adjustments of Mixtures. The mixture design 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 907-804.02.10.3 and approval by the Engineer.

907-804.02.11--Concrete Batch Plants. 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. The Contractor shall provide and maintain a quality control program that will provide reasonable assurance that all materials and products submitted to the Department for acceptance will conform to the contract requirements, whether manufactured or processed by the Contractor or procured from suppliers, subcontractors, or vendors.

The Contractor's Quality Control program shall implement the minimum quality control requirements shown in Table 4, "CONTRACTOR'S MINIMUM REQUIREMENTS FOR QUALITY CONTROL". The quality control activities shown in the table are considered to be normal activities necessary to control the production and placing of a given product or material at an acceptable quality level. To facilitate the Department's activities, all completed gradation samples shall be retained for a maximum of sixty (60) days by the Contractor until further disposition is designated by the Department.

The Contractor shall perform, or have performed, the tests required to substantiate product conformance to contract document requirements and shall also perform, or have performed, all tests otherwise required.

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 shall be allowed to be added. Water shall not be added at a later time. Job site adjustment of a batch using chemical admixtures or the mechanical adjustment of a batch may be performed by the Contractor if the requirements of Subsection 907-804.02.12.1.1 have been satisfactorily addressed in the Quality Control Plan. If either the maximum permitted slump is exceeded or the total air content is not within the required range after all adjustments are made at the job site, the concrete shall be rejected.

The Contractor's quality control tests shall be documented and shall be available for review by the Engineer throughout the life of the contract.

As set out in these specifications, quality control sampling and testing performed by the Contractor will be used by the Department for determination of acceptability of the concrete.

The Contractor shall maintain standard equipment and qualified personnel as required to assure conformance to contract requirements.

907-804.02.12.1--Quality Control Plan. The Contractor shall prepare a Quality Control Plan which shall identify the personnel responsible for the Contractor's quality control including the company official who will act as liaison with Department personnel. The Quality Control Plan shall be submitted in writing to the Engineer for approval 30 days prior to the production of concrete.

The class(es) of concrete involved will be listed separately. If an existing mixture design(s) is to be used, the mixture design number(s) as previously approved shall be listed.

It is intended that sampling and testing be in accordance with standard methods and procedures, and that measuring and testing equipment be standard and properly calibrated. If alternative sampling methods and procedures, and inspection equipment are to be used, they shall be detailed in the Quality Control Plan.

907-804.02.12.1.1--Elements of Plan. The Plan shall address all elements that affect the quality of the structural concrete including, but not limited to, the following items:

1) Stockpile Management
2) Procedures for Corrective Actions for Non Compliance of Specifications
3) Procedure for Controlling Concrete Temperatures
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 this section of the Plan shall be utilized.

   If either the maximum permitted slump is exceeded or the total air content is not within the required range after all adjustments are made 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 regardless of the number of mixtures associated with the project.

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.

6) Mechanical Adjustment of Trucks

907-804.02.12.2--Personnel Requirements. The Contractor's Designated Certified Technician shall perform and use quality control tests and other quality control practices to assure that delivered materials and proportioning meet the requirements of the mixture design including temperature, slump, air content, and strength and shall periodically inspect all equipment used in transporting, proportioning, and mixing.

The Contractor's Designated Technician shall periodically inspect all equipment used placing, consolidating, finishing, and curing to assure it is operating properly and that placement, consolidation, finishing, and curing conform to the mixture design and other contract requirements.

907-804.02.12.3--Documentation. The Contractor shall maintain adequate records of all inspections and tests. The records shall indicate the nature and number of observations made, the number and type of deficiencies found, date and time of samples taken, the quantities approved and rejected, and the nature of corrective action taken as appropriate. The Contractor's

documentation procedures will be subject to approval of the Department prior to the start of the work and to compliance checks during the progress of the work.

All conforming and non-conforming results shall be kept complete and shall be available at all times to the Department during the performance of the work. Forms shall be on a computer-acceptable medium. 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. All material added to a batch by both the batch plant or added manually shall be documented on the ticket. Batch tickets shall also contain the concrete producer's permanent unique mixture number assigned to the concrete mixture design. Copies shall be submitted to the Department as the work progresses.

Test data for portland cement concrete, including gradation, shall be charted in accordance with the applicable requirements.

The Contractor may use additional control charts as deemed appropriate. It is normally expected that testing and charting will be completed within 24 hours after sampling.

All records documenting the Contractor's quality control tests shall become the property of the Department upon completion of the work.

907-804.02.12.4--Corrective Action. The Contractor shall take prompt action to correct conditions that have resulted, or could result, in the submission to the Department of materials and products that do not conform to the requirements of the contract documents. All corrective actions shall be documented.

907-804.02.12.5--Non-Conforming Materials. The Contractor shall establish and maintain an effective and positive system for controlling non-conforming material, including procedures for its identification, isolation and disposition. Reclaiming or reworking of non-conforming materials shall be in accordance with procedures acceptable to the Department.

All non-conforming materials and products shall be positively identified to prevent use, shipment, and intermingling with conforming materials and products. Holding areas, mutually agreeable to the Department and the Contractor, shall be provided by the Contractor.

TABLE 4
CONTRACTOR'S MINIMUM REQUIREMENTS FOR QUALITY CONTROL

Portland Cement Concrete		
Control Requirement	**Frequency**	**AASHTO/ASTM Designation**
A. PLANT AND TRUCKS		
1. Mixer Blades	Monthly	
2. Scales		
a. Tared	Daily	
b. Calibrate	Every 6 months	
c. Check Calibration	Weekly	
3. Gauges & Meters - Plant & Truck		
a. Calibrate	Every 6 months	
b. Check Calibration	Weekly	
4. Admixture Dispenser		
a. Calibrate	Every 6 months	
b. Check Operation & Calibration	Daily	
B. AGGREGATES		
1. Sampling		T 2
2. Fine Aggregate		
a. Gradation / FM	250 yd^3 concrete	T 27
b. Moisture	Check meter against test results weekly	T 255
c. Specific Gravity / Absorption	2500 yd^3 concrete	T 84
3. Coarse Aggregates		
a. Gradation	250 yd^3 concrete	T 27
b. Moisture	Minimum of once daily or more as needed to control production. Check meter against test results weekly.	T 255
c. Specific Gravity / Absorption	2500 yd^3 Concrete	T 85
C. PLASTIC CONCRETE		
1. Sampling		T 141
2. Air Content	First load then one per 50 yd^3	T 152 or T 196
3. Slump	First load then one per 50 yd^3	T 119
4. Compressive Strength	A minimum of one set (three cylinders) for each 100 yd^3 inclusive and one set for each additional 100 yd^3 or fraction thereof for each class concrete delivered and placed on a calendar day from a single supplier. A test shall be the average of three cylinders.	T 22, T 23, T 231
5. Yield	Each 400 yd^3	T 121
6. Temperature	With each sample	C 1064

907-804.02.13--Quality Assurance Sampling and Testing. Quality Assurance (QA) inspection and testing will be provided by the Department to assure that the Contractor's Quality Control (QC) testing meets the requirements of these specifications.

Acceptance of the material is based on the inspection of the construction, monitoring of the Contractor's QC program, QC and QA test results per Subsection 907-804.02.13.1, and the comparison of the QA test results with the QC test results. The Department may use the results of the Contractor's QC tests as a part of the acceptance procedures instead of the results of QA tests, provided:

a) The Department's inspection and monitoring activities indicate that the Contractor is following the approved QC program and, respectively,
b) For aggregates, the results from the Contractor's QC and the Department's QA testing of aggregate gradations compare by both meeting the aggregate type's gradation requirements;
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.

The minimum frequency for QA testing of aggregate and plastic concrete by the Department will follow the frequencies listed in Table 5, **"**DEPARTMENT'S MINIMUM REQUIREMENTS FOR QUALITY ASSURANCE".

TABLE 5
DEPARTMENT'S MINIMUM REQUIREMENTS FOR QUALITY ASSURANCE

Quality Assurance Tests	Frequency	AASHTO/ASTM Designation
A. AGGREGATES		
1. Sampling		T 2
2. Fine Aggregate Gradation and FM	250 yd^3 concrete	T 27
3. Coarse Aggregates Gradation	250 yd^3 concrete	T 27
B. PLASTIC CONCRETE		
1. Sampling		T 141
2. Air Content	Every 100 yd^3	T 152 or T 196
3. Slump	Every 100 yd^3	T 119
4. Compressive Strength	One set (three cylinders) for every 100 yd^3 inclusive. A test shall be the average of three cylinders.	T 22, T 23, T 231
5. Temperature	With each sample	C 1064

Periodic inspection by the Department of the Contractor's QC testing and production will continue through the duration of the project. Weekly reviews will be made of the Contractor's QC records and charts.

For aggregates, comparison of data of the Contractor's QC aggregate gradation test results to those of the Department's QA aggregate gradation test results will be made monthly during concrete

production periods according to Department Standard Operating Procedures. When it is determined that the Contractor's QC test results of aggregate gradations are comparative to that of the Department's QA test results, then the Department will use the Contractor's QC results as a basis for acceptance of the aggregates and the Department's QA testing frequency of aggregates may be reduced to a frequency of no less than three QA tests to every 10 QC tests. If the Contractor's QC aggregate gradation test results fail to compare to those of the Department's QA aggregate gradation test results, Department testing for aggregate gradations will revert to the frequency shown in Table 5 for aggregates until the Contractor's and Department's aggregate gradation test data compare.

For concrete compressive strength, comparison of data of the Contractor's QC compressive strength test results to those of the Department's QA compressive strength test results will be made monthly during concrete production periods according to Department's *Concrete Field Manual*. When it is determined that the Contractor's QC test results of concrete compressive strengths are comparative to that of the Department's QA test results, then the Department will use the Contractor's QC results as a basis for acceptance of the concrete and the Department's QA testing frequency of concrete compressive strengths may be reduced to a frequency of no less than three QA tests to every 10 QC tests. If the Contractor's QC compressive strength test results fail to compare to those of the Department's QA compressive strength test results, Department testing will revert to the frequency shown in Table 5 for plastic concrete until the Contractor's and Department's compressive strength test data compare.

907-804.02.13.1--Job Control Testing.

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 three percent (±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 (±3%). If batching of the proportions of the mixture design varies outside the batching tolerance range of the originally approved proportions by more than the tolerances allowed in Subsection 907-804.02.12, the new proportions shall be field verified per Subsection 907-804.02.10.3.

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

907-804.03.16.2. Concrete with a temperature more than the maximum allowable temperature shall be rejected and not used in Department work.

The maximum acceptance temperature for Class DS concrete mixtures is 95°F.

The maximum acceptance temperature of Class C concrete mixtures is 100°F for mixtures meeting the cement replacement requirements of Subsection 907-701.02.2. For Class C concrete mixtures that do not meet the cement replacement requirements of Subsection 907-701.02.2, the maximum acceptance temperature is 95°F.

The maximum acceptance temperature for all other concrete mixtures meeting the cement replacement requirements of Subsection 907-701.02.2 is 95°F. The maximum acceptance temperature for all other concrete mixtures which do not meet the cement replacement requirements of Subsection 907-701.02.2 is 90°F.

907-804.02.13.1.6--Compressive Strength. Standard 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)

$$\% \text{ Reduction} = \frac{(f'_c - X)}{f'_c - (f_c + s)} \times 100 \text{ x M}$$

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
M = pay reduction multiplier, per the *Concrete Field Manual*, paragraph 7.3

* 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)

$$\% \text{ Reduction} = \frac{(f'_c - X)}{f'_c} \times 100 \text{ x M}$$

where:

f'c = Specified 28-day compressive strength, psi
X = Individual compressive strength below f'c, psi
M = pay reduction multiplier, per the *Concrete Field Manual*, paragraph 7.3

907-804.02.14--Dispute Resolution. Disputes over variations between Contractor's QC test results and the Department's QA test results shall be resolved at the lowest possible level using the latest edition of the Department's *Concrete Field Manual*. When there are significant discrepancies between the QC test results and the QA test results, the Contractor's QC Manager, the Project Engineer, and/or the District Materials Engineer shall look for differences in the procedures, and correct the inappropriate procedure before requesting a third party resolution.

If the dispute cannot be resolved at the project or District level, the Department's Materials Division will serve as a third party to resolve the dispute. The Materials Division's decision shall be binding.

