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SM No. CBWO6241300011

# PROPOSAL AND CONTRACT DOCUMENTS

## FOR THE CONSTRUCTION OF

10

Construction of Ocean Springs Maintenance Headquarters Building and Site Work,  
known as State Project Nos. BWO-6241-30(001) / 503010301 & LWO-6037-30  
(002) / 503010303 in Jackson County.

Project Completion: 10/31/2019

**(STATE DELEGATED)**

### NOTICE

**BIDDERS MUST COMPLETE AN ONLINE REQUEST  
FOR PERMISSION TO BID THIS PROJECT.**

Electronic addendum updates will be posted on [www.gomdot.com](http://www.gomdot.com)

# SECTION 900

## OF THE CURRENT 2017 STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION

JACKSON, MISSISSIPPI

**MISSISSIPPI DEPARTMENT OF TRANSPORTATION  
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LWO-6037-30(002)/503010303 - Jackson**

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

08/01/2018 07:31 AM

# MISSISSIPPI DEPARTMENT OF TRANSPORTATION

## SECTION 901 - ADVERTISEMENT

Electronic bids will be received by the Mississippi Transportation Commission at 10:00 o'clock A.M., Tuesday, August 28, 2018, from the Bid Express Service and shortly thereafter publicly read on the Sixth Floor for:

Construction of Ocean Springs Maintenance Headquarters Building and Site Work, known as State Project Nos. BWO-6241-30(001) / 503010301 & LWO-6037-30(002) / 503010303 in Jackson 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.

Contractors may request permission to bid online at <http://shopmdot.ms.gov> at no cost. Upon approval, Contractors shall be eligible to submit a bid using Bid Express at <http://bidx.com>. Specimen proposals may be viewed and downloaded online at no cost at <http://mdot.ms.gov> or purchased online at <http://shopmdot.ms.gov> at a cost of Ten Dollars (\$10.00) per proposal plus a small convenience fee. Cash or checks will not be accepted as payment.

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

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

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

MELINDA L. MCGRATH  
EXECUTIVE DIRECTOR

# MISSISSIPPI DEPARTMENT OF TRANSPORTATION

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

**CODE: (IS)**

**DATE: 03/01/2017**

**SUBJECT: Governing Specifications**

The current (2017) 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 within this proposal. Copies of the specification book may be purchased from the MDOT Construction Division, or online at [shopmdot/default.aspx?StoreIndex=1](http://shopmdot/default.aspx?StoreIndex=1).

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 2004 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 2017 Edition of the Standard Specifications.

**MISSISSIPPI DEPARTMENT OF TRANSPORTATION**

**SECTION 904 - NOTICE TO BIDDERS NO. 9**

**CODE: (IS)**

**DATE: 03/01/2017**

**SUBJECT: Federal Bridge Formula**

Bidders are hereby advised that the latest revision of Federal Highway Administration Publication No. FHWA-HOP-06-105, **BRIDGE FORMULA WEIGHTS**, dated August 2006, is made a part of this contract when applicable.

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

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

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

or

[http://www.ops.fhwa.dot.gov/Freight/publications/brdg\\_frm\\_wgths/bridge\\_formula\\_all\\_rev.pdf](http://www.ops.fhwa.dot.gov/Freight/publications/brdg_frm_wgths/bridge_formula_all_rev.pdf)

An on line **BRIDGE FORMULA WEIGHTS CALCULATOR** is available at

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

# MISSISSIPPI DEPARTMENT OF TRANSPORTATION

**SECTION 904 - NOTICE TO BIDDERS NO. 12**

**CODE: (IS)**

**DATE: 03/01/2017**

**SUBJECT: MASH Compliant Devices**

Bidders are hereby advised that the Standard Specifications may require certain traffic control and permanent safety hardware devices to meet the requirements of the Manual for Assessing Safety Hardware (MASH). However, devices meeting the requirements of NCHRP Report 350 will be allowed until the mandatory effective date for MASH compliance. The following table shows the effective dates for MASH compliant devices.

<b>Device</b>	<b>Effective Date for MASH Compliance</b>
W-beam barriers, cast-in-place concrete barriers	December 31, 2017
W-beam terminals	June 30, 2018
Cable barriers, cable barrier terminals, crash cushions	December 31, 2018
Bridge rails, transitions, all other longitudinal barriers including portable barriers installed permanently, all other terminals, sign supports, all other breakaway hardware	December 31, 2019

Temporary work zone devices, including portable barriers manufactured after December 31, 2019, must have been successfully tested to the 2016 Edition of MASH. Such devices manufactured on or before this date and successfully tested to NCHRP Report 350 or the 2009 Edition of MASH may continue to be used throughout their normal service lives.

**MISSISSIPPI DEPARTMENT OF TRANSPORTATION**

**SECTION 904 - NOTICE TO BIDDERS NO. 30**

**CODE: (SP)**

**DATE: 01/17/2017**

**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 2017 Edition of the Mississippi Standard Specifications for Road and Bridge Construction, the language in the 2017 Edition of the Mississippi Standard Specifications for Road and Bridge Construction shall govern.

**MISSISSIPPI DEPARTMENT OF TRANSPORTATION**

**SECTION 904 - NOTICE TO BIDDERS NO. 113**

**CODE: (SP)**

**DATE: 04/18/2017**

**SUBJECT: Tack Coat**

Bidders are advised that in addition to the products listed on the Department's APL as referenced in Subsection 401.03.1.2 on page 256, the Contractor may use one of the following as a tack coat.

- CSS-1
- CSS-1h
- SS-1
- SS-1h



**MISSISSIPPI DEPARTMENT OF TRANSPORTATION**

**SECTION 904 - NOTICE TO BIDDERS NO. 445**

**CODE: (SP)**

**DATE: 10/10/2017**

**SUBJECT: Mississippi Agent or Qualified Nonresident Agent**

Bidders are hereby advised of the requirements of Subsections 102.08, 103.05.2, and 107.14.2.1 of the *2017 Standard Specifications for Road and Bridge Construction* as it refers to bonding agents. Proposal guaranties, bonds, and liability insurance policies must be signed by a **Mississippi Agent or Qualified Nonresident Agent.**

## MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SECTION 904 - NOTICE TO BIDDERS NO. 516

CODE: (IS)

DATE: 11/28/2017

SUBJECT: Errata and Modifications to the 2017 Standard Specifications

<u>Page</u>	<u>Subsection</u>	<u>Change</u>
16	102.06	In the seventh full paragraph, change “Engineer” to “Director.”
33	105.05.1	In the sixth sentence, change “Contract Administration Engineer” to “Contract Administration Director.”
34	105.05.2.1	In subparagraph 2, change “SWPPP, ECP” to “SWPPP and the ECP”
35	105.05.2.2	In subparagraphs 2, add “ and” to the end of the sentence. In subparagraph 3, remove “, and” and add “.”.
90	109.04.2	In the last paragraph of subparagraph (a), place a period “.” at the end of the sentence.
93	109.04.2	In the last paragraph of subparagraph (g), place a period “.” at the end of the sentence. Also, in the first paragraph of subparagraph (h), place a period “.” at the end of the sentence.
97	109.07	Under ADJUSTMENT CODE, subparagraph (A1), change “HMA mixture” to “Asphalt mixtures.”
98	109.11	In the third sentence, change “Engineer” to “Director.”
219	308.04	In the last sentence of the last paragraph, change “Contractor’s decision” to “Engineer’s decision.”
300	405.02.5.9	In the first sentence of the second paragraph, change “Hot Mix Asphalt” to “Asphalt Mixtures.”
502	630.01.1	In the first paragraph, change “AASHTO” to “AASHTO’s LRFD”.
636	646.05	Change “each” to “per each” for the pay item units of payment.
640	656.02.6.2	In item 7), change “down stream” to “downstream”.
688	630.03.2	Change the subsection number from “630.03.2” to “680.03.2.”

725      702.08.3      In the second sentence of the first paragraph, change “hot-mix” to “asphalt.”

954      804.02.13.1.6      In the definition for “M” in the % Reduction formulas, change “paragraph 7.3” to “paragraph 5.3.”

**MISSISSIPPI DEPARTMENT OF TRANSPORTATION**

**SECTION 904 - NOTICE TO BIDDERS NO. 1083**

**CODE: (SP)**

**DATE: 07/25/2018**

**SUBJECT: Contract Time**

**PROJECT: BWO-6241-30(001) / 503010301&  
LWO-6037-30(002) / 503010303 – Jackson County**

The calendar date for completion of work to be performed by the Contractor for this project shall be **October 31, 2019** which date or extended date as provided in Subsection 108.06 shall be the end of contract time. It is anticipated that the Notice of Award will be issued no later than **September 11, 2018** and the effective date of the Notice to Proceed / Beginning of Contract Time will be **October 11, 2018**.

Should the Contractor request a Notice to Proceed earlier than **October 11, 2018** and it is agreeable with the Department for an early Notice to Proceed, the requested date will become the new Notice to Proceed date.

## MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-102-2

CODE: (IS)

DATE: 11/22/2017

SUBJECT: **Bidding Requirements and Conditions**

Section 102, Bidding Requirements and Conditions, of the 2017 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows.

**907-102.01--Prequalification of Bidders.** Delete the last sentence of the third paragraph of Subsection 102.01 on page 13, and substitute the following.

The Bidder's Certificate of Responsibility number must be on file with the Department's Contract Administration Division prior to request for permission to bid.

**907-102.02--Contents of Proposal Forms.** Delete the fourth paragraph in Subsection 102.02 on page 13, and substitute the following.

Prospective bidders must complete an online request for permission to be eligible to bid a project. Upon approval, the bidder will be authorized to submit a bid electronically using Bid Express at <http://bidx.com>.

## MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-103-2

CODE: (SP)

DATE: 06/22/2017

SUBJECT: Award and Execution of Contract

Section 103, Award and Execution of Contract, of the 2017 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows.

**907-103.01--Consideration of Proposal.** Delete the second and third paragraphs of Subsection 103.01 on page 19, and substitute the following.

**907-103.01.1--For Projects Constructed Without Federal Funds.** Resident Contractors actually domiciled in Mississippi are to be granted preference over nonresidents in awarding of Contracts financed 100% with State funds.

In consideration of proposals that are equal to or in excess of \$50,000 and financed 100% with State funds, a nonresident bidder domiciled in a state having laws granting preference to local Contractors will be considered for such contracts on the same basis as the nonresident bidder's state awards contracts to Mississippi Contractors bidding under similar circumstances. When a nonresident Contractor submits a bid equal to or in excess of \$50,000 on a contract financed 100% with State funds, a copy of the current laws from the state of domicile and an explanation thereof pertaining to treatment of nonresident Contractors shall be attached. If no preferential treatment is provided for Contractors in the state of domicile and contracts are awarded to the lowest responsible bidder, a statement to this effect shall be attached. Should the attachment not accompany the bid when submitted, the Contractor shall have 10 days following the opening of the bids to furnish the required information to the Contract Administration Director for attachment to the bid. Failure to provide the attachment within 10 days will result in the nonresident Contractor's bid being rejected and not considered for award. As used herein, the term "resident Contractor" includes a nonresident person, firm or corporation that has been qualified to do business in this State and has maintained a permanent full-time office in the State of Mississippi for two years prior to the submission of the bid, and the subsidiaries and affiliates of such a person, firm or corporation.

**MISSISSIPPI DEPARTMENT OF TRANSPORTATION**

**SPECIAL PROVISION NO. 907-242-6**

**CODE: (SP)**

**DATE: 07/17/2018**

**SUBJECT: Maintenance Area Headquarters**

**PROJECT: BWO-6241-30(001) / 503010301& LWO-6037-30(002) 503010303 -- Jackson County**

Section 907-242, Maintenance Area Headquarters, is hereby added to and made part of the 2017 Edition of the Mississippi Standard Specifications for Road and Bridge Construction as follows.

**SECTION 907-242--MAINTENANCE AREA HEADQUARTERS**

The specification format for this item of work is different than normal. The Contractor shall perform the construction of the Ocean Springs Maintenance Area Headquarters Building and Site Work in accordance with the requirements set forth as follows. All other items of work shall be performed in accordance with the 2017 Mississippi Standard Specification.

DOCUMENT 00 01 07

SEAL PAGE

Architectural  
J. Russell Perkins, Architect  
MDOT-ASU  
401 N. West Street  
Jackson, MS 39201  
(601) 359-7292

Civil  
Wallace Smith, PE  
Garver, LLC  
4701 Northshore Drive  
North Little Rock, AR 72118  
(501) 376-3633

Structural  
David Clement, PE, SE  
Garver, LLC  
4701 Northshore Drive  
North Little Rock, AR 72118  
(501) 376-3633

Plumbing / Mechanical  
Joel Funkhouser, PE  
Garver, LLC  
4701 Northshore Drive  
North Little Rock, AR 72118  
(501) 376-3633

Electrical  
Bryan Melton, PE  
Garver, LLC  
4701 Northshore Drive  
North Little Rock, AR 72118  
(501) 376-3633



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PROJECT: MAINTENANCE AREA HEADQUARTERS AT OCEAN SPRINGS, JACKSON COUNTY, MISSISSIPPI

PROJECT NUMBER: BWO-6241-30(001) 503010  
LWO-6037-30(002) 503010

DATE: 5-23-18

**DESCRIPTION A:** This Work shall consist of minor site work and all construction work necessary in constructing a Maintenance Area Headquarters for District Six at Ocean Springs, Jackson County, Mississippi, Project No. BWO-6241-30(001) 503010, in accordance with these Specifications and conforming to the Drawings.

The Site Improvements portion of this Work shall consist of demolition of existing shop building and site work outside and adjacent to the Work described for construction of the buildings or structures for District Six at Ocean Springs, Jackson County, Mississippi, Project No. LWO-6037-30(002) 503010. See Civil Drawings and Special Provisions for extent of this portion of the Work.

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.

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## 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:

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## DOCUMENT 00 21 13

## INSTRUCTIONS TO BIDDERS

## 1.01 QUESTIONS

- A. Questions Regarding Bidding: Bidders are advised that all questions that arise regarding the contract documents (proposal) or plans on this project shall be directed to the [www.gomdot.com](http://www.gomdot.com) current letting webpage. Click on the call number for this project to open an email form to submit your question. Questions must be submitted by 8:00 a.m. on the Thursday prior to the letting. Answers to questions will be posted by 5:00 p.m. on the Thursday prior to the letting. Answers can be viewed by clicking on Q&A link under the Proposal Addenda column.
- B. 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.

## 1.02 BIDDER'S QUALIFICATIONS

- A. Prequalification of Bidders: Refer to Mississippi Standard Specifications for Road and Bridge Construction 2017 Edition Section 102 – Bidding Requirements and Conditions, Subsection 102.01 – Prequalification of Bidders.

## 1.03 NON-RESIDENT BIDDER

- A. Consideration of Proposals: Refer to Mississippi Standard Specifications for Road and Bridge Construction 2017 Edition Section 103 – Award and Execution of Contract, Subsection 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 2017 Edition Section 102 – Bidding Requirements and Conditions, Subsection 102.05 – Examination of Plans, Specifications, Special Provisions, Notice to Bidders and Site Work.
- B. There will be no Pre-Bid Meeting, but failure to visit the site prior to submitting a bid will in no way relieve the successful Bidder from furnishing materials or performing work required to complete Work in accordance with Drawings and Project Manual (Proposal).

## 1.06 LAWS AND REGULATIONS

- A. Laws and Regulations: Refer to Mississippi Standard Specifications for Road and Bridge Construction 2017 Edition Section 107 – Legal Relations and Responsibility to Public, Subsection 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 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 2017 Edition Section 102 – Bidding Requirements and Conditions, Subsection 102.06 – Preparation of Proposal.

## 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.

## 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 <https://corp.sos.ms.gov/corp/portal/c/page/corpBusinessIdSearch/portal.aspx?#clear=1> which should be the same as you applied for at the Mississippi Board of Contractors <http://www.msdoc.us/>
- C. Legal Address: The address appearing on the Proposal Form should be the same address exact as recorded at the Secretary of State <https://corp.sos.ms.gov/corp/portal/c/page/corpBusinessIdSearch/portal.aspx?#clear=1> which should be the same as you applied for at the Mississippi Board of Contractors <http://www.msdoc.us/>

- 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 2017 Edition Section 102 – Bidding Requirements and Conditions, Subsection 102.08 – Proposal Guaranty with the exception that the first and second paragraphs in Subsection 102.08 on page 20 should be deleted and substitute:
1. 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 103.05.1, 103.05.2, and as required by law.
  2. If a bid bond is offered as guaranty, the bond must be 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 103.05.2, applicable.

#### 1.15 POWER OF ATTORNEY

- A. Power of Attorney: Refer to Mississippi Standard Specifications for Road and Bridge Construction 2017 Edition Section 103 – Award and Execution of Contract, Subsection 103.05 – Requirement of Contract Bond.

#### 1.16 SUBMITTAL

- A. Delivery of Proposals: Refer to Mississippi Standard Specifications for Road and Bridge Construction 2017 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 2017 Edition Section 102 – Bidding Requirements and Conditions, Subsection 102.12 – Public Opening of Proposal.

**1.19 IRREGULARITIES**

- A. Irregular Proposals: Refer to Mississippi Standard Specifications for Road and Bridge Construction 2017 Edition Section 102 – Bidding Requirements and Conditions, Subsection 102.07 – Irregular Proposal. Proposals will be considered irregular and may be rejected for any of the following reasons:
1. If the proposal is on a form other than that furnished by the Department, or if the form is altered or any part thereof is detached except that is allowed.
  2. If there are unauthorized additions, conditions or alternate bids, or irregularities of any kind that may tend to make the proposal incomplete, indefinite, or ambiguous as to its meaning.
  3. If the bidder adds any provisions reserving the right to accept or reject an award, or to enter into a Contract pursuant to an award.
  4. If the proposal, Section 905, does not contain acknowledgement of receipt and addition to the proposal and contract documents of all addenda.
  5. Failure to execute required affidavits, certificates, etc., and furnish proposal guaranty.
  6. The Commission reserves the right, for any reason, to reject any or all proposals, to waive technicalities or irregularities, or to advertise for new proposals, and the decision of the Commission to reject any bid or proposal shall not be cause for any liability or damage against the Commission, the Department, or any of its officers or employees.

**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 2017 Edition Section 103 – Award and Execution of Contract, Subsection 103.02 – Award of Contract.
- B. Consideration of Proposal: Refer to Mississippi Standard Specifications for Road and Bridge Construction 2017 Edition Section 103 – Award and Execution of Contract, Subsection 103.01 – Consideration of Proposal. .

**1.23 FAILURE TO ENTER INTO A CONTRACT**

- A. Failure to Execute Contract: Refer to Mississippi Standard Specifications for Road and Bridge Construction 2017 Edition Section 103 – Award and Execution of Contract, Subsection 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 2017 Edition Section 103 – Award and Execution of Contract, Subsection 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..
2. Alternates:  
 Fill-in each alternates amount in 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 <https://corp.sos.ms.gov/corp/portal/c/page/corpBusinessIdSearch/portal.aspx?clear=1> which should be the same as you applied for at the Mississippi Board of Contractors <http://www.msdoc.us/>  
 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: Kerry Harris – Contract Administration (601) 359-7700
  - 2. Bid Forms: Neal Dougherty – Contract Admin. Director (601) 359-7730
  - 3. Specifications: Shane Martin – Assist. Construction Engr. (601) 359-7301
  - 4. Drawings: Shane Martin – Assist. Construction Engr. (601) 359-7301
  - 5. 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 2017 Edition Section 107 – Legal Relations and Responsibility to Public, Subsection 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 2017 Edition Section 107 – Legal Relations and Responsibility to Public, Subsection 107.22.7 – Quarantine Information.

1.04 PROMPT PAYMENT

- A. General: Refer to Mississippi Standard Specifications for Road and Bridge Construction 2017 Edition Section 108 – Prosecution and Progress, Subsection 108.01.1 – General.

1.05 ALTERATIONS IN BIDDING PROCESS

- A. Preparation of Proposal: Refer to Mississippi Standard Specifications for Road and Bridge Construction 2014 Edition Section 102 – Bidding Requirements and Conditions, Subsection 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 2017 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 for building construction.

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. Metal Building System
    - d. Thin-Set Tiling
    - e. Plumbing Items
    - f. Heating, Ventilating and Air Conditioning Items
    - g. Security and Surveillance Items
    - h. Electrical Items
  2. These items are not to be confused with Division 10 – Specialties of the Specifications.
  3. See Notice To Bidders for Specialty Items associated with the Site Improvements for this Project.

END OF DOCUMENT



DOCUMENT 00 31 26

EXISTING HAZARDOUS MATERIAL INFORMATION

1.01 EXISTING HAZARDOUS MATERIAL INFORMATION

- A. This Document with its referenced attachments, Asbestos Survey Report, MDOT Ocean Springs Project Office, Ocean Springs, Jackson County, Mississippi, prepared by Terracon Consultants, Inc. on January 4, 2018, is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of Bidders' own investigations. They are made available for Bidders' convenience and information, but are not a warranty of existing conditions. This Document and its attachments are not part of the Contract Documents.
  
- B. Related Requirements:
  - 1. Document 00 21 13 "Instructions to Bidders" for the Bidder's responsibilities for examination of Project site and existing conditions.
  - 2. Document 00 31 19 "Existing Condition Information" for information about existing conditions that is made available to bidders.
  - 3. Document 00 31 32 "Geotechnical Data" for reports and soil-boring data from geotechnical investigations that are made available to bidders.
  - 4. Section 02 41 16 "Structure Demolition" for notification requirements if materials suspected of containing hazardous materials are encountered.