The Contractor shall be responsible for the cost associated with the third party resolution if the final decision is such that the Department's QA test results were correct. Likewise, the Department will be responsible for the cost when the final decision is such that the Contractor's QC test results were correct.

907-804.03--Construction Requirements.

907-804.03.1--Measurement of Materials.

907-804.03.1.1--General. The accuracy for measuring materials shall be in accordance with AASHTO Designation: M 157.

907-804.03.1.2--Measurement by Weighing. Except when otherwise specified or authorized, the materials shall be measured by weighing. The apparatus provided for weighing materials shall be

suitably designed and constructed for this purpose. Cementitious materials and aggregates shall be weighed separately. Cement in standard bags need not be weighed, but bulk cement and other cementitious materials shall be weighed. The mixing water shall be measured by volume or by weight. All measuring devices shall be subject to approval.

907-804.03.2--Blank.

907-804.03.3--Blank.

907-804.03.4--Hand Mixing. Hand mixing of concrete will not be allowed.

907-804.03.5--Delivery. The plant supplying concrete shall have sufficient capacity and transporting apparatus to ensure continuous delivery at the rate required. The rate of delivery shall be such as to provide for the proper continuity in handling, placing, and furnishing of the concrete. The rate shall be such that the interval between batches shall not exceed 20 minutes. The methods of delivering and handling the concrete shall be that which will facilitate placing with minimum re-handling and without damage to the structure or the concrete.

907-804.03.6--Handling and Placing Concrete.

907-804.03.6.1--General. Prior to placing concrete, all reinforcement shall have been accurately placed in the position shown on the plans and fastened as set out in Section 805. All sawdust, chips, and other construction debris and extraneous matter shall have been removed from the interior of the forms. Temporary struts, braces, and stays holding the forms in correct shape and alignment shall be removed when the concrete placing has reached an elevation rendering their service unnecessary. These temporary members shall be entirely removed from the forms and shall not be buried in the concrete.

No concrete shall be placed until the forms and reinforcement have been inspected.

Except as provided for truck mixers and truck agitators, concrete shall be placed in the forms within 30 minutes after the time that the cement is first added to the mixture.

Concrete shall be placed so as to avoid segregation of materials and displacement of reinforcement. The use of troughs, chutes, and pipes over 25 feet in length for gravity conveyance of concrete to the forms, will not be permitted except when authorized by the Engineer and subject to the production of quality concrete.

Only approved mechanical conveyors will be permitted.

Open troughs and chutes shall be metal or metal lined. The use of aluminum pipes, chutes, or other devices made of aluminum that come into direct contact with the concrete shall not be used. Where steep slopes are required, the chutes shall be equipped with baffles or be in short sections that change the direction of movement.

All chutes, troughs, and pipes shall be kept clean and free from coatings of hardened concrete by thoroughly flushing with water after each run. Water used for flushing shall be discharged clear of the structure.

When placing operations involve dropping the concrete more than five feet, it shall be deposited through sheet metal or other approved pipes to prevent segregation and unnecessary splashing. The pipes shall be made in sections to permit discharging and raising as the placement progresses. A non-jointed pipe may be used if sufficient openings of the proper size are provided to allow for the flow of the concrete into the shaft. As far as practicable, the pipes shall be kept full of concrete during placing, and their ends shall be kept buried in the newly placed concrete.

Except as herein provided, concrete shall be placed in horizontal layers not more than 12 inches thick. When, with the Engineer's approval, less than the complete length of a layer is placed in one operation, it shall be terminated in a vertical bulkhead. Each layer shall be placed and compacted before the preceding layer has taken its initial set and shall be compacted so as to avoid the formation of a construction joint with the preceding layer.

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.

907-804.03.6.2--Consolidation. Immediately after depositing the concrete mixture, the concrete mixture shall be thoroughly consolidated by the use of approved mechanical vibrators and suitable spading tools. Only concrete mixture which has not achieved initial set shall be consolidated. Hand spading alone will be permitted on small structural members such as railing, small culvert headwalls, and as necessary to ensure smooth surfaces and dense concrete along form surfaces, in corners, and in locations impossible to reach with vibrators. When hand spading is used for consolidation, a sufficient number of workmen with spading tools shall be provided. For hand spading, flush a thin layer of mortar to all the surfaces and thoroughly and satisfactorily consolidate the concrete.

The Contractor shall conduct operations of depositing and consolidating the concrete mixture such that the operation produces concrete which is uniformly smooth and dense, having no honeycombing or pockets of segregated aggregate.

Movement of personnel through the consolidated concrete shall not be permitted. If it is determined it is necessary to step into previously consolidated concrete, the concrete in the stepped into area shall be consolidated again.

907-804.03.6.2.1--Requirements for Vibrators. Mechanical vibrators shall be subject to the following:

1. To verify compliance with these requirements, the Contractor shall provide the Engineer with a copy of the manufacturer's specifications for each type and brand of vibrator used on the project.

2. The Contractor shall provide a sufficient number of personnel with vibrators to properly consolidate each batch immediately after the concrete is placed in the forms. The Contractor shall provide at least one stand-by vibrator and required power source.
3. Concrete having been consolidated shall not be walked in or through. If it is determined it is necessary to step into previously consolidated concrete, the concrete in the stepped into area shall be consolidated again.
4. Internal vibrators shall be of the spud or tube type, meeting the following characteristics and performance:
    a. The diameter of the head of the vibrator shall be 1¼ to 2½ inches.
    b. The frequency of vibration shall be 8000 to 12000 vibrations per minute (Hz) while operating in the concrete.
    c. The average amplitude shall be 0.025 to 0.05 inch while operating in air.
    d. The minimum radius of influence shall be seven (7) inches.
    e. The length of the vibrator head shall be nearly equal to the depth of the layer of concrete placed.
5. When the reinforcing steel is coated with epoxy, internal vibrators with heads of rubber or other resilient material shall be used. Rubber covers securely fastened over steel heads shall be acceptable.
6. For consolidation of concrete used in concrete bridge decks, the following additional requirements shall apply:
    a. Only internal vibration shall be used.
    b. Internal vibrators shall all be of the same type and size.
    c. The configuration of the internal vibrators shall meet the requirements of Subsection 907-804.03.6.2.3.

907-804.03.6.2.2--Operation of Internal Vibration. Mechanical vibrators used for internal vibration shall be operated as follows:

1. Vibrators shall not be dragged or moved laterally through the concrete to transport concrete. Vibrators shall not be used in such a manner that the concrete segregates or forms pockets of grout. Vibrators shall not be applied directly or through the reinforcement to sections or layers of concrete which have taken initial set.
2. Vibrators shall only be inserted into the concrete while operating and at the point of placement to consolidate the concrete for such a length of time that there is a general cessation in the escape of large entrapped air bubbles at the surface.
3. Vibrators shall be inserted slowly into the concrete and allowed to penetrate into the concrete under their own weight.
4. Vibrators shall be inserted into the concrete while they are in a vertical position with enough flexibility to work themselves around the reinforcing steel.
5. The head of the vibrator shall be completely submerged in the concrete for a time of consolidation between 3 and 15 seconds prior to removal, unless otherwise defined by the Engineer.
6. For consolidation of two or more layers of concrete, the vibrator shall be inserted into the bottom most layer at least six (6) inches. The vibrator shall be manipulated in a series of up-and-down motions to knit the layers together.

7. Vibrators shall be removed slowly from the concrete after the consolidation has been accomplished. However, once the head of the vibrator has become only partially immersed in the concrete, vibrators shall be removed rapidly.
8. The insertions of the vibrators shall be systematically spaced such that the entire surface of the concrete comes under the influence of the vibrator during consolidation. This includes areas around the reinforcing steel, imbedded fixtures, the corners and angles of forms, and any irregular areas. The distance between insertions shall not exceed 1.5 times the radius of influence such that the area visibly affected by the vibrator overlaps the adjacent, just-vibrated area.
9. For additional information, refer to ACI 309-07, Chapter 7, Sections 7.1 through 7.3

907-804.03.6.2.3--Method of Consolidation. It is anticipated the Contractor will accomplish consolidation by internal vibration using one of the following two methods: vibrators mounted on a mechanical device or an orchestrated effort utilizing personnel. Regardless of the chosen method, the method shall be included in the QCP in accordance with Subsection 907-804.02.12.1.1.5 and shall only receive tentative approval until the method is demonstrated as effectively meeting the requirements of Subsection 907-804.03.6.2.

907-804.03.6.3--Discontinuance of Placing. When placing is temporarily discontinued, the concrete, after becoming firm enough to retain its form, shall be cleaned of laitance and other objectionable material to a sufficient depth to expose sound concrete. To avoid visible joints insofar as possible upon exposed faces, the top surface of the concrete adjacent to the forms shall be smoothed with a trowel. Where a "feather edge" might be produced at a construction joint, such as in the sloped top surface of a wing wall, an inset form work shall be used in the preceding layer to produce a blocked out portion that will provide an edge thickness of at least six inches (6") in the succeeding layer. Work shall not be discontinued within 18 inches of the top of any face unless provision has been made for a coping less than 18 inches thick. In this case and if permitted by the Engineer, the construction joint may be made at the underside of the coping.

Immediately following the discontinuance of placing concrete, all accumulations of mortar splashed on the reinforcement and the surface of forms shall be removed. Dried mortar chips and dust shall not be puddled into the unset concrete. If the accumulations are not removed prior to the concrete becoming set, care shall be exercised not to break or injure the concrete-steel bond at and near the surface of the concrete while cleaning the reinforcement. After initial set the forms shall not be jarred, and no strain shall be placed on the ends of projecting reinforcement until the concrete has sufficiently set to ensure against any damage by such jarring or strain.

907-804.03.6.4--Placing Bridge Concrete. The method and sequence of placing concrete shall conform to the provisions and requirements set forth for the particular type of construction.

907-804.03.6.4.1--Foundations and Substructures. Concrete seals shall be placed in accordance with Subsection 907-804.03.9. All other concrete for foundations shall be poured in the dry unless otherwise stipulated or authorization is given in writing by the Engineer to do otherwise. Concrete shall not be placed in foundations until the foundation area has been inspected and approved.

Unless otherwise specified, the placement of concrete in the substructure shall be in accordance with the general requirements of Subsection 907-804.03.6.

Unless otherwise directed, concrete in columns shall be placed in one continuous operation, and shall be allowed to set at least 12 hours before the caps are placed.

907-804.03.6.4.2--Superstructure. For simple spans, concrete shall preferably be deposited by beginning at the center of the span and working toward the ends. For continuous spans, concrete shall be deposited as shown on the plans. Concrete in girders shall be uniformly deposited for the full length of the girder and brought up evenly in horizontal layers. Concrete in areas below the bridge deck but being deposited at the same time as concrete for the bridge deck, like a diaphragm, shall be placed and consolidated sufficiently ahead of placing the concrete for the bridge deck such that the placing, consolidating, finishing, and curing of concrete for the bridge deck shall not be impeded or slowed.

Unless otherwise permitted by the Engineer, concrete shall not be placed in the superstructure until the column forms have been stripped sufficiently to determine the character of the concrete in the columns. Unless otherwise permitted by the Engineer, the load of the superstructure shall not be placed on pile bents until the caps have been in place at least seven (7) days and shall not be placed on other types of bents until the bents have been in place at least 14 days.

In placing concrete around steel shapes, it shall be placed on one side of the shape until it flushes up over the bottom flange of the shape on the opposite side, after which it shall be placed on both sides to completion.

Concrete in girder haunches less than three feet (3') in height shall be placed at the same time as that in the girder stem. Whenever a haunch or fillet has a height of three feet (3') or more at the abutment or columns, the haunch and the girder shall be poured in three successive stages: first, up to the lower side of the haunch; second, to the lower side of the girder; and third, to completion.

Except when intermediate construction joints are specified, concrete in slab, T-beam, or deck-girder spans shall be placed in one continuous operation for each span.

The floors and girders of through-girder superstructures shall be placed in one continuous operation unless otherwise specified, in which case special shear anchorage shall be provided to ensure monolithic action between girder and floor.

Concrete in box girders shall be placed as shown on the plans.

Concrete shall not be chuted directly into the forms of the span and shall be placed continuously with sufficient speed to be monolithic and to allow for finishing before initial set.

907-804.03.6.4.3--Bridge Deck. When using the Transverse Method in accordance with Subsection 907-804.03.19.7.3, the period of time between concrete placement and completion of the final curing shall be kept to a minimum, as directed by the Engineer.

907-804.03.7--Pneumatic Placing. Pneumatic placing of concrete will be permitted only if specified in the contract or if authorized by the Engineer. The equipment shall be so arranged that no vibrations result which might damage freshly placed concrete.

Where concrete is conveyed and placed by pneumatic means the equipment shall be suitable in kind and adequate in capacity for the work. The machine shall be located as close as practicable to the place of deposit. The position of the discharge end of the line shall not be more than 10 feet from the point of deposit. The discharge lines shall be horizontal or inclined upwards from the machine. At the conclusion of placement the entire equipment shall be thoroughly cleaned.

907-804.03.8--Pumping Concrete. Placement of concrete by pumping will be permitted only if specified in the contract or if authorized in writing by the Engineer. If used, the equipment shall be arranged so that no vibrations result which might damage freshly placed concrete.

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. 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.

The use of aluminum pipe as a conveyance for the concrete will not be permitted.

907-804.03.9--Depositing Concrete Under Water. Concrete shall not be deposited in water except with the approval of the Engineer.

Concrete deposited under water shall be Class S.

Concrete deposited under water shall be carefully placed in a compact mass in its final position by means of a tremie, a bottom dump bucket, or other approved method and shall not be disturbed after being deposited. Special care shall be exercised to maintain still water at the point of deposit. No concrete shall be placed in running water and all form work designed to retain concrete under water shall be water-tight. The consistency of the concrete shall be carefully regulated, and special care shall be exercised to prevent segregation of materials.

Concrete seals shall be placed continuously from start to finish, and the surface of the concrete shall be kept as nearly horizontal as practicable at all times. To ensure thorough bonding, each succeeding layer of a seal shall be placed before the preceding layer has taken initial set.

When a tremie is used, it shall consist of a tube having a diameter of at least 10 inches and constructed in sections having flanged couplings fitted with gaskets. The means of supporting the tremie shall be such as to permit the free movement of the discharge over the entire top surface of the work and to permit it to be lowered rapidly when necessary to choke off or retard the flow of concrete. The discharge end shall be closed at the start of the work so as to prevent water entering the tube and shall be entirely sealed. The tremie tube shall be kept full to the bottom of the hopper. When a batch is dumped into the hopper, the flow of concrete shall be induced by slightly raising the discharge end, always keeping it in the deposited concrete. The flow is then stopped by lowering the tremie. The flow shall be continuous until the work is completed.

Depositing of concrete by the drop bottom bucket method shall conform to the following: The top of the bucket shall be open. The bottom doors shall open freely downward and outward when tripped. The bucket shall be completely filled and slowly lowered to avoid backwash. It shall not be dumped until it rests on the surface upon which the concrete is to be deposited and when discharged shall be withdrawn slowly until well above the concrete.

Dewatering may proceed when the concrete seal is sufficiently hard and strong. As a general rule, this time will be 48 hours for concrete made with high-early-strength cement and three days for concrete made with other types of cement. All laitance and other unsatisfactory material shall be removed from the exposed surface by scraping, chipping, or other means which will not injure the surface of the concrete.

907-804.03.10--Construction Joints.

907-804.03.10.1--General. Unless otherwise approved by the Engineer, construction joints shall be made only where located on the plans or shown in the pouring schedule. If not detailed on the plans, or in the case of emergency, construction joints shall be placed as directed by the Engineer. Shear keys or inclined reinforcement shall be used where necessary to transmit shear or to bond the two sections together.

For continuous spans, bridge deck concrete shall be deposited as shown on the plans. Deviation from the pouring schedule shown in the plans is not permitted.

907-804.03.10.2--Bonding. Before depositing new concrete on or against concrete which has hardened, the forms shall be retightened. The surface of the hardened concrete shall be roughened as required by the Engineer and in a manner that will not leave loosened particles of aggregate or damaged concrete at the surface. It shall be thoroughly cleaned of foreign matter and laitance and saturated with water. When directed by the Engineer, the cleaned and saturated surfaces, including vertical and inclined surfaces, shall first be thoroughly covered with a coating of mortar or neat cement grout against which the new concrete shall be placed before the grout has attained its initial set.

The placing of concrete shall be carried continuously from joint to joint. The face edges of all joints which are exposed to view shall be carefully finished, true to line and elevation.

In order to bond successive courses suitable depressed or raised keys of the designated size shall be constructed. Raised keys shall be monolithic with the concrete of the lower course.

907-804.03.11--Concrete Exposed to Seawater. Unless otherwise specifically provided, concrete for structures exposed to seawater shall be Class AA concrete as referenced in Subsection 907-804.02.10. The clear distance from the face of the concrete to the nearest face of reinforcing steel shall be at least four inches. The mixing time and the water content shall be carefully controlled and regulated so as to produce concrete of maximum impermeability. The concrete shall be thoroughly compacted, and stone pockets shall be avoided. No construction joints shall be formed between the levels of extreme low water and extreme high water as determined by the Engineer. Between these levels, seawater shall not come in direct contact with the new concrete until at least 30 days have elapsed. The surface concrete as left by the forms shall be left undisturbed.

907-804.03.12--Blank.

907-804.03.13--Falsework. The Contractor shall submit to the Engineer four copies of structural design analysis and detail drawings, which show the method of falsework or centering. These designs and detail plans shall be prepared and bear the seal of a Registered Professional Engineer with experience in falsework design.

Falsework plans shall include falsework elevations together with all other dimensions and details which is considered necessary for the construction. Other pertinent data needed is size and spacing of all falsework members and minimum bearing requirements for false piles.

Upon completion of falsework erection, the Registered Professional Engineer shall certify that the erected falsework is capable of supporting the load for construction.

Falsework piling shall be spaced and driven so that the bearing value of each pile is sufficient to support the load that will be imposed upon it. The bearing value of the piles should be calculated according to the appropriate formula given in Section 803.

For designing falsework and centering, a weight of 150 pounds per cubic foot shall be assumed for green concrete. All falsework shall be designed and constructed to provide the necessary rigidity and to support the loads without appreciable settlement or deformation. The Contractor may be required to employ screw jacks or hardwood wedges to take up slight settlement in the falsework either before or during the placing of concrete. An allowance shall be made for anticipated compressibility of falsework and for the placement of shims, wedges, or jacks to produce the permanent structural camber shown on the plans. If during construction, any weakness develops and the falsework shows any undue settlement or distortion, the work shall be stopped, the part of the structure affected removed, and the falsework strengthened before work is resumed. Falsework which cannot be founded on a satisfactory footing shall be supported on piling, which shall be spaced, driven, and removed, as referenced in Subsection 907-804.03.15, in a manner approved by the Engineer.

All structures built across a public street or highway on which maintenance of traffic is required, shall have falsework so arranged that a vertical clearance of at least 12' 6" is provided. Unless otherwise specified, a horizontal clearance of at least the width of the traveled way shall be provided at all times. If the vertical clearance is less than 13' 6" or the horizontal clearance is less than the full crown width of the roadway, the Contractor shall install and maintain appropriate safety devices, clearance signs and warning lights, and shall notify the Engineer sufficiently in advance of restricting the clearance for the Engineer to advise both the Traffic Engineering and the Maintenance Divisions. All traffic control and safety devices shall be in accordance with the Manual on Uniform Traffic Control Devices (MUTCD).

907-804.03.14--Forms.

907-804.03.14.1--General. Forms shall be wood, metal, or other material approved by the Engineer. All forms shall be built mortar-tight and sufficiently rigid to prevent distortion due to pressure of the concrete and other loads incident to the construction operations. Forms shall be constructed and maintained so as to prevent warping and the opening of joints due to shrinkage. The forms shall be substantial and unyielding and shall be so designed that the finished concrete

will conform to the proper dimensions and contours. The design of the forms shall take into account the effect of vibration of concrete as it is placed.

Minimum requirements for slab overhang forms shall be 3/4-inch plywood supported on 2-inch x 6-inch S4S wood timbers placed flatwise on 16-inch centers.

Adjustable brackets for support of slab overhang forms shall be spaced at a maximum distance of 3' 0" center to center unless specifically approved otherwise. Grade points for forms shall coincide with the location of the adjustable form brackets.

Forms for surfaces exposed to view shall be of uniform thickness with a smooth inside surface of an approved type. Joints in forms for exposed surfaces shall be closely fitted to eliminate fins, stone pockets, or other variations in the surface of the concrete which would mar a smooth and uniform texture.

Forms shall be filleted at all sharp corners and shall be given a bevel or draft in the case of all projections, such as girders and copings, to ensure easy removal.

Metal ties or anchorages within the forms shall be so constructed as to permit their removal, without injury to the concrete, to a depth of at least the reinforcing steel clearance shown on the plans. In case ordinary wire ties are permitted, all wires, upon removal of the forms, shall be cut back at least 1/4 inch from the face of the concrete with chisels or nippers. Nippers shall be used for green concrete. All fittings for metal ties shall be designed so that upon their removal the cavities which are left will be the smallest practicable size. The cavities shall be filled with cement mortar and the surface left sound, smooth, even, and uniform in color.

Forms shall be set and maintained to the lines designated until the concrete is sufficiently cured for form removal. Forms shall remain in place for periods which shall be determined as hereinafter specified. If forms are deemed to be unsatisfactory in any way, either before or during the placing of concrete, the Engineer will order the work stopped until the defects have been corrected.

The shape, strength, rigidity, water-tightness, and surface smoothness of reused forms shall be maintained at all times. Warped or bulged lumber shall be resized before being reused. Forms which are unsatisfactory in any respect shall not be reused.

Access to the lower portions of forms for narrow walls and columns shall be provided for cleaning out extraneous material immediately before placing the concrete.

All forms shall be treated with an approved oil or saturated with water immediately before placing the concrete. For rail members or other members with exposed faces, the forms shall be treated only with an approved oil to prevent the adherence of concrete. Any material which will adhere to or discolor the concrete shall not be used.

When metal forms are used they shall be kept free from rust, grease, or other foreign matter which will discolor the concrete. They shall be of sufficient thickness and so connected that they will remain true to shape and line, and shall conform in all respects as herein prescribed for mortar

tightness, filleted corners, beveled projections, etc. They shall be constructed so as to ensure easy removal without injury to concrete. All inside bolt and rivet heads shall be countersunk.

All chamfer strips shall be dressed, straight, and of uniform width and shall be maintained as such at all times.

907-804.03.14.2--Stay-In-Place Metal Forms. 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 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 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 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 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 Engineer along with the delivery of the coated forms to the job site.

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 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 of 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 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--Concrete. The Contractor shall ensure concrete placement does not damage the SIP metal forms. Approved pouring sequences shall be used. The completed SIP metal form system shall be sufficiently tight to prevent leakage of mortar or concrete. The concrete shall be consolidated to avoid honeycomb and voids, especially at construction joints, expansion joints, valleys, and ends of form sheets. Calcium chloride or any other admixture containing chloride salts shall not be used in the concrete.

907-804.03.14.2.8--Inspection. The 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 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 Engineer determines that there has been any change in the concrete mix or in the procedures warranting additional inspection.

If, in the 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 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 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 Engineer will examine the concrete surfaces for cavities, honeycombing, and other defects. If irregularities are found and the Engineer determines that these irregularities do not justify rejection of the work, the concrete shall be repaired as directed by the Engineer. If the 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 Engineer.

The Contractor shall provide a safe and convenient means of conducting of the inspection.

907-804.03.15--Removal of Falsework, Forms, and Housing. In the determination of the time for the removal of falsework, forms, and housing and the discontinuance of heating, consideration shall be given to the location and character of the structure, the weather and other conditions influencing the setting of the concrete, and the materials used in the mix. No forms or supports shall be removed prior to approval by the Engineer. During cold weather, removal of housing and the discontinuance of heating shall be in accordance with Subsection 907-804.03.16.1.

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. It is important that falsework be removed as evenly as possible to prevent excessive deflection stresses in the spans.

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. The facilities shall include an approved concrete testing machine of sufficient capacity and calibrated by an acceptable commercial laboratory. Tests shall be conducted in the presence of a Department representative

to witness and record strengths obtained on each break or performed by a Department certified technician in an approved testing laboratory.