END OF DOCUMENT

# Asbestos Survey Report

MDOT Ocean Springs Project Office  
Ocean Springs, Jackson County, Mississippi

January 4, 2018

Terracon Project No. EB177209



**Prepared for:**

Mississippi Department of Transportation  
Jackson, Mississippi

**Prepared by:**

Terracon Consultants, Inc.  
Ridgeland, Mississippi

[terracon.com](http://terracon.com)

**Terracon**

Environmental



Facilities



Geotechnical



Materials



January 4, 2018

Mississippi Department of Transportation  
P.O. Box 1850  
Jackson, Mississippi 39225

Attn: Ms. Joni Moore  
E: [jonimoore@mdot.ms.gov](mailto:jonimoore@mdot.ms.gov)

Re: Asbestos Survey Report  
MDOT Work Assignment: TCI-ASB 2017-02  
Project No.: BWO-6067-30(002)/503010-101100  
Ocean Springs Project Office  
Ocean Springs, Mississippi  
Terracon Project No. EB177209

Dear Ms. Moore:

The purpose of this report is to present the results of an asbestos survey performed on December 21, 2017, at the above referenced location in Ocean Springs, Mississippi. This survey was conducted in general accordance with MDOT Work Assignment TCI-ASB 2017-01, dated December 4, 2017. We understand that this survey was requested due to a planned demolition of the building.

No asbestos-containing materials (>1% asbestos) were identified in the sampled suspect materials. Please refer to the attached report for complete details associated with this asbestos survey.

Terracon Consultants, Inc. appreciates the opportunity to provide this service to the Mississippi Department of Transportation. If you have any questions regarding this report, please contact the undersigned at (601) 956-4467.

Sincerely,  
**Terracon Consultants, Inc.**

Prepared by:

Brad McKnight  
Project Industrial Hygienist

Reviewed by:

Richard M. Simon  
Senior Principal/Regional Manager

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**APPENDIX B ASBESTOS ANALYTICAL LABORATORY REPORTS**

**APPENDIX C PHOTOGRAPHIC DOCUMENTATION**

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**ASBESTOS SURVEY REPORT**  
**MISSISSIPPI DEPARTMENT OF TRANSPORTATION**  
**OCEAN SPRINGS PROJECT OFFICE**  
**OCEAN SPRINGS, MISSISSIPPI**

**TERRACON PROJECT NO. EB177209**  
**JANUARY 4, 2018**

## **1.0 INTRODUCTION**

Terracon Consultants, Inc. (Terracon) conducted an asbestos survey of the Ocean Springs Project Office located in Ocean Springs, Mississippi. The asbestos survey was conducted on December 21, 2017 by a State of Mississippi accredited asbestos inspector in general accordance with MDOT Work Assignment TCI-ASB 2017-02, dated December 4, 2017. Components of the building were surveyed and homogeneous areas of suspect asbestos-containing materials (ACM) were visually identified and documented. Suspect ACM samples were collected in general accordance with the sampling protocols outlined in EPA regulation 40 CFR 763 (Asbestos Hazard Emergency Response Act, AHERA). Samples were delivered to an accredited laboratory for analysis by Polarized Light Microscopy (PLM).

### **1.1 Project Objective**

We understand this asbestos survey was requested due to the planned demolition of the Ocean Springs Project Office. EPA regulation 40 CFR 61, Subpart M, National Emission Standards for Hazardous Air Pollutants (NESHAP) and Mississippi Administration Code Title 11, Part 2, Chapter 1, Rule 1.8, prohibits the release of asbestos fibers to the atmosphere during renovation or demolition activities. The asbestos NESHAP and MDEQ requires that potentially regulated ACM (RACM) be identified, classified and quantified prior to planned disturbances or demolition activities.

## **2.0 SITE DESCRIPTION**

The Ocean Springs Project Facility is currently developed as an office space and a shop. The facility is constructed of metal panels and metal windows. The interior has wood and metal framing with sheetrock and wood paneled walls. The office space is finished with ceramic floor tile and textured ceiling. The shop area has concrete floors and exposed metal roof with fiberglass insulation.

## **3.0 FIELD ACTIVITIES**

The survey was conducted by Mr. Brad McKnight, a State of Mississippi accredited asbestos inspector (accreditation No. ABI-0001685). A copy of Mr. McKnight's asbestos inspector license is

## **Asbestos Survey Report**

MDOT/Ocean Springs Project Office ■ Ocean Springs, Mississippi

January 4, 2018 ■ Terracon Project No. EB177209



attached in Appendix D. The survey was conducted in general accordance with the sample collection protocols established in EPA regulation 40 CFR 763, the Asbestos Hazard Emergency Response Act (AHERA). A summary of survey activities is provided below.

### **3.1 Visual Assessment**

Our survey activities began with visual observation of the site to identify homogeneous areas of suspect ACM. A homogeneous area consists of building materials that appear similar throughout in terms of color and texture, with consideration of the date of application.

Materials identified as concrete, glass, wood, masonry, metal or rubber were not considered suspect ACM.

### **3.2 Physical Assessment**

A physical assessment of each homogeneous area of suspect ACM was conducted to assess the friability and condition of the materials. A friable material is defined by the EPA as a material which can be crumbled, pulverized or reduced to powder by hand pressure when dry. Friability was assessed by physically touching suspect materials.

### **3.3 Sample Collection**

Based on results of the visual observation, bulk samples of suspect ACM were collected in general accordance with AHERA sampling protocols. Random samples of suspect materials were collected in each homogeneous area. Samples were placed in sealable containers and labeled with unique sample numbers using an indelible marker.

Eleven (11) bulk samples were collected from five (5) homogeneous areas of suspect ACM.

### **3.4 Sample Analysis**

Bulk samples of suspect ACM were submitted under chain of custody (COC) to EMSL Analytical, Inc. (EMSL) of Baton Rouge, Louisiana for analysis by PLM with dispersion staining techniques per EPA methodology 600/R-93/116. The percentage of asbestos, where applicable, was determined by microscopical visual estimation. EMSL is accredited under the National Voluntary Laboratory Accreditation Program (NVLAP Accreditation No. 200375.03).

## **4.0 REGULATORY OVERVIEW**

The State of Mississippi utilizes the Mississippi Department of Environmental Quality (MDEQ) to regulate and enforce asbestos-related activity within the state. MDEQ requires that all individual or company performing an asbestos-related activity be accredited or licensed by the State of Mississippi, through the MDEQ. MDEQ requires each owner or operator of a demolition or renovation activity to notify at least 10 working days before asbestos stripping or removal work or any other activity begins that would break up, dislodge, or similarly disturb asbestos material. An asbestos-related activity consists of the disturbance (whether intentional or unintentional) or abatement of ACM, the performance of asbestos surveys, the development of management plans, asbestos project design, monitoring for airborne asbestos.

The asbestos NESHAP (40 CFR Part 61, Subpart M) regulates asbestos fiber emissions and asbestos waste disposal practices. The asbestos NESHAP regulation also requires the identification and classification of existing ACM according to friability prior to demolition or renovation activity. Friable ACM is a material containing more than 1% asbestos that, when dry, can be crumbled, pulverized or reduced to powder by hand pressure. All friable ACM is considered regulated asbestos containing material (RACM).

The asbestos NESHAP regulation classifies ACM as either RACM, Category I non-friable ACM or Category II non-friable ACM. RACM includes all friable ACM, along with Category I and Category II non-friable ACM that has become friable, will be or has been subjected to sanding, grinding, cutting or abrading, or ACM that has a high probability of becoming or has become crumbled, pulverized, or reduced to powder in the course of renovation or demolition activity. Category I non-friable ACM are exclusively asbestos-containing packings, gaskets, resilient floor coverings, resilient floor covering mastics and asphalt roofing products that contain more than 1% asbestos. Category II non-friable ACM and all other non-friable materials other than Category I non-friable ACM that contain more than 1% asbestos. Category II non-friable ACM generally includes but is not limited to cementitious material such as: cement pipes, cement siding, cement panels, glazing, mortar and grouts.

The United States Occupational Safety and Health Administration (USOSHA) asbestos standard for construction (29 CFR 1926.1101) regulates workplace exposure to asbestos. The USOSHA standard requires that employee exposure to airborne asbestos must not exceed 0.1 fibers per cubic centimeter of air (0.1 f/cc) as an eight-hour time weighted average (TWA) and not exceed 1.0 fibers per cubic centimeter of air (1.0 f/cc) over a 30-minute time period known as an excursion limit (EL). The TWA and EL are known as USOSHA's asbestos permissible exposure limits (PELs). The USOSHA standard classifies construction and maintenance activities which could disturb ACM, and specifies work practices and precautions which employers must follow when engaging in each class of regulated work.

## Asbestos Survey Report

MDOT/Ocean Springs Project Office ■ Ocean Springs, Mississippi

January 4, 2018 ■ Terracon Project No. EB177209



## 5.0 FINDINGS AND RECOMMENDATIONS

Laboratory analysis did not detect ACM (>1% asbestos) in the sampled materials. Should un-sampled materials become evident during the demolition or renovation activities, Terracon should be contacted to perform further sampling activities before the material is disturbed.

Due to the limitations of the survey performed, the possibility exists that additional suspect ACM is present that was not identified herein. Any suspect ACM not previously identified should be treated as assumed ACM until laboratory analysis confirms the presence or absence of asbestos.

In addition, MDEQ requires a 10-working day notification of any demolition activity, when the building is not expected to contain any asbestos.

## 6.0 GENERAL COMMENTS

This asbestos survey was conducted in a manner consistent with the level of care and skill ordinarily exercised by members of the profession currently practicing under similar conditions in the same locale. The results, findings, conclusions and recommendations expressed in this report are based on conditions observed during our survey of the building. The information contained in this report is relevant to the date on which this survey was performed, and should not be relied upon to represent conditions at a later date. This report has been prepared on behalf of and exclusively for use by the Mississippi Department of Transportation to their project as discussed. This report is not a bidding document. Contractors or consultants reviewing this report must draw their own conclusions regarding further investigation or remediation deemed necessary. Terracon does not warrant the work of regulatory agencies, laboratories or other third parties supplying information which may have been used in the preparation of this report. No warranty, express or implied is made.



**APPENDIX A**  
**ASBESTOS SURVEY SAMPLE SUMMARY**

**MDOT/Ocean Springs Project Office  
Ocean Springs, Mississippi**

**ASBESTOS SURVEY SAMPLE LOCATION SUMMARY**

<b>HA #.</b>	<b>SAMPLE #</b>	<b>MATERIAL DESCRIPTION</b>	<b>SAMPLE LOCATIONS</b>	<b>LAB RESULTS</b>
1	OSPO-01-01	SHEETROCK/MUD	OFFICE AREA	ND
1	OSPO-01-02	SHEETROCK/MUD	OFFICE AREA	ND
2	OSPO-02-01	CEILING TEXTURE	OFFICE AREA	ND
2	OSPO-02-02	CEILING TEXTURE	OFFICE AREA	ND
2	OSPO-02-03	CEILING TEXTURE	OFFICE AREA	ND
3	OSPO-03-01	WALL INSULATION	OFFICE AREA	ND
3	OSPO-03-02	WALL INSULATION	OFFICE AREA	ND
4	OSPO-04-01	WINDOW CAULKING	OFFICE AREA	ND
4	OSPO-04-02	WINDOW CAULKING	OFFICE AREA	ND
5	OSPO-05-01	TILE GROUT	OFFICE AREA	ND
5	OSPO-05-02	TILE GROUT	OFFICE AREA	ND

ND = no asbestos detected

**APPENDIX B**

**ASBESTOS LABORATORY ANALYTICAL REPORTS**



# EMSL Analytical, Inc.

18369 Petroleum Drive Baton Rouge, LA 70809  
Tel/Fax: (225) 755-1920 / (225) 755-1989  
<http://www.EMSL.com> / [batonrougelab@emsl.com](mailto:batonrougelab@emsl.com)

**EMSL Order:** 251707297  
**Customer ID:** AQTA63  
**Customer PO:** EB177209  
**Project ID:**

**Attention:** Brad McKnight  
Terracon  
859 Pear Orchard Road  
Ridgeland, MS 39157

**Phone:** (601) 956-4467  
**Fax:** (601) 956-9533  
**Received Date:** 12/26/2017 9:35 AM  
**Analysis Date:** 12/29/2017 - 01/02/2018  
**Collected Date:** 12/21/2017

**Project:** O.S. PROJECT OFFICE EB177209

## Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Description	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
OSPO-01-01-Texture <small>251707297-0001</small>	Front Offices - Sheetrock/Mud	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
OSPO-01-01-Sheetrock <small>251707297-0001A</small>	Front Offices - Sheetrock/Mud	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
OSPO-01-02-Texture <small>251707297-0002</small>	Front Offices - Sheetrock/Mud	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
OSPO-01-02-Sheetrock <small>251707297-0002A</small>	Front Offices - Sheetrock/Mud	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
OSPO-02-01-Texture <small>251707297-0003</small>	Front Offices - Ceiling Surface Material	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
OSPO-02-01-Sheetrock <small>251707297-0003A</small>	Front Offices - Ceiling Surface Material	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
OSPO-02-02-Texture <small>251707297-0004</small>	Front Offices - Ceiling Surface Material	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
OSPO-02-02-Sheetrock <small>251707297-0004A</small>	Front Offices - Ceiling Surface Material	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
OSPO-02-03-Texture <small>251707297-0005</small>	Front Offices - Ceiling Surface Material	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
OSPO-02-03-Sheetrock <small>251707297-0005A</small>	Front Offices - Ceiling Surface Material	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
OSPO-03-01 <small>251707297-0006</small>	Front Offices - Wall Insulation	Yellow Fibrous Homogeneous	98% Glass	2% Non-fibrous (Other)	None Detected
OSPO-03-02 <small>251707297-0007</small>	Front Offices - Wall Insulation	Yellow Fibrous Homogeneous	98% Glass	2% Non-fibrous (Other)	None Detected
OSPO-04-01 <small>251707297-0008</small>	Front Offices - Exterior Window Caulking	White/Clear Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
OSPO-04-02 <small>251707297-0009</small>	Front Offices - Exterior Window Caulking	White/Clear Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
OSPO-05-01-Ceramic Tile <small>251707297-0010</small>	Front Offices - Tile Grout	Brown Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
OSPO-05-01-Grout <small>251707297-0010A</small>	Front Offices - Tile Grout	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected

Initial report from: 01/02/2018 09:38:46



# EMSL Analytical, Inc.

18369 Petroleum Drive Baton Rouge, LA 70809  
Tel/Fax: (225) 755-1920 / (225) 755-1989  
<http://www.EMSL.com> / [batonrougelab@emsl.com](mailto:batonrougelab@emsl.com)

EMSL Order: 251707297  
Customer ID: AQTA63  
Customer PO: EB177209  
Project ID:

## Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Description	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
OSPO-05-02	Front Offices - Tile Grout	Brown/Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
251707297-0011					

Analyst(s)  
Brett Heitzmann (7)  
Joshua Brunet (10)

*Jamie Laginess*  
Jamie Laginess, Laboratory Operations Manager  
or Other Approved Signatory

EMSL maintains liability limited to cost of analysis. This report relates only to the samples reported and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST or any agency of the federal government. Non-friable organically bound materials present a problem matrix and therefore EMSL recommends gravimetric reduction prior to analysis. Samples received in good condition unless otherwise noted. Estimated accuracy, precision and uncertainty data available upon request. Unless requested by the client, building materials manufactured with multiple layers (i.e. linoleum, wallboard, etc.) are reported as a single sample. Reporting limit is 1%

Samples analyzed by EMSL Analytical, Inc. Baton Rouge, LA NVLAP Lab Code 200375-0, LELAP 01950, TX 300238

Initial report from: 01/02/2018 09:38:46

**APPENDIX C**  
**PHOTOGRAPHIC DOCUMENTATION**

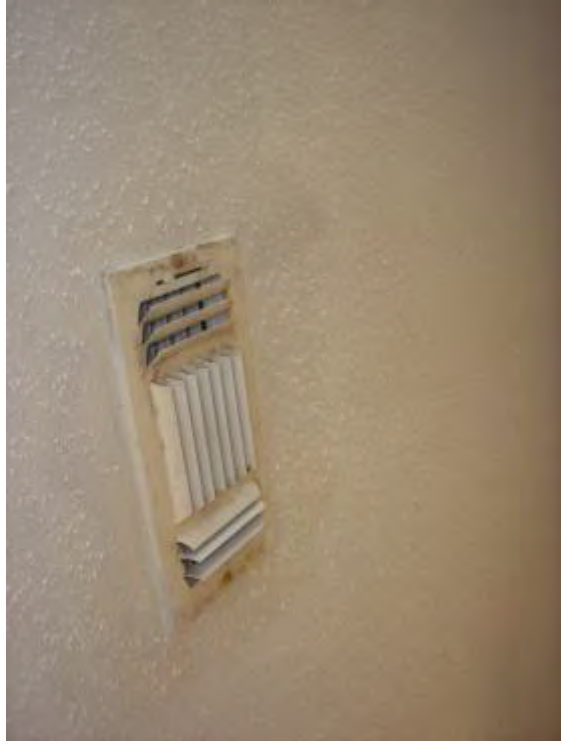


Photo 1: Ceiling Texture Material

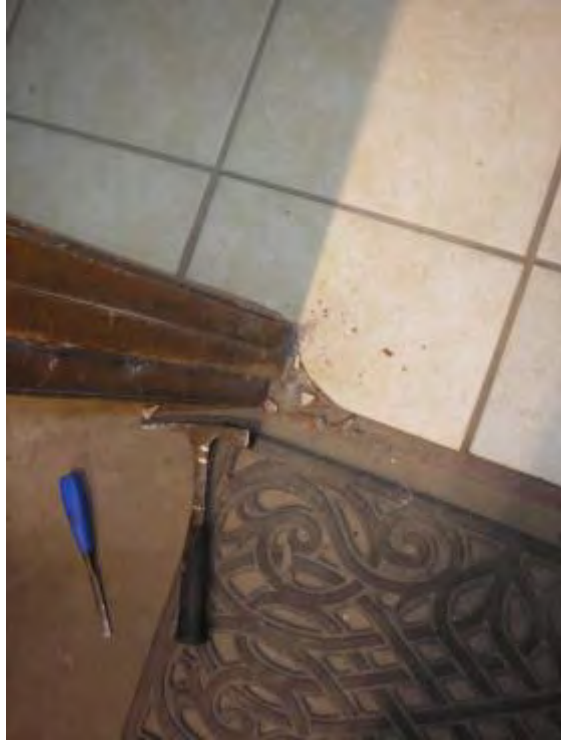


Photo 2: Tile Grout



Photo 3: Wall Insulation



Photo 4: Window Caulking

**APPENDIX D**  
**LICENSES AND CERTIFICATIONS**



# *State of Mississippi*

*Department of Environmental Quality  
Office of Pollution Control*

## *Certificate of Licensure*

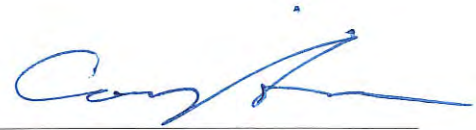
In accordance with the Asbestos Abatement Accreditation and Certification Act,  
Enacted as 1989 Mississippi Law, Chapter 505

Be it known that

***Brad McKnight***

Having submitted acceptable evidence of qualifications and  
training and other appropriate information, is hereby granted this

***Asbestos Inspector  
Certification***



*Certificate No.: ABI-00001685  
Expiration Date: Jul 12th, 2018  
Training Expires on Jul 12th, 2018*

*Chief, Asbestos & Lead Certification Branch*

41468 LIC20170001

DOCUMENT 00 31 32

GEOTECHNICAL DATA

1.01 GEOTECHNICAL DATA

- A. This Document with its referenced attachments, Geotechnical Engineering Report, MDOT Maintenance Building, Gautier, Mississippi, prepared by Terracon Consultants, Inc. on February 1, 2018, is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of Bidders' own investigations. They are made available for Bidders' convenience and information, but are not a warranty of existing conditions. This Document and its attachments are not part of the Contract Documents. Geotechnical Data may also be referred to in the Contract Documents as the "Geotechnical Report" or "Soils Engineering Report".
- 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.
- C. In the event of a conflict between the Geotechnical Data and the Construction Documents, notify the Project Engineer in writing of conflict to determine course of action prior to proceeding.

END OF DOCUMENT

# Terracon GeoReport

**MDOT Maintenance Building  
Gautier, Mississippi**

February 1, 2018

Terracon Project No. EB175118

**Prepared for:**

Garver, LLC

Jackson, Mississippi

**Prepared by:**

Terracon Consultants, Inc.

Ridgeland, Mississippi

[terracon.com](http://terracon.com)

# Terracon

Environmental



Facilities



Geotechnical



Materials

February 1, 2018

Garver, LLC  
6360 I-55 Frontage Road North, #340  
Jackson, Mississippi 39211



Attn: Mr. Joel Funkhouser  
E: [JCFunkhouser@GarverUSA.com](mailto:JCFunkhouser@GarverUSA.com)

Re: Geotechnical Engineering Report  
MDOT Maintenance Building  
Gautier, Mississippi  
Terracon Project Number: EB175118


Mr. Funkhouser:

We have completed the geotechnical engineering services for the above-referenced project. This work was performed in accordance with our proposal number PEB175118 dated October 26, 2017.

This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of foundations, floor slabs and pavements for the proposed project.

We should collaborate with you as you finalize the designs. We should also review the pertinent aspects of the plans and specifications and provide construction materials and engineering testing services when the project moves into construction. If you have any questions concerning this report, or if we may be of further service, please contact us.