[a1]The cylinders shall be cured under conditions which are not more favorable than those existing for the portions of the structure which they represent.

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

For bridges, non-SIP metal 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.

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

Structure Component	Quantity of Concrete	No. of Probes
Slabs, beams, walls, & miscellaneous items	0 - 30 yd^3	2
	> 30 to 60 yd^3	3
	> 60 to 90 yd^3	4
	> 90 yd^3	5
Footings, Columns & Caps	0 - 13 yd^3	2
	> 13 yd^3	3
Pavement, Pavement Overlays	1200 yd^2	2
Pavement Repairs	Per repair or 900 yd^2 Whichever is smaller	2

Methods of form removal likely to cause overstressing of the concrete shall not be used. Forms and supports shall be removed in a manner that will permit the concrete to uniformly and gradually take the stresses due to its own weight. Centers shall be gradually and uniformly lowered in a manner that will avoid injurious stresses in any part of the structure.

As soon as concrete for railings, ornamental work, parapets and vertical faces which require a rubbed finish has attained a safe strength, the forms shall be carefully removed without marring the surfaces and corners, the required finishing performed, and the required curing continued.

Prior to final inspection of the work, the Contractor shall remove all falsework, forms, excavated material or other material placed in the stream channel during construction. Falsework piles may be cut or broken off at least one foot below the mudline or ground line unless the plans specifically indicate that they are to be pulled and completely removed from the channel.

907-804.03.16--Cold or Hot Weather Concreting.

907-804.03.16.1--Cold Weather Concreting. In cold weather, the temperature of the concrete when delivered to the job site shall conform to the temperature limitations of "Temperature Limitations on Concrete when Delivered to Job Site" listed in Table 8 below. Cold weather is defined as three consecutive days when there is a probability that the daily average of the highest and lowest ambient temperatures is expected to be less than 40°F. This three-day forecast shall be based on the latest information available from the National Weather Service.

When the Contractor proposes to place concrete during seasons when there is a probability of ambient temperatures lower than 40°F, the Contractor shall have available on the project the approved facilities necessary to enclose uncured concrete and to keep the temperature of the air inside the enclosure within the ranges and for the minimum periods specified herein.

When there are indications of temperatures of less than 40°F during the first four days after placement of the concrete, the concrete shall be protected from cold temperatures by maintaining a temperature between 50°F and 100°F for at least four days after placement and between 40°F and 100°F for at least three additional days. The Contractor shall use such heating equipment such as stoves, salamanders, or steam equipment as deemed necessary to protect the concrete. When dry heat is used, means of maintaining atmospheric moisture shall be provided.

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 that 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.

One or more of the aggregates and/or mixing water may be heated. The aggregates may be heated by steam, dry heat, or by placing in the mixing water which has been heated. Frozen aggregates shall not be used. When either aggregates or water are heated above 100°F, the aggregates and water shall be combined first in the mixer before the cement is added to avoid flash set. Cement shall not be mixed with water or with a mixture of water and aggregate having a temperature greater than 100°F.

The use of salt or other chemical admixtures in lieu of heating will not be permitted.

Before placing concrete, all ice or frost shall be removed from the forms and reinforcement.

In the case of concrete placed directly on or in the ground, such as for footings or bottom slabs, protection and curing during cold weather may be provided as set for concrete pavement under Subsection 501.03.20.3.

The Contractor shall assume all risk and added cost connected with the placing and protecting of concrete during cold weather. Permission given by the Engineer to place concrete during such time will in no way relieve the Contractor of responsibility for satisfactory results. Should it be determined at any time that the concrete placed under such conditions is unsatisfactory, it shall be removed and replaced with satisfactory concrete by the Contractor without extra compensation.

TABLE 8
COLD WEATHER TEMPERATURE LIMITATIONS ON CONCRETE WHEN DELIVERED TO JOB SITE

Section thickness in the least dimension inches	Jobsite Acceptance Temperature Range °F
Less than 12	55 to 75
12 to 36	50 to 70
36 to 72	45 to 65
Greater than 72	40 to 60

907-804.03.16.2--Hot Weather Concreting. The manufacture, placement, and protection of concrete during hot weather requires special attention to ensure that uniform slump ranges and satisfactory placement qualities are maintained, that surface cracking is held to a minimum, and that design strengths are produced.

When the ambient temperature is above 90°F, the forms, reinforcing steel, steel beam flanges, and other surfaces which will come in contact with the concrete shall be cooled to below 90°F by means of a water spray or other approved methods.

When the atmospheric temperature is predicted to be 90°F or above based on the latest information available from the National Weather Service any time during the day of placement or day after placement, the time of placement shall not begin until 5:00 p.m. on the day of placement and shall be completed by 6:00 a.m. the following day.

907-804.03.17--Curing Concrete. 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 finishing method is complete.

When stay-in-place (SIP) metal forms are used in accordance with Subsection 907-804.03.14.2 in conjunction with the Transverse Method in accordance with Subsection 804.03.19.7.3, if the concrete mixture contains lightweight aggregate (LWA) meeting the requirements of Subsection 907-703.19.2 and an internal curing water content of 8.0 pounds or greater per 100 pounds of total cementitious materials, curing shall be accomplished in accordance with either Subsection 907-804.03.17.1 or Subsection 907-804.03.17.2. The minimum amount of LWA shall be established following the information in the Department's *Concrete Field Manual*, Paragraph 5.5.5. If the concrete mixture does not meet or exceed this internal curing water content, curing shall be accomplished in accordance with Subsection 907-804.03.17.1.

When SIP metal forms are not used or used in conjunction with the Longitudinal Method in accordance with Subsection 804.03.19.7.2, curing shall be accomplished in accordance with either Subsection 907-804.03.17.1 or Subsection 907-804.03.17.2.

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 907-804.03.17.1 shall continue uninterrupted for at least 14 days.
b) Curing following the requirements of Subsection 907-804.03.17.2 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.

For bridge decks, 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 applied burlap shall completely cover all exposed concrete surfaces. In areas where the burlap may not be directly applied due to the concrete surface, for example, in areas where reinforcing steel protrudes thru the concrete surface, like in the areas of a bridge deck where the bridge railing will be constructed at a later time, the saturated burlap shall be draped over the steel. 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 bridge deck surface once every eight (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 for Bridge Decks. 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. All 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 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, including the area in which the bridge railing will be later constructed, 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.

After the specified time for curing, but prior to constructing the bridge railing, all liquid membrane shall be removed from both the exposed surfaces of the reinforcing steel and the concrete surfaces on which bridge rail will be constructed. This removal of liquid membrane may be accomplish by high pressure washing or other methods approved by the Engineer.

907-804.03.18--Expansion and Fixed Joints, Bearings, Anchor Bolts, Plates, Castings, Pipes, Drains, Conduits, Etc. All joints shall be constructed according to details shown on the plans. The edges of the concrete at open or filled joints shall be chamfered or edged as indicated on the plans.

907-804.03.18.1--Open Joints. Open joints shall be placed in the locations shown on the plans and shall be constructed by the insertion and subsequent removal of a wood strip, metal plate, or other approved material. The insertion and removal of the template shall be accomplished without chipping or breaking the corners of the concrete. Reinforcement shall not extend across an open joint unless so specified on the plans.

907-804.03.18.2--Filled Joints. Poured expansion joints and joints to be sealed with premolded materials shall be constructed similar to open joints. When premolded types are specified, the filler shall be placed in correct position as the concrete on one side of the joint is placed. When

the form is removed, the concrete on the other side shall be placed. Adequate water stops of metal, rubber, or plastic shall be carefully placed as shown on the plans.

907-804.03.18.3--Premolded and Preformed Joint Seals. When preformed elastomeric compressive joint seals are specified, the previously formed and cured open joint shall be thoroughly cleaned of all foreign matter, the required adhesive uniformly applied, and the seal installed in accordance with the recommendations of the manufacturer of the seal.

When premolded filler is used for the joints in the roadway slab, the tops shall be adequately sealed with poured joint filler in accordance with details on the plans. Premolded filler shall be permanently fastened to an adjacent concrete surface by appropriate use of copper wire, copper nails, or galvanized nails.

907-804.03.18.4--Steel Joints. The plates, angles, or other structural shapes shall be accurately shaped at the shop to conform to the section of the concrete floor. Fabrication and painting shall conform to the specifications covering those items. When called for on the plans or in the special provisions, the material shall be galvanized in lieu of painting. Care shall be taken to ensure that the surface in the finished plane is true and free of warping. Positive methods shall be employed in placing the joints to keep them in correct position during the placing of the concrete. The opening at expansion joints shall be that designated on the plans at normal temperature, and care shall be taken to avoid impairment of the clearance in any manner.

907-804.03.18.5--Water Stops. Adequate water stops of metal, rubber, or plastic shall be placed as shown on the plans. Where movement at the joint is provided for, the water stops shall be of a type permitting movement without injury. They shall be spliced, welded, or soldered to form continuous watertight joints.

907-804.03.18.6--Bearing Devices. Bearing plates, rockers, and other bearing devices shall be constructed according to details shown on the plans. Unless otherwise specified or set in plastic concrete, they shall be set in grout to insure uniform bearing. Structural steel and painting shall conform to the requirements of Sections 810 and 814. When specified, the material shall be galvanized in lieu of painting. The rockers or other expansion bearing devices shall be set, considering the temperature at the time of erection, so that the required position of the device is provided.

At all points of bearing contact, concrete members shall be separated from underlying members by dimensioned bearing pads or by methods and/or materials specified on the plans.

When not otherwise specifically provided, contact areas between concrete super-structures and substructures shall be separated by three layers of No. 15, Type I, roofing felt.

907-804.03.18.7--Friction Joints. Metal friction joints shall consist of plates as indicated on the plans and shall be securely anchored in correct position. All sliding surfaces shall be thoroughly coated with an approved graphite grease. Movement shall not be impeded by the concrete in which the plates are embedded.

907-804.03.18.8--Placing Anchor Bolts, Plates, Castings, Grillage, Conduits, Etc. All anchor bolts, plates, castings, grillage, conduits, etc. indicated on the plans to be placed in or on the concrete shall be placed, set, or embedded as indicated or as directed. These items of the construction shall be set in portland cement mortar as referenced in Subsection 714.11.5, except that anchor bolts may, as permitted by the Engineer, be built into the masonry, set in drilled holes, or placed as the concrete is being constructed by inserting encasing pipe or oiled wooden forms of sufficient size to allow for adjustment of the bolts. After removal of the pipe or forms, the space around the bolts shall be filled with portland cement mortar completely filling the holes. The bolt shall be set accurately and perpendicular to the plane of the seat.

Anchor bolts which are to be set in the masonry prior to the erection of the superstructure shall be carefully set to proper location and elevation with a template or by other suitable means.

When bed plates are set in mortar, no superstructure or other load shall be placed thereon until this mortar has been allowed to set for a period of at least 96 hours, subject to the restrictions for cold weather concreting in Subsection 907-804.03.16.1. The mortar shall be kept well moistened during this period.

Weep hole drains shall be installed in abutments and retaining walls, and roadway drains or scuppers shall be installed in the roadway slabs in accordance with the details shown on the plans.

Where backfill is to be made at weep holes or openings in the structure, sand or stone chimneys or French drains shall be constructed as specified and shall extend through the portion of the backfill to be drained. Except as otherwise provided, the sand, stone, or slag used in this construction shall meet the requirements of Subsection 704.04.

907-804.03.19--Finishing Concrete Surfaces.

804.03.19.1--Classes of Finishes. Surface finishes of exposed concrete surfaces shall be classified as follows:

Class 1 - Ordinary Surface Finish
Class 2 - Rubbed or spray Finish
Class 3 - Tooled Finish
Class 4 - Sand-Blast Finish
Class 5 - Wirebrush or Scrubbed Finish
Class 6 - Floated Surface Finish

907-804.03.19.2--Class 1, Ordinary Surface Finish. Immediately following the removal of forms, all fins and irregular projections shall be removed from all surfaces except from those which are not to be exposed or not to be waterproofed. On all surfaces, the cavities produced by form ties and all other holes, honeycomb spots, broken corners or edges, and other defects shall be thoroughly cleaned, and after having been kept saturated with water for at least three hours shall be carefully pointed and trued with a mortar of cement and fine aggregate mixed in the proportions used in the class of the concrete being finished. Mortar used in pointing shall be not more than one hour old. The mortar patches shall be cured as specified under Subsection 907-804.03.17. All

construction and expansion joints shall be left carefully tooled and free of mortar and concrete. The joint filler shall be left exposed for its full length with clean and true edges.