Sincerely,  
**Terracon Consultants, Inc.**

  
Nick K. Leber, E.I.  
Staff Engineer  
Geotechnical Services



Jeffrey W. Williams, P.E.  
Senior Engineer  
Geotechnical Services  
Mississippi PE No. 16392

Terracon Consultants, Inc. 859 Pear Orchard Ridgeland, MS 39157  
P [601] 956 4467 F [601] 956 9533 [terracon.com](http://terracon.com)

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## **APPENDIX A – EXPLORATION AND LABORATORY RESULTS**

Exhibit A-1	Site Location
Exhibit A-2	Exploration Plan
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## **APPENDIX B – SUPPORTING DOCUMENTS**

Exhibit B-1	General Notes
Exhibit B-2	Unified Soil Classification System

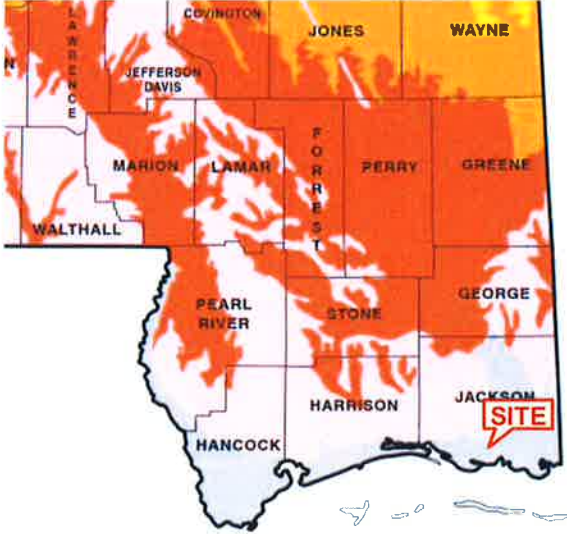
## PROJECT DESCRIPTION

Our initial understanding of the project was provided in our Stage 1 submittal in **Project Understanding**. Our current understanding of the project conditions is as follows.

ITEM	DESCRIPTION
<b>Project Location</b>	Off of Linda Drive in Gautier, Mississippi (approximately 30° 25' 40.99" N, -88° 42' 49.42" W) See <b>Site Location</b>
<b>Proposed Structure</b>	The project will include an approximate 8,200 square foot single-story building
<b>Building construction</b>	The proposed building will be steel-framed with brick exterior walls
<b>Maximum loads</b>	Columns: 75 kips maximum Walls: 3 kips per linear foot maximum Slabs: 100 pounds per square foot maximum
<b>Grading/Slopes</b>	Finished floor elevation is understood to be at Elev. 26.5 feet. We expect nominal fill thicknesses of 1 to 2 feet to be required to achieve final grades. Final slope angles of as steep as 3(H): 1(V) are expected.
<b>Pavements</b>	A paved parking area will be constructed west of the proposed building. No decision has been made at this point regarding pavement surface, so we assume that both rigid (concrete) and flexible (asphalt) pavement sections should be considered. Anticipated Traffic is as follows: Autos/Light Trucks: 1,000 vehicles per day Light Delivery and Trash Collection Vehicles: 10 vehicles per week Tractor-trailer trucks: Less than 1 vehicle per week. The pavement design life is 20 years.
<b>Estimated Start of Construction</b>	Spring 2018

## SITE CONDITIONS

The following description of site conditions is derived from our site visit in association with the field exploration and our review of publically available geologic and topographic maps.

ITEM	DESCRIPTION
<b>Parcel Information</b>	Off of Linda Drive in Ocean Springs, Mississippi See <b>Site Location</b>
<b>Existing improvements</b>	Maintenance building with asphalt and gravel parking areas
<b>Current ground cover</b>	Various, existing building, asphalt and gravel parking and drive areas, and grass
<b>Existing topography</b>	The site is relatively level with a maximum elevation difference of about 2 feet
<b>Geology</b>	<p>The soils at this site are sediments of the coastal deposits of the Mississippi gulf coast. This formation is geologically young in age and is characterized by a cross-bedded mixture of silt, sand, gravel, and clay. The deposits may also contain limestone at depth. The sediments of the coastal deposits lack regional lithologic layering and tend to be discontinuous with variable thickness.</p>  <p>The map shows the state of Mississippi divided into counties. The counties labeled are LAWRENCE, COVINGTON, JONES, WAYNE, JEFFERSON, DAVIS, MARION, LAMAR, FOREST, PERRY, GREENE, WALTHALL, PEARL RIVER, STONE, GEORGE, HANCOCK, HARRISON, and JACKSON. A red box labeled 'SITE' is located in Jackson County, near the Gulf of Mexico coast.</p>

## EXPLORATION AND TESTING PROCEDURES

### Field Exploration

Our field exploration work included the drilling and sampling of exploratory soil borings consistent with the following schedule.

NUMBER OF BORINGS	BORING DEPTH	PLANNED LOCATION
3	24	Building
4	10	Parking and Drive Areas

The locations of field exploration points were established in the field by Terracon's exploration team using a hand-held GPS unit to establish boring locations with reference to known points. The accuracy of the exploration points is usually within 20 feet of the noted location.

We advanced the soil borings with a tractor-mounted drill rig using continuous flight augers (solid stem). We primarily obtained samples using the split-barrel sampling procedure. In the split-barrel sampling procedure, a standard, 2-inch O.D., split-barrel sampling spoon is driven into the boring with a 140-pound automatic SPT (Standard Penetration Test) hammer falling 30 inches. We recorded the number of blows required to advance the sampling spoon the last 12 inches of an 18-inch sampling interval as the standard penetration resistance value, N.

We also obtained one thin-walled tube sample to secure relatively undisturbed samples. The Shelby tube samples was obtained by hydraulically pushing a seamless steel tube with a sharpened cutting edge into the boring to obtain a relatively undisturbed sample of cohesive soil.

We reported the sampling depths, hand penetrometer readings, and the standard penetration resistance values on the boring logs. In the field, we placed the samples into containers, sealed them, and returned them to the laboratory for observation, testing and classification.

Our exploration team prepared field boring logs as part of the drilling operations. These field logs include visual classifications of the materials encountered during drilling and our interpretation of the subsurface conditions between samples. Final boring logs were prepared from the field logs. The final boring logs represent the engineer's interpretation of the field logs and include modifications based on observations and tests of the samples in the laboratory.



## Laboratory Testing

The project engineer reviewed the field data and assigned various laboratory tests to better understand the engineering properties of the various soil strata as necessary for this project. Procedural standards noted below are for reference to methodology in general. In some cases, variations to methods are applied as a result of local practice or professional judgment. Standards noted below include reference to other, related standards. Such references are not necessarily applicable to describe the specific test performed.

- ASTM D2216-10 Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
- ASTM D4318-10e1 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- ASTM D422-63(2007)e2 Standard Test Method for Particle-Size Analysis of Soils

The laboratory testing program may often include examination of soil samples by an engineer. Based on the material's texture and plasticity, we describe and classify the soil samples in accordance with the *Unified Soil Classification System*.

## GEOTECHNICAL MODEL AND GROUNDWATER CONDITIONS

The soils encountered at the project site were found to primarily consist of silty sand (SM) and clayey sand (SC). These soils were generally found to be very loose to loose relative to density. Lean clay with sand (CL) was also encountered in Boring B-02 at a depth of about 14 to 18 feet below existing grades and in Boring B-03 at a depth of about 22 feet below existing grades. These soils were found to be of a very soft to soft consistency.

Conditions encountered at each boring location are indicated on the individual boring logs. Stratification boundaries on the boring logs represent the approximate location of changes in soil types; in situ, the transition between materials may be gradual. Details for each of the borings can be found on the boring logs in **Exploration Results**.

### Groundwater Conditions

The boreholes were observed while drilling and after completion for the presence and level of groundwater. Specific observations of groundwater level as recorded for each boring are noted on the boring logs in Appendix A, and are summarized below.

BORING NUMBER	DEPTH TO GROUNDWATER WHILE DRILLING, FT.
B-01	11
B-02	11
B-03	11

Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff, and other factors that are not evident at the time of drilling. Therefore, the groundwater levels that may prevail during construction or at other times in the life of the structure may be higher or lower than the levels indicated on the boring logs. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for this project.

## SITE CLASSIFICATION FOR SEISMIC DESIGN

Design of buildings and other structures subject to earthquake ground motions requires classification of the upper 100 feet of the site profile in accordance with Chapter 20 of ASCE 7. The Site Class types are listed below and are basically defined by an average value of either shear wave velocity, standard penetration resistance, or undrained shear strength.

- A. Hard Rock
- B. Rock
- C. Very dense soil and soft rock
- D. Stiff soil
- E. Soft clay soil
- F. Soils vulnerable to potential failure or collapse under seismic loading

Based on the results of our site characterization program, we conclude that Site Class D is appropriate for the subject site. Note that the scope of services did not include site profile determination to a depth of 100 feet. Explorations for this project extended to a maximum depth of 24 feet and the site classification assumes that materials encountered at the bottom of the deepest exploration continue to a depth of 100 feet. Based upon our **Expected Geotechnical Conditions**, we expect that the soil conditions below the maximum explored depth are consistent with the Site Class noted for this site.

## GEOTECHNICAL OVERVIEW

Based on the results of the subsurface exploration, laboratory testing, and our analyses, it is our opinion that the proposed building can be supported on shallow foundations provided the recommendations in this report are implemented. Geotechnical considerations for this project include:

- Soft subgrade potential
- Shallow groundwater

### Soft Subgrade Potential

As noted in our **Exploration Results** and **Geotechnical Model**, very loose to loose silty sands (SM) and clayey sands (SC) were encountered within Borings B-01 through B-03 made for the proposed building and in pavement areas represented by Borings B-04 through B-07. Based on the provided preliminary grading plan, finished floor elevation for the building is planned to be at Elev. 26.5 feet. After stripping and grubbing but prior to placing fill, the exposed subgrade should be evaluated to confirm the presence and extent of unstable soils. It should be anticipated that unstable soils will be present upon initial stripping and grubbing and mitigation of the soils will be required. Mitigation within the building pad should consist of over-excavating the unstable soils to expose a stable material or to a maximum depth of 5 feet below finished subgrade (about Elev. 20.5 feet, assuming that finished subgrade elevation below the floor slab and aggregate base is about Elev. 25.5 feet). Should unstable soils still be present at the base of the excavation, a layer of woven geotextile (MDOT Type V or equivalent) should be placed at the base of the excavation, and a thickened bridge lift (about 12 inches) of engineered fill should be placed at a minimum compaction level of 92% of the material's standard Proctor. Subsequent lifts of engineered fill should be placed as specified in **Site Preparation**. The maximum undercut depth may be reduced to 3 feet in pavement areas. On-site soils appear suitable for re-use as engineered fill provided it is moisture conditioned prior to placement and compaction.