The resulting surfaces shall be true and uniform. All surfaces which cannot be repaired to the satisfaction of the Engineer shall be given a Class 2 rubbed finish.

907-804.03.19.3--Class 2, Rubbed or Spray Finish.

907-804.03.19.3.1--Rubbed Finish. 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. Surfaces 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 are filled, and a uniform surface has been obtained. The paste produced by this rubbing shall be left in place at this time.

After all concrete above the surface being treated has been cast, the final finish shall be obtained by rubbing with a fine Carborundum stone and water. This rubbing shall continue until the entire surface is of a smooth texture and uniform color.

After the final rubbing is completed and the surface has dried, it shall be rubbed with burlap to remove loose powder and objectionable marks.

907-804.03.19.3.2--Spray Finish. Prior to the spray finish, the concrete shall be given a Class 1 finish in accordance with Subsection 907-804.03.19.2, supplemented if necessary with a grout meeting the requirements of Subsection 714.11 with fine aggregate modified to require 100 percent passing the No. 16 Sieve.

Grout shall be applied with burlap pads or float sponges, and as soon as the grout has dried the surface shall be brushed to remove all loose grout and the surface left smooth and free of air holes. Surfaces to be sprayed shall be free of efflorescence, flaking coatings, dirt, oil, and other foreign substances. Prior to application of the spray finish, the surfaces shall be free of moisture, as determined by sight and touch, and in a condition consistent with the manufacturer's published recommendations.

The spray finish material shall meet the requirements of Subsection 714.12 and shall be listed on of Approved Sources of Materials. The spray finish shall be applied with heavy duty spray equipment capable of maintaining a constant pressure as necessary for proper application. The material shall be applied as recommended by the manufacturer except the rate of application shall not be less than one gallon per 50 square feet of surface area without prior written approval of the Engineer.

The completed finish shall be tightly bonded to the structure and present a uniform appearance and texture equal to or better than a rubbed finish. If necessary, additional coats shall be sprayed to produce the desired surface texture and uniformity. Upon failure to adhere positively to the

structure without chipping or cracking or to attain the desired surface appearance, the coatings shall be completely removed and the surface given a rubbed finish in accordance with 907-804.03.19.3.1, or other approved methods shall be used to obtain the desired surface finish to the satisfaction of the Engineer without additional cost to the State.

907-804.03.19.4--Classes 3, 4, and 5 Finishes. If required, specifications for these finishes will be contained in the special provisions.

907-804.03.19.5--Class 6, Floated Surface Finish. After the concrete has been deposited in place, it shall be consolidated and the surface shall be struck off by means of a strike board and floated with a wooden or cork float. An edging tool shall be used on edges and expansion joints. The surface shall not vary more than 1/8 inch under a 10-foot straightedge. The surface shall have a granular or matte texture which will not be slick when wet.

907-804.03.19.6--Required Finishes for Various Surfaces.

907-804.03.19.6.1--General. Unless otherwise specified, the top surface of sidewalks, the top horizontal surfaces of footings, and top slabs of box bridges, box culverts, or other structures shall be given a Class 6 finish. All formed concrete surfaces shall be given a Class 1 finish, except on surfaces which are completely enclosed, such as the inside surfaces of cells of box girders, the removal of fins and form marks and the rubbing of mortared surfaces to a uniform color will not be required.

In reference to finishing, exposed surfaces are surfaces or faces which may be seen after all backfill has been placed. Exposed surfaces requiring a Class 2 finish shall be finished at least one foot below the ground line or the low water elevation, whichever is higher.

The Class 2 finish shall be made upon a Class 1 finish. After the removal of forms the Class 1 finish shall be completed and the rubbing of concrete shall be started as soon as the condition of the concrete will permit.

Bridge floors shall be finished in accordance with Subsection 907-804.03.19.7.

907-804.03.19.6.2--Finishing Formed Concrete Surfaces of Box Bridges, Box Culverts, Pipe Headwalls, and Minor Structures. The exposed surfaces of wing walls and parapets of box bridges and box culverts to be used as vehicular or pedestrian underpasses shall be given a Class 2 finish. Exposed surfaces of other box culverts or box bridges, pipe culvert headwalls, and other minor structures shall be given a Class 1 finish unless otherwise indicated on the plans.

The exposed surfaces of retaining walls including copings and parapets shall receive a Class 2 finish.

907-804.03.19.6.3--Finishing Formed Concrete Surface of Bridges. All formed concrete bridge surfaces which are exposed shall have a Class 1 or 2 finish as set forth herein unless designated otherwise on the plans.

Bridges with designated surfaces for Class 2 finish are classified as follows:

Group A - Bridges over highways, roads and streets.
Group B - Bridges over waterways and railroads.
Group BB - Twin or adjacent bridges of Group B category.

When a Group B or BB bridge also spans a highway, road or street, exposed concrete surfaces shall be finished in accordance with Group A requirements.

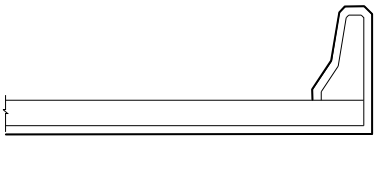
(A) Superstructures. Concrete surfaces to be given a Class 2 finish shall be the exposed surfaces of wings and rails and other exposed surfaces indicated by a double line in Figures 804-1, 804-2, and 804-3.

When a Group B or BB also spans a highway, road or street, the superstructure of spans over and extending one span in each direction beyond the lower level highway, road or street shall be given a Class 2 finish as shown for Group A.

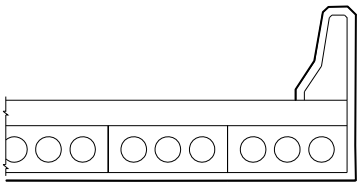
(B) Substructures. Concrete surfaces to be given a Class 2 finish are as follows:

Group A. Exposed surfaces of abutments, end bents, end bent posts, wing walls, railing, retaining walls, parapets, copings, piers, columns, piles, caps, struts or walls between columns or piles, encasement of steel piles, arch rings and spandrel walls.

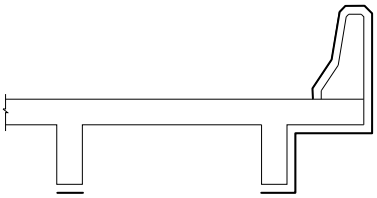
Group B and BB. Exposed surfaces of abutments, wing walls, end bent posts, railing, retaining walls, parapets and copings.



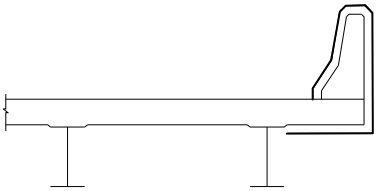
CONCRETE SLAB SPAN & HOLLOW SLAB SPAN



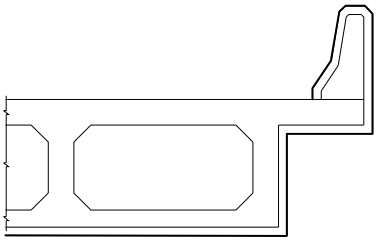
PRECAST HOLLOW SLAB SPAN



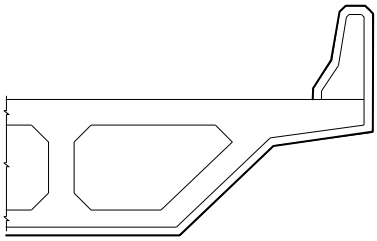
CONCRETE GIRDER SPAN



STEEL BEAM SPAN

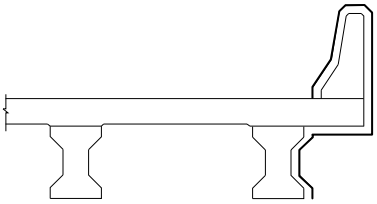


Vertical Face

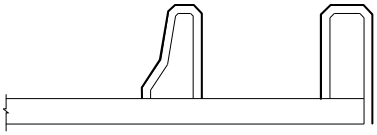


Slope Face

CONCRETE BOX GIRDER SPAN



PRESTRESSED CONCRETE BEAM SPANS



For Finishing On The Remainder Of Superstructure, See The Appropriate Section On This Page.

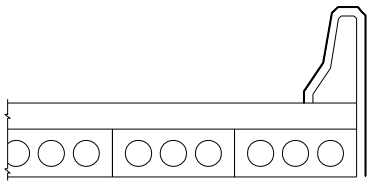
TYPICAL SIDEWALK SECTION

GROUP "A"

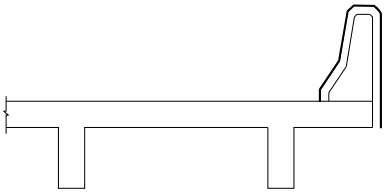
BRIDGES OVER HIGHWAYS, ROADS & STREETS

CLASS 2 FINISH - BRIDGE SUPERSTRUCTURES - FIG. 804-1

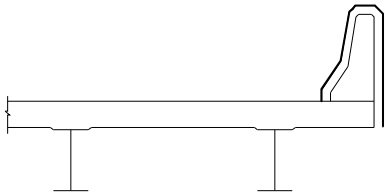
CONCRETE SLAB SPAN & HOLLOW SLAB SPAN



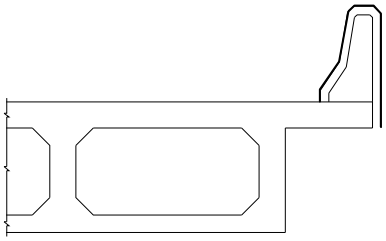
PRECAST HOLLOW SLAB SPAN



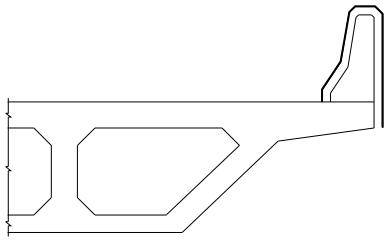
CONCRETE GIRDER SPAN



STEEL BEAM SPAN

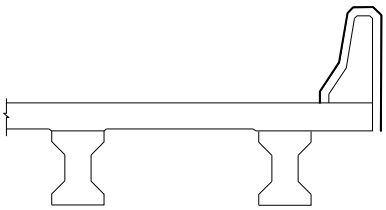


Vertical Face

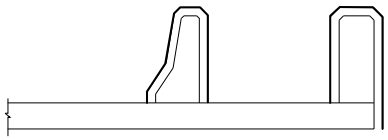


Slope Face

CONCRETE BOX GIRDER SPAN



PRESTRESSED CONCRETE BEAM SPANS



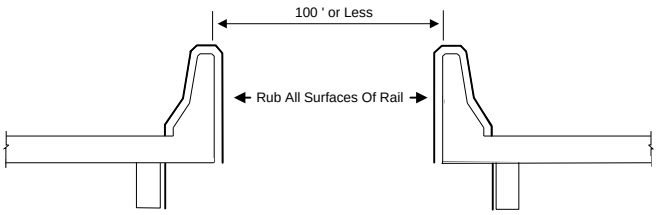
For Finishing On The Remainder Of Superstructure, See The Appropriate Section On This Page.

TYPICAL SIDEWALK SECTION

GROUP "B"

BRIDGES OVER WATERWAYS AND BRIDGES OVER RAILROAD TRACKS

CLASS 2 FINISH - BRIDGE SUPERSTRUCTURES - FIG. 804-2



GROUP "B B" - ADJACENT BRIDGES

GROUP "B B"

TWIN or DUAL BRIDGES

CLASS 2 FINISH - BRIDGE SUPERSTRUCTURES - FIG. 804-3

907-804.03.19.7--Finishing Bridge Decks.

907-804.03.19.7.1--General. Concrete bridge decks shall be struck off and finished by the method(s) designated on the plans.

In the event a method is not designated, the Contractor may use either the longitudinal or transverse method subject to the requirements contained in these specifications.

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. The longitudinal method may be used for repairs to bridge decks or bridge widening projects. For bridge widening projects, curing in accordance with Subsections 907-804.03.17 shall be completed within 30 minutes of initial strike-off for bridges without skew and within 35 minutes of initial strike-off for bridges with skew.