### Shallow Groundwater

Groundwater was encountered at a depth of about 11 feet below existing grades in Borings B-01 through B-03. Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the borings were performed. We expect that groundwater levels could be shallower during rainy times of the year, even approaching the ground surface. Groundwater seepage likely will need to be controlled during construction and the groundwater level may need to be lowered prior to construction. We recommend that the specifications require the contractor to maintain the area in a relatively dry condition. Adequate surface drainage will also be required to minimize the amount of surface water entering the area. We recommend that the contractor retain the services of a dewatering expert to assist them in evaluating dewatering methods. We recommend maintaining water at least 2 feet beneath the footing level and pavement subgrade during construction.

## SITE PREPARATION

Our recommended site preparation specifications are included in this GeoReport as **Site Preparation Specifications**. These specifications include critical quality criteria as necessary to render the site in the state anticipated by our geotechnical engineer for foundations and pavements.

All existing above and below grade improvements (i.e buildings, pavements, etc..) within the proposed development area, including any concrete footings, slabs, asphalt and Portland cement pavement, any vegetation and topsoil, or other loose, soft or otherwise unsuitable material should be removed from the entire construction area.

It is common for areas beneath old pavements and slabs to have higher moisture contents than typical which may prove to be unstable during construction and require some mitigation. The demolition phase may also encounter buried foundations, old fills, or other past site improvements. Former utility lines and utility backfill should be removed from beneath the building, and the resulting excavations should be properly backfilled as outlined herein. These conditions should be evaluated at the time of construction by the geotechnical engineer.

The in-place soils must be stable prior to the placement of fill materials or structures. After achieving finished subgrade elevation in cut areas, and prior to placing fill in any areas that are currently below finished subgrade elevation, the exposed subgrade should be evaluated to confirm that all soft, yielding and unsuitable materials have been removed. During this evaluation, those areas which are at finished subgrade or are to receive fill should be proof-rolled with a loaded tandem-axle dump truck or similar pneumatic-tired equipment with a minimum weight of 15 tons and a maximum weight of 25 tons. Proof-rolling will help reveal the presence of unstable materials that were not identified during our drilling program.

Any areas that yield or pump under proof-roll equipment should be mitigated. Mitigation might include processing to remove excess moisture, overexcavation and backfilling, chemical stabilization, or modification with geotextile reinforcement. Should mitigation of wet and pumping soils be required, our office should be notified so that appropriate mitigation can be prescribed by the project geotechnical engineer.

If undercutting of weak soils becomes excessive (5 feet in the building area and 3 feet in pavement areas), bridging can be performed. Groundwater seepage is likely to be encountered in excavations made at the site. Bridging should consist of the placement of Type V or equivalent geotextile fabric and a thickened 12-inch lift placed at a minimum compaction level of 92% of the material's standard Proctor. The bridging lift should be composed of a clean sand (SP, SP-SM) with 10% or less passing the #200 sieve. Subsequent lifts should be placed as outlined below.

## Material Types

Engineered fill should meet the following material property requirements:

FILL TYPE <sup>1</sup>	USCS CLASSIFICATION	Physical Properties	Acceptable Location for Placement
Lean Clay	CL	10 ≤ PI ≤ 25 LL ≤ 45	All locations and elevations
Sands <sup>2</sup>	SC, SM	6 ≤ PI ≤ 25 LL ≤ 45	All locations and elevations
Clean Sand	SP, SP-SM	% Passing No. 200 sieve < 10%	Bridge lift
On-Site Soils <sup>2</sup>	SC, SM	10 ≤ PI ≤ 25 LL ≤ 45	Typically appear suitable for re-use as fill

1. Controlled, compacted fill should consist of approved materials that are free of organic matter and debris. A sample of each material type should be submitted to the geotechnical engineer for evaluation.
2. Silty soils (SM) can be used with the understanding that the soils are especially susceptible to pumping when wet and erosion protection is provided at the surface.

## Compaction Requirements

Engineered fill should be placed in accordance with the following requirements:

ITEM	DESCRIPTION
<b>Fill Lift Thickness</b>	9 inches or less in loose thickness when heavy, self-propelled compaction equipment is used 4 to 6 inches in loose thickness when hand-guided equipment (i.e. jumping jack or plate compactor) is used
<b>Compaction Requirements <sup>1</sup></b>	95% of the material's standard Proctor maximum dry density (ASTM D 698), with stability present
<b>Moisture Content of Cohesive Soil</b>	Within -2 to +2 percent of optimum moisture content as determined by the standard Proctor test at the time of placement and compaction
<b>Moisture Content of Granular Material <sup>2</sup></b>	Workable moisture levels
<b>Minimum Testing Frequency Requirements</b>	Building Area: 1 test per 1,500 square feet per lift Pavement Area: 1 test per 3,000 square feet per lift Utility Trench: 1 test per 100 linear feet per lift

ITEM	DESCRIPTION
1.	The moisture content and compaction should be measured for each lift of engineered fill during placement. Should the results of the in-place density tests indicate the specified moisture or compaction limits have not been met, the area represented by the test should be reworked and retested as required until the specified moisture and compaction requirements are achieved. The zone of fill compacted to meet this criteria should extend at least 5 feet horizontally beyond the building footprint.
2.	Specifically, moisture levels should be maintained low enough to allow for satisfactory compaction to be achieved without the cohesionless fill material pumping when proofrolled.

### Utility Trench Backfill

All trench excavations should be made with sufficient working space to permit construction including backfill placement and compaction. If utility trenches are backfilled with relatively clean granular material, they should be capped with at least 18 inches of cohesive fill in non-pavement areas to reduce the infiltration and conveyance of surface water through the trench backfill.

### Grading and Drainage

All grades must provide effective drainage away from the building during and after construction. Water permitted to pond next to the building can result in greater soil movements than those discussed in this report. These greater movements can result in unacceptable differential floor slab and/or foundation movements, cracked slabs and walls, and roof leaks. Estimated movements described in this report are based on effective drainage for the life of the structure and cannot be relied upon if effective drainage is not maintained. The roof should have gutters/drains with downspouts that discharge onto splash blocks at a distance of at least 10 feet from the building.

### Earthwork Construction Considerations

Although the exposed subgrade is anticipated to be relatively unstable upon initial exposure, subgrade conditions could worsen during general construction operations, particularly if the soils are wetted or subjected to repetitive construction traffic. Areas beneath existing pavements and slabs are likely to be wetter and less stable. The use of light construction equipment would aid in reducing subgrade disturbance. Should unstable subgrade conditions develop, stabilization measures will need to be employed.

It is anticipated that shallow excavations for the proposed construction can be accomplished with conventional earthmoving equipment. Upon completion of filling and grading, care should be taken to maintain the subgrade moisture content prior to construction of floor slabs. Construction traffic over the completed subgrade should be avoided to the extent practical. The site should

also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. If the subgrade should become frozen, desiccated, saturated, or disturbed, the affected material should be removed or these materials should be scarified, moisture conditioned, and recompacted prior to floor slab and pavement construction and observed by Terracon.

Surface water should not be allowed to pond on the site and soak into the soil during construction. Construction staging should provide drainage of surface water and precipitation away from the building areas. Any water that collects over or adjacent to construction areas should be promptly removed, along with any softened or disturbed soils. Surface water control in the form of sloping surfaces, drainage ditches and trenches, and sump pits and pumps will be important to avoid ponding and associated delays due to precipitation and seepage.

As a minimum, excavations should be performed in accordance with OSHA 29 CFR, Part 1926, Subpart P, "Excavations" and its appendices, and in accordance with any applicable local, state, and federal safety regulations. The contractor should be aware that slope height, slope inclination, and excavation depth should in no instance exceed those specified by these safety regulations. Flatter slopes than those dictated by these regulations may be required depending upon the soil conditions encountered and other external factors. These regulations are strictly enforced and if they are not followed, the owner, contractor, and/or earthwork and utility subcontractor could be liable and subject to substantial penalties.

Construction site safety is the sole responsibility of the contractor who controls the means, methods and sequencing of construction operations. Under no circumstances shall the information provided herein be interpreted to mean that Terracon is assuming any responsibility for construction site safety or the contractor's activities; such responsibility shall neither be implied nor inferred.

Terracon should be retained during the construction phase of the project to observe earthwork and to perform necessary tests and observations during subgrade preparation; proofrolling; placement and compaction of controlled compacted fills; backfilling of excavations into the completed subgrade, and just prior to construction of building floor slabs or pavements.



## SHALLOW FOUNDATIONS

Provided the site preparation recommendations outlined in this report are implemented, the soil conditions are conducive for support of the planned structure using shallow foundations. The following paragraphs summarize design recommendations and construction considerations for a shallow foundation system.

### Design Parameters

PARAMETER	ISOLATED COLUMNS	CONTINUOUS
Maximum net allowable bearing pressure on existing soils or engineered fill <sup>1</sup>	2,000 psf	2,000 psf
Required bearing stratum <sup>2</sup>	Stable, compacted natural soils or compacted engineered fill. Bearing stratum should be verified by Terracon.	
Minimum foundation width dimensions	24 inches	18 inches (formed) 16 inches (trenched)
Minimum embedment below finished grade	18 inches	18 inches
Uplift Resistance <sup>3</sup>	Total unit weight of concrete below grade (145 pcf) + Total unit weight of soil above footing (110 pcf).	
Ultimate coefficient of sliding friction <sup>4</sup>	0.32	
Ultimate passive pressure <sup>4</sup>	250 pcf, equivalent fluid density	
Est. total settlement from structural loads <sup>5</sup>	< 2 inch	< 2 inch
Estimated differential settlement <sup>5</sup>	< 1 inch over 30 feet	< 1 inch over 40 feet

1. The maximum net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. An appropriate factor of safety has been applied. These bearing pressure values can be increased by 1/3 for transient loads.
2. Unsuitable or soft soils should be undercut, and the footings should be deepened to bear on the competent bearing stratum or could bear on lean concrete extending from the foundation base to competent bearing stratum. The exposed soils in the bottoms of the footings should be compacted to at least 95% of the material's standard Proctor maximum dry density, with stability present.
3. Apply Factor of safety of at least 1.5 to this value when designing for uplift forces.
4. The shallow foundation excavation sides must be nearly vertical and the concrete should be placed neat against these vertical faces for the passive earth pressure values to be valid. Passive resistance in the upper 3 feet of the soil profile should be neglected. If passive resistance is used to resist lateral loads, the base friction should be neglected. Apply a factor of safety of at least 2.0 to this value when designing for lateral force resistance.
5. Settlements as a result of the structural loads as noted in **Project Description**.

## Foundation Construction Considerations

We should observe the footing excavations prior to placement of steel and concrete. If unsuitable bearing soils are encountered in footing excavations, the following measures can be implemented:

- Excavation could be extended deeper to suitable native soils so that the footing will bear directly on these soils at the lower level.
- Excavation could be extended deeper to suitable native soils and then backfilled with lean concrete to the design footing level (left figure).
- Excavation could be extended deeper and wider to suitable native soils and then backfilled with properly compacted engineered/structural fill to the design footing level (right figure).



**Lean Concrete Backfill**

**Overexcavation / Backfill**

NOTE: Excavations in sketches shown vertical for convenience. Excavations should be sloped as necessary for safety.