The longitudinal method requires that the strike-off screed be supported on accurately graded and supported bulkheads or templates placed across the full width at the end(s) of the pour. Before the concrete is placed, approved fixed templates or wooden bulkheads of not less than 1¼-inch lumber shall be placed perpendicular to the centerline of the roadway, or in the case of skew bridges at the angle of skew. At least one dry run shall be made the length of each pour with a "tell-tale" device attached to the screed to assure the specified clearance to the reinforcing steel. The upper surface of the template or bulkheads shall be accurately set to conform to the required grade and crown.

Special attention shall be given to the gutter lines where the strike-off screed cannot reach. The gutters shall be finished by hand and tested with the straight edge. Floor drains shall be set lower than the finished gutter line and finished over. After initial set, the concrete shall be dished out and finished around the drains to form an outlet.

After the concrete has been deposited and rough graded, it shall be struck off by means of a strike-off screed resting on the bulkheads or fixed templates. The strike-off screed shall be of a type satisfactory to the Engineer and shall have sufficient strength to retain its shape under all working conditions. The final surface shall comply with the applicable requirements of Subsections 501.03.17.6 and 501.03.18, and unless otherwise specified in the contract, the final finish under this method shall be the belt finish.

In general, the overall strike-off screed should be trussed, with bracing heavy enough to support the weight of a man without deflecting, and should be adjustable for camber and correction of sag.

The strike-off screed will ride on the bulkheads or fixed templates at the ends of the section being finished. Care shall be taken to see that the bulkhead or fixed template elevations are accurately set since the entire span surface will be controlled by them. The manipulation of the screed shall be such that neither end is raised from the bulkheads or templates during the process.

The concrete shall be struck off by beginning at one curb and proceeding entirely across the span. A slight excess of concrete shall be kept in front of the cutting edge at all times. This operation shall be repeated at least three times. In each case, the strike-off screed shall be picked up and carried back to the point of beginning. No backward strokes will be allowed. The strike-off screed shall be moved along the bulkheads or fixed templates with a combined longitudinal and transverse motion. This operation may be manual or mechanical. Standing or walking in the fresh concrete ahead of the strike-off screed will not be permitted.

907-804.03.19.7.3--Transverse Method. The transverse method requires that the screeding equipment be supported on accurately graded and supported rails placed beyond the gutter lines and parallel with the centerline of the bridge.

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. Manual transverse methods of screeding will not be permitted.

The finishing machine shall be supported on vertically adjustable rails set a sufficient distance from the gutter line to allow free movement of the screed from gutter line to gutter line. Satisfactory means of load distribution with minimum rail deflection shall be provided. The screed rails for a deck pour shall be completely in place for the full length of the pour and shall be firmly secured prior to placing concrete. The screed rails shall be adjusted as necessary to compensate for settlement and deflection occurring during the screeding operations. Supports for the screed rail shall be located directly over slab overhang support brackets as referenced in Subsection 907-804.03.14.1.

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.

The screed shall be equipped with a metal cutting edge or other approved mechanical means for accurately fine grading the plastic concrete to the required grade and surface smoothness and shall be supported by a bridging structure sufficiently rigid and heavy to perform operations

satisfactorily on concrete of minimum slump without vibration, distortion, and wrecking of forms. 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.

The screed shall complete sufficient passes to strike off all of the excess concrete with ample mortar along the entire leading edge to assure filling of low spots. Care shall be taken to remove all objectionable material from the gutters where final hand finishing will be required.

The selection of the transverse method may require the Contractor to furnish bridge deck concrete which contains an approved water-reducing set-retarding admixture in the quantities approved by the Engineer at no additional cost to the State. See Subsection 713.02 for more information.

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.

907-804.03.19.7.4--Acceptance Procedure for Bridge Deck Smoothness. After the bridge decks and bridge end slabs are completed and preferably before the construction of the bridge railing, they shall be tested for ride quality using a Contractor furnished profilograph. Profile Index Values shall be determined in accordance with Department SOPs and these specifications. The profilograph shall meet the requirements of Subsection 907-804.03.19.7.5. Profiles will be obtained in the wheel paths of the main thru lanes and, where conditions allow, in the wheel paths of any auxiliary lanes or tapers. Profile Index Values for bridge decks and bridge end slabs shall be obtained for all state roads with four lanes or more, on state roads three lanes or less where the current traffic count is 2000 ADT or higher, or as designated on the plans. Ride quality tests will begin at a point where the rearmost wheel of the profilograph is as close to the beginning of the bridge end slab as possible and shall proceed forward across the remainder of the bridge end slab, across the bridge deck and continue across the next bridge end slab to a point where the front-most wheel of the profilograph reaches the far-most edge of the bridge end slab. Bridges and bridge end slabs not requiring a ride quality test must meet a 1/8 inch in 10-foot straightedge requirement in longitudinal and transverse directions. Bridges in horizontal curves having a radius of less than 1000 feet at the centerline and bridges within the superelevation transition of such curves are excluded from a test with the profilograph.

The Profile Index Value for bridge decks including the bridge end slabs shall be averaged for the left and right wheel path for each lane and where applicable, each auxiliary lane and taper, and shall not exceed 65 inches per mile for each lane. 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. In addition, individual bumps or depressions exceeding 0.3 of an inch, when measured from a chord length of 25 feet, shall be corrected and the surface shall meet a 1/8 inch in 10-foot straightedge check made transversely across the deck or slab.

Bridge decks and bridge end slabs not meeting the preceding requirements shall be corrected. Corrective work shall be done at no additional cost to the Department. Corrective work shall consist of grinding the bridge deck in accordance with this specification. All corrective work shall precede final surface texturing. After completion of final surface texturing, all surface areas

corrected by grinding shall be sealed with a nonstaining 40% minimum alkylalkoxysilane penetrating sealant applied per the manufacturer's directions.

In case the bridge end slabs are to be constructed on a future project, the bridge deck(s) alone shall be tested for ride quality using the acceptance procedure outlined above, except that the ride quality test will begin at a point where the rearmost wheel of the profilograph is as close to the beginning of the bridge as possible and shall proceed forward across the bridge deck to a point where the front-most wheel of the profilograph reaches the far-most edge of the bridge.

Expansion joint installation shall be delayed and the joint temporarily bridged to facilitate operation of the profilograph and grinding equipment across the joint wherever feasible.

It shall be the Contractor's responsibility to schedule profilograph testing. The Contractor shall notify the Department at least five (5) days in advance of profilograph testing. The Contractor shall ensure that the area to be tested has been cleaned and cleared of all obstructions. Profilograph testing of bridge decks and bridge end slabs shall be performed by the Contractor under supervision of the Engineer. All profilograph testing shall be performed at no additional cost to the Department. The Contractor will be responsible for traffic control associated with this testing operation.

907-804.03.19.7.4.1--Grinding Bridge Decks.

907-804.03.19.7.4.1.1--Equipment. The grinding equipment shall be a power driven, self-propelled machine that is specifically designed to smooth and texture portland cement concrete pavement with diamond blades. The effective wheel base of the machine shall not be less than 12.0 feet. It shall have a set of pivoting tandem bogey wheels at the front of the machine and the rear wheels shall be arranged to travel in the track of the fresh cut pavement. The center of the grinding head shall be no further than 3.0 feet forward from the center of the back wheels.

The equipment shall be of a size that will cut or plane at least 3.0 feet wide. It shall also be of a shape and dimension that does not encroach on traffic movement outside of the work area. The equipment shall be capable of grinding the surface without causing spalls at cracks, joints, or other locations.

907-804.03.19.7.4.1.2--Grinding. The grinding areas will be determined by the Contractor and approved by the Engineer. The Contractor shall develop and submit to the Engineer for approval a Grinding Plan. The Contractor shall allow up to 45 days for the Department to review the Plan prior to starting any grinding operations. This plan shall include as a minimum:

1) Name of the project superintendent in responsible charge of the grinding operation.
2) List and description of all equipment to be used.
3) Maximum depth of each pass allowed by the grinding equipment.
4) Maximum width of each pass allowed by the grinding equipment.
5) Details of a sequence of the grinding operation.
6) Complete data from Profilograph runs, based on a 0.3 inch bump height, for each wheel path over the entire bridge including bridge end slabs, which shall include profile index,

bump locations (in stations), bump heights and proposed final cross-slopes. When a computerized profilograph is used, a complete printout of the profile including the header information for each wheel path will be required.

7) Data showing reinforcing steel clearance in all areas to be ground.
8) A detailed drawing of the deck showing areas to be ground with station numbers and grinding depths clearly indicated.
9) A description of grinding in areas where drains are in conflict with grind areas.
10) Details of any changes in deck drainage, anticipated ponding, etc.

The Engineer will evaluate the grinding plan for conformance with the plans and specifications, after which the Engineer will notify the Contractor of any additional information required and/or changes that may be needed. Any part of the plan that is unacceptable will be rejected and the Contractor shall submit changes for reevaluation. All approvals given by the Engineer shall be subject to trial and satisfactory performance in the field, and shall not relieve the Contractor of the responsibility to satisfactorily complete the work.

The construction operation shall be scheduled and proceed in a manner that produces a uniform finished surface. Grinding will be accomplished in a manner that eliminates joint or crack faults while providing positive lateral drainage by maintaining a constant cross-slope between grinding extremities in each lane. Auxiliary or ramp lane grinding shall transition as required from the mainline edge to provide positive drainage and acceptable riding surface.

The operation shall result in a finished surface that conforms as close as possible to the typical cross-section and the requirements specified in Subsection 907-804.03.19.7.4.1.3.

The Contractor shall establish positive means for removal of grinding residue. Residue shall not be permitted to flow across lanes used by public traffic or into gutters or drainage facilities.

907-804.03.19.7.4.1.3--Final Surface Texture. The grinding process shall produce a finish surface that is as close as possible to grade and uniform in appearance with a longitudinal line type texture. The line type texture shall contain parallel longitudinal corrugations that present a narrow ridge corduroy type appearance. The peaks of the ridges shall be approximately 1/16 inch higher than the bottoms of the grooves with approximately 53 to 57 evenly spaced grooves per foot. Grinding chip thickness shall be a minimum of 0.080 inches thick.

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. The finished results shall meet the following conditions:

(a) Individual bumps or depressions shall not exceed 0.3 inches when measured from a chord length of 25 feet.
(b) The final index value for the bridge deck and bridge end slabs shall be an average of both the right and left wheel paths of each lane and shall not exceed 65 inches per mile.

The final profilogram will be furnished to the Engineer for informational purposes.

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.

907-804.03.19.8--Finishing Horizontal Surfaces of Footings or Top Slabs of Box Bridges, Culverts, or Other Structures. The finishing of horizontal surfaces of footing or top slabs of box bridges, culverts, or other structures shall be achieved by placing an excess of material in the form and removing or striking off the excess with a template, forcing the coarse aggregate below the mortar surface. After the concrete has been struck off the surface shall be given a Class 6 finish.

907-804.03.19.9--Finishing Exposed Surfaces of Sidewalks. After the concrete has been deposited in place it shall be consolidated and the exposed surface shall be given a Class 6 finish. An edging tool of the required radius shall be used on all edges and at all expansion joints. The surface shall have a granular texture which will not be slick when wet.

Sidewalk surfaces shall be laid out in blocks with an approved grooving tool as shown on the plans or as directed.

907-804.03.20--Opening Bridges.

907-804.03.20.1--Public Traffic. Unless otherwise specified, concrete bridge decks shall be closed to public highway traffic for a period of at least 21 days after placing concrete.

907-804.03.20.2--Construction Traffic. Unless otherwise specified, concrete bridge decks shall be closed to construction traffic for the time required for curing in Subsection 907-804.03.17 and the minimum required compressive strength for the concrete placed is obtained.

907-804.03.21--Final Cleanup. Upon completion of the work all equipment, surplus materials, forms, and waste material shall be removed, the bridge cleaned, and the site of the work given a final cleanup.

907-804.03.22--Precast-Prestressed Concrete Bridge Members.