The following precautions are essential to the satisfactory performance of shallow foundations:

- Provide positive drainage away from the foundations, both during and after construction.
- Avoid excavations during inclement weather and place concrete within the excavations within 24 hours after completion of the excavations.
- Verify that the excavations are completely within the required bearing stratum or engineered fill and remove and replace any unacceptable soils as discussed herein.
- Maintain adequate moisture levels in exposed excavation and slab subgrades, but do not allow the areas to become saturated.
- Place a “mudmat” of lean concrete to seal the bearing stratum in the event wet conditions are experienced or expected.
- Minimize traffic in excavations to only that necessary to place the steel and concrete for the footings.
- Remove free water in the excavations prior to placing concrete.

## FLOOR SLABS

### Design Parameters

ITEM	DESCRIPTION
<b>Floor slab support</b> <sup>1,2</sup>	Upper 9-inches of subgrade should be compacted to 95% of the material's standard Proctor maximum dry density (ASTM D 698) as outlined <b>Site Preparation</b>
<b>Modulus of subgrade reaction</b>	100 pounds per square inch per inch (psi/in) for point loading conditions
<b>Aggregate base course/capillary break</b> <sup>3</sup>	4 inches of free draining granular material

1. Floor slabs should be structurally independent of any building footings or walls to reduce the possibility of floor slab cracking caused by differential movements between the slab and foundation.
2. Floor subgrades should be maintained in a relatively moist condition until floor slabs are constructed. If the subgrade should become desiccated prior to construction of floor slabs, the affected material should be removed or the materials scarified, moistened, and recompact. Upon completion of grading operations in the building areas, care should be taken to maintain the recommended subgrade moisture content and density prior to construction of the building floor slabs.
3. The floor slab design should include a capillary break, comprised of free-draining, compacted, granular material, at least 4 inches thick. Free-draining granular material should have less than 5 percent fines (material passing the #200 sieve). Other design considerations such as cold temperatures and condensation development could warrant more extensive design provisions.

Where appropriate, saw-cut control joints should be placed in the slab to help control the location and extent of cracking. For additional recommendations refer to the ACI Design Manual.

### Floor Slab Construction Considerations

On most project sites, the site grading is generally accomplished early in the construction phase. However as construction proceeds, the subgrade may be disturbed due to utility excavations, construction traffic, desiccation, rainfall, etc. As a result, the floor slab subgrade may not be suitable for placement of capillary break material and concrete, and corrective action will be required.

Terracon should review the condition of the floor slab subgrades immediately prior to placement of the capillary break material and construction of the slabs. Particular attention should be paid to high traffic areas that were rutted and disturbed earlier and to areas containing backfilled trenches. Areas where unsuitable conditions are located should be repaired by removing and replacing the affected material with properly compacted fill.

The use of a vapor retarder should be considered beneath concrete slabs on grade that will be covered with wood, tile, carpet or other moisture sensitive or impervious coverings, or when the slab will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer and slab contractor should refer to ACI 302 and ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder.

## PAVEMENTS

### General Notes

Pavement designs are provided for the traffic conditions and pavement life conditions as noted in **Project Description**. A critical aspect of pavement performance is site preparation. The pavement designs noted in this section must be applied to the site that has been prepared as required in the **Site Preparation** Section. Pavement designs were performed for estimated traffic types and volumes. We would be pleased to provide revised pavement thickness designs upon your request and the provision of additional data related to the anticipated traffic.

Designs for minimum thicknesses for new pavement sections for this project have been based on the procedures outlined in the 1993 Guideline for Design of Pavement Structures by the American Association of State Highway and Transportation Officials (AASHTO-1993). Pavement design methods are intended to provide structural sections with adequate thickness over a particular subgrade such that wheel loads are reduced to a level the subgrade can support.

Pavement performance is affected by its surroundings. In addition to providing preventive maintenance, the civil engineer should consider the following recommendations in the design and layout of pavements:

- Final grade adjacent to paved areas should slope down from the edges at a minimum 2%;
- The subgrade and pavement surface should have a minimum 2% slope to promote proper surface drainage;
- Install below pavement drainage systems surrounding areas anticipated for frequent wetting;
- Install joint sealant and seal cracks immediately;
- Seal all landscaped areas in or adjacent to pavements to reduce moisture migration to subgrade soils;
- Place compacted, low permeability backfill against the exterior side of curb and gutter; and,
- Place curb, gutter and/or sidewalk directly on sandy subgrade soils rather than on unbound granular base course materials.

## Asphaltic Cement Concrete Thickness

The below pavement sections represent minimum thicknesses and not averages. Asphaltic concrete should conform to the requirements for surface and binder course from the Mississippi Department of Transportation (MDOT) *Standard Specifications for Road and Bridge Construction (MSSRBC)*, 1990 or 2004 Edition.

MINIMUM ACC PAVEMENT SECTION (INCHES)				
TRAFFIC AREA	ASPHALT SURFACE <sup>1</sup>	ASPHALT BINDER <sup>2</sup>	AGGREGATE BASE <sup>3</sup>	TOTAL THICKNESS
Parking Lot	1 ½	2 ½	6	10

1. *MSSRBC (1990)*, MDOT SC-1, Type 8 material or *MSSRBC (2004)*, Hot Mix Asphalt, ST, 9.5mm mixture.
2. *MSSRBC (1990)*, MDOT BC-1, Type 6 material or *MSSRBC (2004)*, Hot Mix Asphalt, ST, 19.0mm mixture.
3. Aggregate base course should consist of a MDOT Size No. 610 stone or crushed concrete material. Aggregate base course should be compacted to 100 percent of its maximum dry density as determined by ASTM D-698, Standard Proctor Test.

## Portland Cement Concrete Thickness

The following table presents the minimum thicknesses and not averages for Portland cement concrete pavement sections.

MINIMUM PCC PAVEMENT SECTION (INCHES)			
TRAFFIC AREA	PORTLAND CEMENT CONCRETE <sup>1,2</sup>	AGGREGATE BASE <sup>3</sup>	TOTAL THICKNESS
Parking Lot	5 ½	4	9 ½

1. 4,000 psi at 28 days, 4-inch maximum slump. PCC pavements are recommended for trash container pads and in any other areas subjected to heavy wheel loads and/or turning traffic.
2. Joint design should be performed in accordance with ACI330R-01 "Guide for Design and Construction of Concrete Parking Lots".
3. Aggregate base course should consist of a MDOT Size No. 610 stone or crushed concrete material. Aggregate base course should be compacted to 100 percent of its maximum dry density as determined by ASTM D-698, Standard Proctor Test.
4. The trash container pad should be large enough to support the container and the tipping axle of the collection truck.

All Portland cement concrete pavement details for joint spacing, joint reinforcement, and joint sealing should be prepared in accordance with American Concrete Institute (ACI 330R-01 and ACI 325R.9-91). Portland cement concrete pavements should be provided with mechanically reinforced joints (doweled or keyed) in accordance with ACI 330R-01.

## **Pavement Drainage**

Pavements should be sloped to provide rapid drainage of surface water. Water allowed to pond on or adjacent to the pavements could saturate the subgrade and contribute to premature pavement deterioration. In addition, the pavement subgrade should be graded to provide positive drainage within the granular base section. Appropriate sub-drainage or connection to a suitable daylight outlet should be provided to remove water from the granular subbase.

## **Pavement Maintenance**

The pavement sections provided in this report represent minimum recommended thicknesses and, as such, periodic maintenance should be anticipated. Therefore preventive maintenance should be planned and provided for through an on-going pavement management program. Maintenance activities are intended to slow the rate of pavement deterioration, and to preserve the pavement investment. Maintenance consists of both localized maintenance (e.g. crack and joint sealing and patching) and global maintenance (e.g. surface sealing). Preventive maintenance is usually the first priority when implementing a planned pavement maintenance program. Additional engineering observation is recommended to determine the type and extent of a cost effective program. Even with periodic maintenance, some movements and related cracking may still occur and repairs may be required.

## GENERAL COMMENTS

Our work is conducted with the understanding of the project as noted in **Project Understanding**. Verification of any stated assumptions and revision of our understanding to reflect actual conditions is important to our work, and the design team should collaborate with Terracon to confirm this understanding.

The design team should collaborate with Terracon to prepare the final design plans and specifications. This facilitates the incorporation of our opinions related to implementation of our geotechnical recommendations.

Our analysis and opinions are based upon our understanding of the geotechnical conditions in the area, the data obtained from the site exploration performed and from our understanding of the project. Variations will occur between exploration point locations, across the site, or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. So, Terracon should be retained to provide observation and testing services during grading, excavation, foundation construction and other earth-related construction phases of the project. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our scope of services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence are intended for the exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly impact excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for that specific purposes to obtain the specific level of detail necessary for costing. Site safety, and other cost estimating including, excavation support, and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.