907-804.03.22.1--General. All installations and plants for the manufacture of precast-prestressed bridge members shall be PCI (Precast / Prestressed Concrete Institute) Certified. Bridge members manufactured in plants or installations not so approved will not be accepted for use in the work. The Contractor or other manufacturer shall employ a technician skilled in the adopted system of prestressing to supervise the manufacturing operations. This technician shall be certified according to the guidelines of this specification. The Contractor shall develop and implement a Quality Control Program as per Division I of PCI Quality Control Manual, 4th Edition. The Quality Control Program shall be submitted to the District Materials Engineer for approval.

907-804.03.22.2--Stressing Requirements. The jacks for stressing shall be equipped with accurate calibrated gauges for registering the jacking pressure. Means shall be provided for measuring elongation of strands to at least the nearest 1/16 inch.

Prior to beginning work, the Contractor or manufacturer shall have all jacks to be used, together with their gauges, calibrated by an approved laboratory. All jacks and gauges shall have an accuracy of reading within two percent. The testing agency shall furnish the Engineer a statement certifying that the jacks and gauges meet this requirement. During the progress of the work, if a gauge appears to be giving erratic results or if the gauge pressure and elongations indicate materially differing stresses, recalibration will be required.

Calibration of jacks and gauges shall be repeated at intervals deemed necessary by the Engineer. These intervals for calibration shall not exceed one year.

Shop drawings of prestressed beams, including an erection plan, shall be submitted in duplicate to the Bridge Engineer for approval prior to manufacture of members.

907-804.03.22.2.1--Methods. Plans for the particular bridge members will show prestressing by one of the following methods:

(A) Pretensioning. The prestressing strands are stressed initially. After the concrete is placed, cured, and has attained the compressive strength shown on the plans, the stress is transferred to the member. The method used for pretensions shall be in accordance to Division V of PCI Quality Control Manual, 4th Edition.

(B) Posttensioning. The posttensioning tendons are installed in voids or ducts and are stressed and anchored after development of the compressive strength specified on the plans. The voids or ducts are then pressure grouted.

(C) Combined Method. Part of the reinforcing is pretensioned and part posttensioned. Under this method all applicable requirements for the two methods specified shall apply to the respective stressing elements being used.

907-804.03.22.2.2--Alternate Details for Prestressed Members. In the event that the Contractor / Manufacturer desires to use materials or methods that differ in any respect from those shown on the plans or described in these specifications, the Contractor shall submit for approval full plan details on acceptable tracings suitable for reproduction and specifications which shall become the property of the Department. In order for alternate materials and/or methods to be considered, they will be required to comply fully with the following:

A. Provisions equal to those stipulated in these specifications.
B. Current AASHTO Specifications.
C. Recommendations of materials manufacturer.
D. Camber tolerance of beams and spans shown on plans.

Note: Alternate materials and methods will not be authorized on Federal-Aid Projects.

The Engineer shall be the sole judge as to the adequacy and propriety of any variation of materials or methods.

907-804.03.22.2.3--Stressing Procedure.

(A) General. Stressing shall be performed by suitable jacks working against unyielding anchorages and capable of maintaining the required stress for an indefinite period without movement or yielding. Strands may be stressed singularly or in a group.

The tension to be applied to each strand shall be as shown on the plans. The tension shall be measured by both jacking gauges and elongations in the strands and the result shall check within close limits.

It is anticipated that there will possibly be a difference in indicated tension between jack pressure and elongation of about five (5) percent. In this event, the discrepancy shall be placed on the side of slight overstress rather than understress.

In the event of an apparent discrepancy between gauge pressure and elongation of as much as five (5) percent, the entire operation shall be carefully checked, and the source of error determined before proceeding further.

Elongation is to be measured after the strands have been suitably anchored, and all possible slippage at the anchorages has been eliminated.

In all stressing operations, the stressing force shall be kept as nearly symmetrical about the vertical axis of the member as practicable.

(B) Pretensioning. All strands to be prestressed shall be brought to a uniform initial tension prior to being given their full pretensioning. This uniform initial tension of approximately 1000 to 2000 pounds shall be measured by suitable means such as a dynamometer so that its value can be used as a check against elongation computed and measured.

After the initial tensioning, the strand or group shall be stressed until the required elongation and jacking pressure is within the limits specified.

When the strands are stressed in accordance with the plan requirements and these specifications and all other reinforcing is in place, the concrete shall be placed in the prepared forms.

Strand stress shall be maintained until the concrete between anchorages has attained the required compressive strength as determined by cylinder tests, after which the strands shall be cut off flush with the ends of column members, and cut as shown on the plans for beams, girders, etc. Strands shall be cut or released in such a manner that eccentricity of prestress will be kept to a minimum and no damage to the member will result. The strand cutting pattern shall be as shown on the plans or as approved by the Bridge Engineer.

(C) Posttensioning. For all posttensioning tendons/bars the anchor plates shall set exactly normal in all directions to the axis of the tendon/bar. Parallel wire anchorage cones shall be recessed within the beams. Tensioning shall not take place until the concrete has reached the compressive strength shown on the plans.

Elongation and jacking pressures shall make appropriate allowance for all possible slippage or relaxation of the anchorage. Posttensioning tendons/bars shall be stressed in the order and manner shown on the plans.

The units shall be tensioned until the required elongations and jacking pressures are attained and reconciled within the limits specified in Subsection 907-804.03.22.2.3(A) with such overstresses as approved by the Engineer for anchorage relaxation.

Independent references shall be established adjacent to each anchorage to indicate any yielding or slippage that may occur between the time of initial stressing and final release of the strands.

Straight tendons/bars may be tensioned from one end. Unless otherwise specified, curved tendons shall be stressed by jacking from both ends of the tendons.

(D) Combined Method. In the event that girders are manufactured with part of the reinforcement pretensioned and part posttensioned, the applicable portions of the requirements listed herein shall apply to each type.

907-804.03.22.3--Manufacture.

907-804.03.22.3.1--Forms. The forms used for precast-prestressed bridge members shall meet the requirements of Division II of the PCI Quality Control Manual, 4th Edition.

907-804.03.22.3.2--Placing and Fastening Steel. Placing and fastening of all steel used for precast-prestressed bridge members shall meet the requirements of Division V of the PCI Quality Control Manual, 4th Edition.

907-804.03.22.3.3--Holes for Prestressing Tendons/Bars. Holes provided in girders for prestressing tendons/bars shall be formed by means of inflatable rubber tubing, flexible metal conduit, metal tubing, or other approved means.

907-804.03.22.4--Placing and Curing Concrete.

907-804.03.22.4.1--Placing. The placing of concrete shall meet the applicable requirements of Division III of PCI Quality Control Manual, 4th Edition.

907-804.03.22.4.2--Curing. Initial and accelerated curing of all members shall meet the applicable requirements of Division IV of PCI Quality Control Manual, 4th Edition except for the following listed requirements.

The source of heat for accelerated cure shall be steam. Calibrated thermocouples shall be implanted into the concrete members to monitor areas expected to have maximum and minimum heat. Curing methods and procedures listed in the prestress producer's PCI Quality System Manual shall be approved by the Department before their implementation.

907-804.03.22.4.3--Removal of Side Forms. Side forms may be removed after the concrete has attained sufficient strength to maintain a true section. In order to obtain "sufficient strength", it may be necessary to cure members for 12 hours or more as prescribed in Subsection 907-804.03.22.4.2, or to attain a minimum compressive strength of 1000 psi.

If high-early-strength concrete is obtained by use of low slump (0 to 1.5-inch) concrete, vacuum process, or other approved methods, side forms may be removed earlier; however, approval of the methods and revision from normal schedules will be made only after inspections by the District Materials Engineer and Materials Division have determined that satisfactory results will be attained by the methods and schedules proposed.

907-804.03.22.4.4--Grouting. The holes through posttensioned members in which the tendons are installed shall be equipped with approved grouting vents. All prestressing tendons to be bonded shall be free of dirt, loose rust, grease, or other deleterious substances. Before grouting, the ducts shall be free of water, dirt, and other foreign substances. The ducts shall be blown out with compressed air until no water comes through the ducts. For long members with draped tendons an open tap at low points may be necessary. After completion of stressing, the annular space between sides of tendon and sides of hole shall be grouted as set in the following paragraphs.

With the grouting vent open at one end of the core hole, grout shall be applied continuously under moderate pressure at the other end until all entrapped air is forced out through the open grout vent, as evidenced by a steady stream of grout at the vent. Whereupon, the open vent shall be closed under pressure. The grouting pressure shall be gradually increased to a refusal of at least 75 psi and held at this pressure for approximately 10 seconds, and the vent shall then be closed under this pressure.

Portland cement grout shall consist of a mixture of:

1	part Type 1 portland cement
1/4	part fly ash
3/4	part washed sand *
4 to 6	gallons of water per bag of cement.

* all passing No. 16 sieve and not more than 5% retained on No. 30

Water-reducing admixtures, subject to approval by the Engineer, shall be used in accordance with the manufacturer's recommendations.

The grout shall be mixed in a mechanical mixer, shall have the consistency of heavy paint, and shall be kept agitated until placed.

Members shall not be moved before the grout has set, ordinarily at least 24 hours at 80°F or higher.

907-804.03.22.5--Finishing and Marking. Units shall be given a Class 1 finish at the plant and shall be given a Class 2 finish after erection when required.

Recesses in girders at end of diaphragm bars, holes left by form ties, and other surface irregularities shall be carefully cleaned and patched with an approved non-shrink commercial grout or a non-shrinkage mortar of the following composition:

1 part Type 1 portland cement
1 1/2 to 2 parts fine sand
1/2 to 3/4 ounces aluminum powder per bag of cement
Approved admixture per Subsection 713.02.
Sufficient water to produce a workable but rather stiff mix.

The units shall be clearly marked in accordance with Department's *Materials Division Inspection, Certification and Testing Manual*.

907-804.03.22.6--Handling, Storage, and Installation. Posttensioned members may be handled immediately after completion of stressing and grout has set. Pretensioned members may be handled immediately after release of tensioning. In either case, the members shall have developed a minimum compressive strength of 4000 psi prior to handling. In the event stressing is not done in a continuous operation, members shall not be handled before they are sufficiently stressed, as determined by the Engineer, to sustain all forces and bending moments due to handling. In the

handling, storage, and transporting of beams or girders, they shall be maintained in an upright position (position as cast) at all times and shall be picked up from points within distance from beam ends equal to beam depth or at pick-up points designated on the plans. Disregard of this requirement and dropping of units may be cause for rejection, whether or not injury to the unit is apparent. Piles shall be picked up and loaded for shipment at points shown by the suspension diagram on the plans. Extreme care shall be used in handling and storing piles to prevent damage. The dropping of a pile may be cause for rejection of same, whether or not there is apparent injury to the member.

Care shall be exercised during the storage, hoisting, and handling of precast units to prevent damage. Damaged units shall be replaced by the Contractor at no additional costs to the State.

When members are stacked for storage, each layer shall be supported at or near the pick-up points. Supports shall be carefully placed in a vertical line in order that the weight of any member will not stress an underlying member. To prevent damage in moving members it is suggested that rigid supports be covered with a cushion of wood or other resilient material.

Members shall not be transported until at least one day after the concrete has reached a compressive strength of 5000 psi or greater strength when shown on the plans.

Piles used in salt water shall not be driven until concrete is seven days old, and air-entrained concrete shall be used in such piles.

After prestressed concrete voided slab units are set, doweled and bolted in their final position the keyways and dowel holes shall be filled with an approved non-shrink grout. Traffic shall not be permitted on the spans for 24 hours after grouting, and heavy construction equipment exceeding 15 tons will not be permitted on the spans for a period of 72 hours after grouting.

Adjacent slab units that mismatch more than one-fourth inch shall be adjusted prior to grouting of the shear keys. The maximum deviation from cross-section and grade (exclusive of camber) at any point shall not exceed one-fourth inch; and when the surface is checked with a ten-foot straightedge applied both parallel and perpendicular to the centerline, the variance shall not exceed one-fourth inch.

In addition to the requirements set out in this section, the applicable requirements of Section 803 shall apply.

907-804.03.22.7--Tolerances for Accepting Precast Prestressed Concrete. Member shall meet the dimension tolerances set by Division VII of PCI Quality Control Manual, 4th Edition.

907-804.03.22.8--Testing of Materials. Concrete and aggregate testing shall meet the requirements of Division VI of PCI Quality Control Manual, 4th Edition, except that the concrete mixture design shall meet the requirements of Subsection 907-804.02.10. Also, in addition to concrete compressive tests samples made for detensioning and 28-day strength, test samples shall be made and tested in order to prove compliance to the requirements of Subsection 907-804.03.22.6 for handling and shipping prestressed members. Compressive strength test cylinders

for detensioning, handling and shipping shall receive the same type curing as the prestressed members for which they represent. Compressive strength samples shall be made each day for each prestress casting bed.

907-804.03.22.9--Testing Personnel. Technicians testing portland cement concrete used in the production of precast-prestressed members shall be PCI Quality Control Technician/Inspector Certified. Each producer of precast-prestressed members shall have at least one PCI Level II certified technician on site during production for Department projects.

907-804.03.22.10--Documentation. The Precast-Prestressed Producer for each precast-prestressed concrete bridge member shall maintain documentation as set forth in the Department's *Materials Division Inspection, Certification and Testing Manual*. Testing and inspection record forms shall be approved by the Central Laboratory and as a minimum contain information listed in Division VI of PCI Quality Control Manual, 4th Edition.

907-804.03.22.11--Use in the Work. Before any precast-prestressed member is incorporated into the work, documentation as described in Subsection 907-804.03.22.10 is required along with visual inspection of the member at the bridge construction site. Project Office personnel as per the Department's *Materials Division Inspection, Certification and Testing Manual* will make visual inspection of the precast-prestressed member at the bridge construction site.

907-804.04--Method of Measurement. Concrete, complete and accepted, will be measured in cubic yards. The concrete volume will be computed from the neat dimensions shown on the plans, except for such variations as may be ordered in writing by the Engineer. The quantity of concrete involved in fillets, scorings, and chamfers one square inch or less in cross-sectional area will be neglected. Deductions shall be made for the following:

(1) The volume of structural steel, including steel piling encased in concrete.
(2) The volume of timber piles encased in concrete, assuming the volume to be 0.80 cubic foot per linear foot of pile.
(3) The volume of concrete piles encased in concrete.

No deduction will be made for the volume of concrete displaced by steel reinforcement, floor drains, or expansion joint material that is one inch or less in width normal to the centerline of the joint. Where railing is bid as a separate item, that portion of the railing above the top of the curb, above the surface of the sidewalk, or above the bridge roadway, as the case may be, will not be included in the measurement of concrete, but will be measured as railing. Massive pylons or posts which are to be excepted from payment for railing and are intended to be measured for as concrete will be so noted on the plans.

When shown on the plans or directed by the Engineer, concrete placed as a seal for cofferdams will be measured by the cubic yard actually in place, except that no measurement will be made of seal concrete placed outside of an area bounded by vertical planes 18 inches outside the neat lines of the footing as shown on the plans or as directed and parallel thereto.

Reinforcing steel will be measured and paid for in pounds as set out in Section 805.

Unless otherwise specified, structural steel will be measured and paid for as set out in Section 810.

Excavation for bridges will be measured and paid for as in Section 801.

Piling will be measured and paid for as set out in Sections 802 and 803.

Railing will be measured and paid for as set out in Section 813.

Prestressed concrete beams and plank will be measured by the linear foot.

Prestressed concrete voided slab units, interior and exterior with railing, and precast concrete caps, intermediate and end cap with winged abutment wall, of the size and type specified will be measured by the unit complete in place and accepted. Railing, winged abutment walls, grout, tie rods, nuts, washers, bearing pads and other appurtenances will not be measured for separate payment.

907-804.05--Basis of Payment. Concrete will be paid for at the contract unit price per cubic yard for the class or classes specified, complete in place. Prestressed concrete beams and plank will be paid for at the contract unit per linear foot of specified size and type.

Prestressed concrete voided slab units and precast caps will be paid for at the contract unit price per each for the specified types and sizes, complete in place and accepted; which price shall be full compensation for furnishing, hauling and erecting the members; including all prestressing reinforcement and other reinforcement in the members. Payment at the contract unit prices bid shall be full compensation for furnishing all materials, equipment, tools, labor and incidentals necessary to complete the work.

Payment will be made under:

907-804-A:	Bridge Concrete, Class ____	- per cubic yard
907-804-B:	Box Bridge Concrete, Class ___	- per cubic yard
907-804-C:	Length Prestressed Concrete Beam, Type ___	- per linear foot
907-804-D:	Length Prestressed Concrete Plank	- per linear foot
907-804-E:	Length Prestressed Concrete Voided Slab, Size Interior	- per each
907-804-F:	Length Prestressed Concrete Voided Slab, Size Exterior	- per each
907-804-G:	Length Precast Concrete Caps, End Unit with Wall	- per each
907-804-H:	Length Precast Concrete Caps, Intermediate Unit	- per each

S E C T I O N 9 0 5 - P R O P O S A L

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.

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.

SECTION 905 -- PROPOSAL (CONTINUED)

I (We) hereby certify by execution of the Section 905 proposal below, that all certifications, disclosures and affidavits incorporated herein are deemed to be duly executed in the aggregate, fully enforceable and binding upon delivery of the bid proposal. I (We) further acknowledge that this certification shall not extend to the bid bond or alternate security which must be separately executed for the benefit of the Commission. This signature does not cure deficiencies in any required certifications, disclosures and/or affidavits. I (We) also acknowledge the right of the Commission to require full and final execution on any certification, disclosure or affidavit contained in the proposal at the Commission's election upon award. Failure to so execute at the Commission's request within the time allowed in the Standard Specifications for execution of all contract documents will result in forfeiture of the bid bond or alternate security.

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.

Revised 11/24/2008

Renovation of the Existing District Six Shop and Minor Site Improvements, known as State Project Nos. BWO-6211-18(003) / 502889301 & LWO-6017-18 (006) / 502889302 in Forrest County.

I (We) agree to complete the entire project within the specified contract time.

*****SPECIAL NOTICE TO BIDDERS*****

BIDS WILL NOT BE CONSIDERED UNLESS BOTH PRICES AND ITEM TOTALS ARE ENTERED.
BIDS WILL NOT BE CONSIDERED UNLESS THE BID CERTIFICATION LOCATED AT THE END OF THE BID SHEETS IS SIGNED

*****BID SCHEDULE*****

Line No.	Item Code	Adj Code	Quantity	Units	Description	Unit Price		Item Amount	
						Dollar	Ct	Dollar	Ct
					Building Items				
0010	907-242-A015		1	Lump Sum	Renovation ofExisting District Shop	XXXXXXX	XXX		
					Roadway Items				
0020	201-A001		1	Lump Sum	Clearing and Grubbing	XXXXXXX	XXX		
0030	202-A001		1	Lump Sum	Removal of Obstructions	XXXXXXX	XXX		
0040	202-B005		1,105	Square Yard	Removal of Asphalt Pavement, All Depths				
0050	202-B041		84	Linear Feet	Removal of Fence, All Types				
0060	202-B064		25	Linear Feet	Removal of Pipe, 8" And Above				
0070	202-B068		528	Square Yard	Removal of Reinforced Concrete Pavement, All Depths				
0080	202-B093		114	Linear Feet	Removal of Curb & Gutter, All Types				
0090	202-B170		2	Each	Removal of Concrete Junction Box, Manhole and Inlet, All Sizes				
0100	203-I002		2	Acre	Site Grading				
0110	219-A001		152	Thousand Gallon	Watering	20.	00	3,040.	00
0120	234-A001		680	Linear Feet	Temporary Silt Fence				
0130	503-C009		4,552	Linear Feet	Saw Cut, 2-inch				

Line No.	Item Code	Adj Code	Quantity	Units	Description	Unit Price		Bid Amount	
0140	602-A001	S	5,154	Pounds	Reinforcing Steel				
0150	603-CA001	S	280	Linear Feet	15" Reinforced Concrete Pipe, Class III				
0160	603-CA002	S	253	Linear Feet	18" Reinforced Concrete Pipe, Class III				
0170	607-B010		160	Linear Feet	72" Type II Chain Link Fence, Class I				
0180	609-D001	S	374	Linear Feet	Combination Concrete Curb and Gutter Type 1				
0190	907-216-A001		3,033	Square Yard	Solid Sodding				
0200	907-234-D001		8	Each	Inlet Siltation Guard				
0210	907-237-A002		288	Linear Feet	Wattles, 12"				
0220	907-258-K001		25	Each	Bollard				
0230	907-258-PP001		1	Each	Handicap Parking Sign and Post, Per Plans				
0240	907-265-PP003		1	Each	Fire Hydrant Assembly, Per Plans				
0250	907-304-H003	GY	626	Cubic Yard	Size 610 Crushed Stone Base, LVM				
0260	907-504-A002	C	51	Square Yard	4" Fiber Reinforced Concrete Pavement				
0270	907-601-B001	S	835	Cubic Yard	Class "B" Structural Concrete, Minor Structures, Per Plans				
0280	907-603-PP001		6	Each	Grate Inlet				
0290	907-604-C001	S	1	Each	Precast Manhole, 48-inch Diameter				
0300	907-607-AA001		88	Linear Feet	Ornamental Iron Fence				
0310	907-607-BB001		2	Each	Ornamental Gate, 6-foot Wide				
0320	907-611-PP003	S	20	Square Feet	Detectable Warning, Per Plans				
0330	907-626-B001		340	Linear Feet	4" Thermoplastic Traffic Stripe, Continuous White				
0340	907-626-B003		24	Linear Feet	6" Thermoplastic Traffic Stripe, Continuous White				

Line No.	Item Code	Adj Code	Quantity	Units	Description	Unit Price		Bid Amount	
0350	907-626-E001		66	Linear Feet	4" Thermoplastic Traffic Stripe, Continuous Yellow				
0360	907-626-G001		140	Linear Feet	Thermoplastic Detail Stripe, Blue-ADA				
0370	907-626-H002		1	Each	Thermoplastic Legend, Blue-ADA Handicap Symbol				

*** BID CERTIFICATION ***

TOTAL BID.....$_____

*** BID STATEMENT ***

BIDDER ACKNOWLEDGES THAT HE/SHE HAS CHECKED ALL ITEMS IN THIS PROPOSAL FOR ACCURACY AND CERTIFIED THAT THE FIGURES SHOWN THEREIN CONSTITUTE THEIR OFFICIAL BID.

_____

BIDDER'S COMPANY

_____

BIDDER'S FEDERAL TAX ID NUMBER

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).

	Project No.	County		Project No.	County
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. _____	_____ _____	_____ _____	_____ _____	_____ _____	

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.

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 September 8, 2011.

I (we) agree that this notification of intent DOES NOT constitute APPROVAL of the subcontracts.

(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 September 8, 2011.

Contractor _____

REV. 1/2016

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

CERTIFICATION

I,_____,
(Name of person signing bid)

individually, and in my capacity as _____ of
(Title of person signing bid)

_____
(Name of Firm, Partnership, or Corporation)

do hereby certify under 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-6211-18(003) / 502889301 & LWO-6017-18(006) / 502889302**,

in **Forrest** 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.

Do exceptions exit and are made a part thereof? Yes / No

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.

S E C T I O N 9 0 2

CONTRACT FOR **BWO-6211-18(003) / 502889301 & LWO-6017-18(006) / 502889302**

LOCATED IN THE COUNTY(IES) OF **Forrest**

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 _____

Title _____

Signed and sealed in the presence of:
(names and addresses of witnesses)

_____

MISSISSIPPI TRANSPORTATION COMMISSION

By _____
Executive Director

_____
Secretary to the Commission

Award authorized by the Mississippi Transportation Commission in session on the ____ day of _____, _____, Minute Book No. _____, Page No. _____.

Revised 8/06/2003

S E C T I O N 9 0 3
PERFORMANCE AND PAYMENT BOND

CONTRACT BOND FOR: **BWO-6211-18(003) / 502889301 & LWO-6017-18(006) / 502889302**

LOCATED IN THE COUNTY(IES) OF: **Forrest**

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, effective as of the contract date shown below, 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.

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, 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.

_____	_____
(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

Revised 9/02/2014

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 **Renovation of the Existing District Six Shop and Minor Site Improvements, known as State Project Nos. BWO-6211-18(003) / 502889301 & LWO-6017-18(006) / 502889302 in Forrest 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)

_____ By: _____
(Witness) (Name) (Title)

_____
(Surety) (Seal)

_____ By: _____
(Witness) (Attorney-in-Fact)

_____
MS Agent

_____
Mississippi Insurance ID Number