**APPENDIX A**  
**EXPLORATION AND LABORATORY RESULTS**

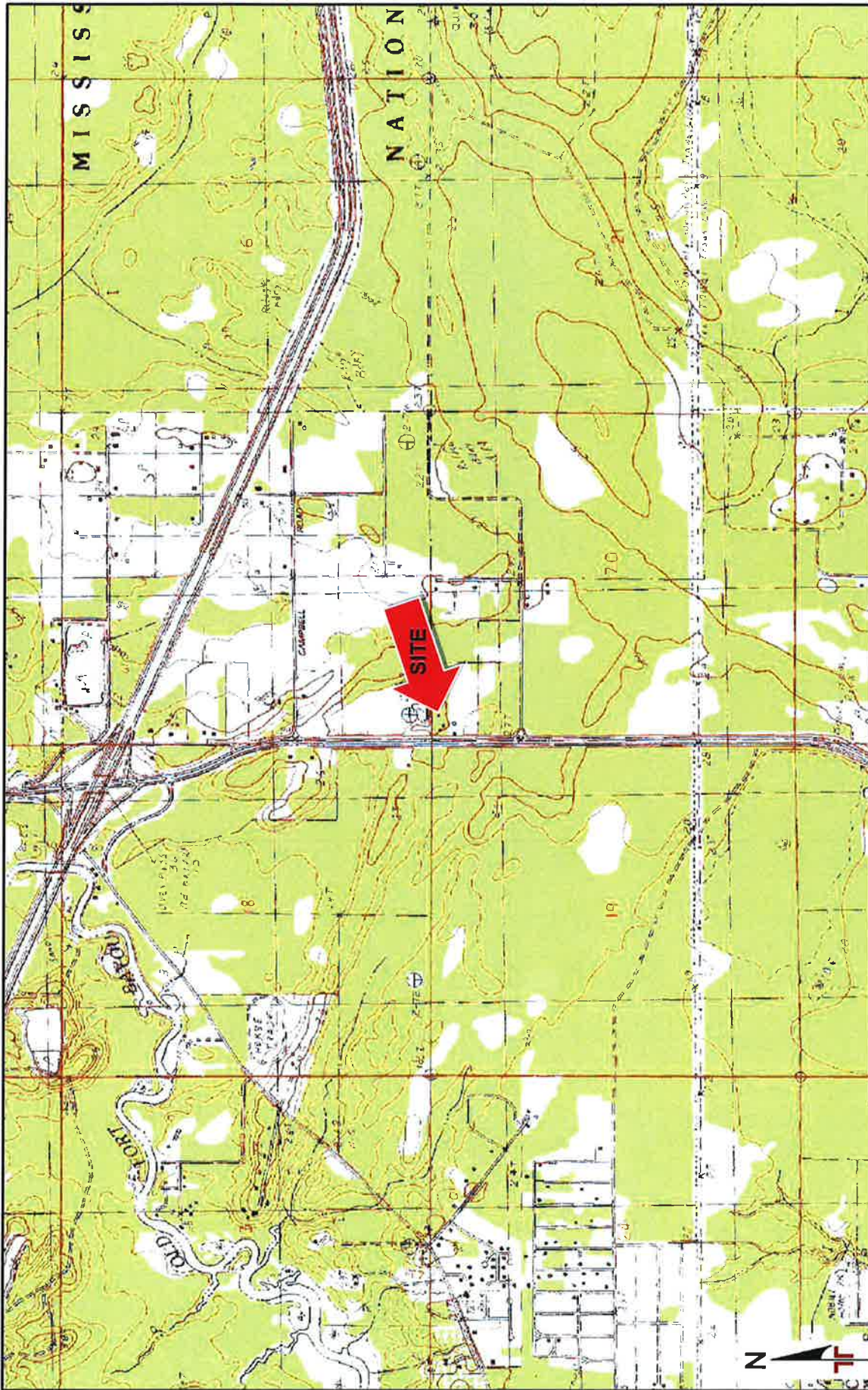


Exhibit  
A-1

**SITE LOCATION PLAN**

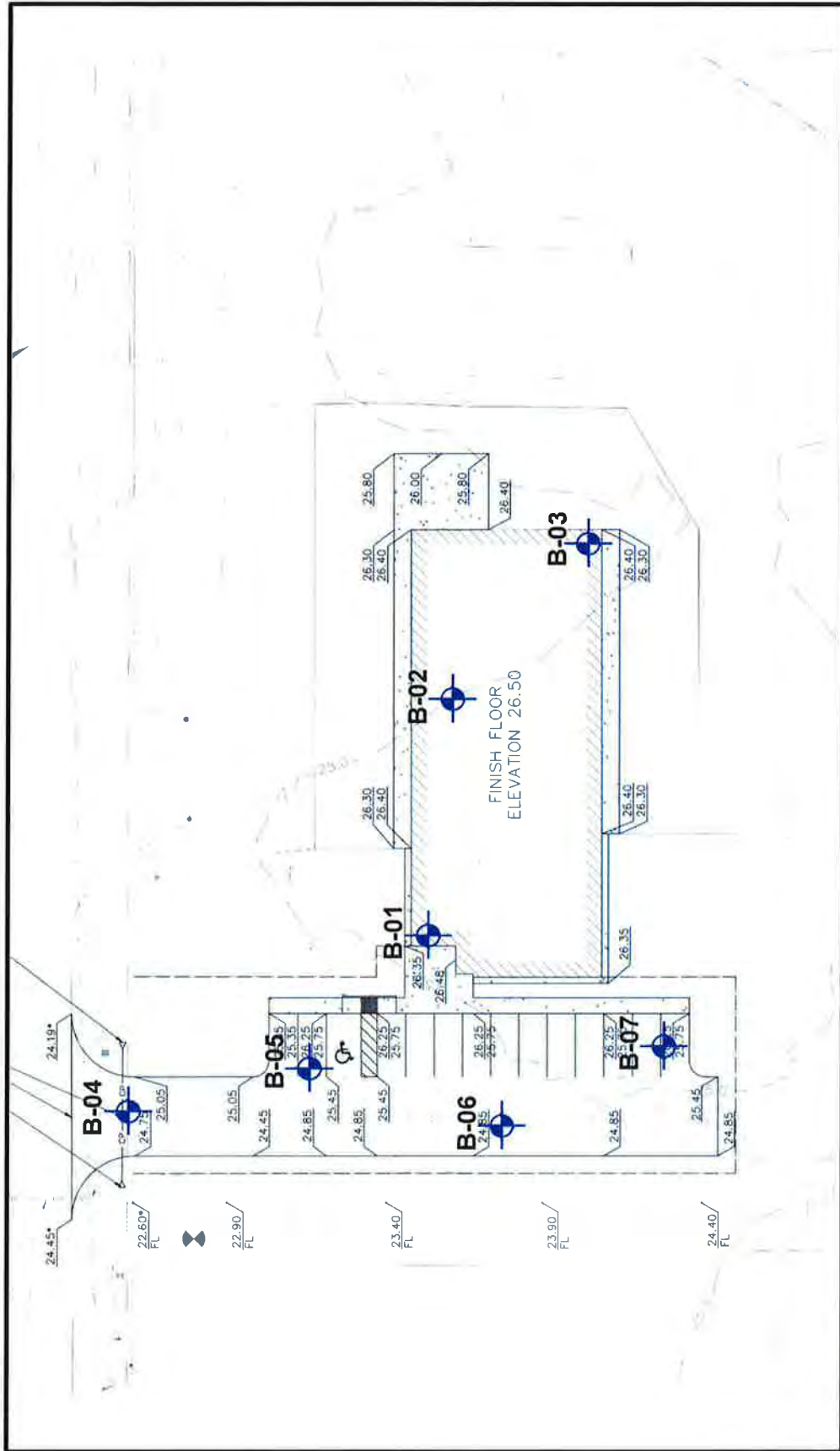
**MDOT Maintenance Building**  
Linda Lee Drive  
Gautier, Mississippi

**Terracon**  
859 S Pear Orchard Rd  
Ridgeland, MS 39157-5105

Project Manager:	NKL	Project No.:	EB175118
Drawn by:	NKL	Scale:	1"=2,000'
Checked by:	JWW	File Name:	Exhibit A-1 EB175118
Approved by:	JWW	Date:	January 2018

TOPOGRAPHIC MAP IMAGE COURTESY OF THE U.S. GEOLOGICAL SURVEY. QUADRANGLES INCLUDE GAUTIER NORTH, MS (1117982).

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES.



**LEGEND**



Approximate Exploration Location

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Manager:	NKL	Project No.:	EB175118
Drawn by:	NKL	Scale:	NTS
Checked by:	JWW	File Name:	Exhibit A-2 EB175118
Approved by:	JWW	Date:	January 2018

**Terracon**

858 Pear Orchard Road  
 PHONE (601) 956 4487  
 Ridgeland, Mississippi 39157  
 FAX (601) 956 4487

**BORING EXPLORATION PLAN**

**MDOT Maintenance Building**  
 Linda Lee Drive  
 Gautier, Mississippi

EXHIBIT

**A-2**

# BORING LOG NO. B-01

**PROJECT: MDOT Maintenance Building**

**CLIENT: Garver, LLC  
Jackson, Mississippi**

**SITE: Linda Lee Drive  
Gautier, Mississippi**

GRAPHIC LOG	LOCATION See <a href="#">Exploration Plan</a> Latitude: 30.4282° Longitude: -88.7139°  Surface Elev.: 25 (Ft.) ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS	PERCENT FINES
							LL-PL-PI	
	DEPTH							
0.4	<b>TOPSOIL</b> , (4-in Topsoil)	24.5						
1.0	<b>SILTY SAND (SM)</b> , brown, loose - trace organics to 2'  - very loose below 2'			X	1-2-3 N=5	18		
2.0				X	0-0-1 N=1	16		33
3.0				X	0-1-1 N=2	28		
6.0	<b>CLAYEY SAND (SC)</b> , gray and red, loose	19		X	2-4-5 N=9	21		27
7.0				X	2-3-3 N=6	26		
11.0	<b>SILTY SAND (SM)</b> , gray, very loose	14	▽	X	WOH N=0	46		
12.0				X	WOH N=0	48		
18.0				X	1-1-1 N=2	30		
24.0		1		X	1-1-2 N=3	23		
<b>Boring Terminated at 24 Feet</b>								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:  
Solid-Flight Auger: 0' - 15'  
Rotary Wash: 15' - 24'

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (if any).

Notes:

Abandonment Method:  
Boring backfilled with auger cuttings upon completion.

See [Supporting Information](#) for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

▽ While drilling



859 S Pear Orchard Rd  
Ridgeland, MS

Boring Started: 01-16-2017

Boring Completed: 01-16-2017

Drill Rig: Tractor

Driller: J. Bradshaw

Project No.: EB175118

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL SLOGS:EB175118.GPJ TERRACON\_DATATEMPLATE.GDT 2/2/18

# BORING LOG NO. B-02

**PROJECT: MDOT Maintenance Building**

**CLIENT: Garver, LLC  
Jackson, Mississippi**

**SITE: Linda Lee Drive  
Gautier, Mississippi**

GRAPHIC LOG	LOCATION See <a href="#">Exploration Plan</a> Latitude: 30.4281° Longitude: -88.7136°  Surface Elev.: 25 (Ft.) ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS	PERCENT FINES
							LL-PL-PI	
0.2	<b>ASPHALT</b> , (1-in limestone/1-in asphalt)	25						
	<b>CLAYEY SAND (SC)</b> , brown, loose  - very loose below 2'  - red and light gray from 4' - 6'  - gray below 6'	5		X	4-4-2 N=6	15		41
		8.0		X	WOH N=0	22		
		11		X	1-1-2 N=3	25	39-18-21	47
		14.0		X	WOH N=0	24		
	<b>SILTY SAND (SM)</b> , gray, loose  - very loose, trace organics below 11'	17		X	3-2-2 N=4	28		
		20	▽		0-0-1 N=1	43		
		22		X	WOH N=0	41		
	<b>LEAN CLAY WITH SAND (CL)</b> , trace organics, gray, very soft	11		X	WOH N=0	41		
		14.0		X	WOH N=0	41		
		18.0		X	WOH N=0	35		29
	<b>SILTY SAND (SM)</b> , gray, very loose  - light gray below 22'	7		X	WOH N=0	35		29
		20		X	WOH N=0	29		
	<b>Boring Terminated at 24 Feet</b>	1		X	WOH N=0	29		
		24.0						

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:  
Solid-Flight Auger: 0' - 17'  
Rotary Wash: 15' - 24'

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (if any).

Notes:

Abandonment Method:  
Boring backfilled with auger cuttings upon completion.

See [Supporting Information](#) for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

▽ While drilling



859 S Pear Orchard Rd  
Ridgeland, MS

Boring Started: 01-16-2017

Boring Completed: 01-16-2017

Drill Rig: Tractor

Driller: J. Bradshaw

Project No.: EB175118

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL. SLOGS.EB175118.GPJ TERRACON\_DATA TEMPLATE.GDT 2/2/18

# BORING LOG NO. B-03

**PROJECT:** MDOT Maintenance Building

**CLIENT:** Garver, LLC  
Jackson, Mississippi

**SITE:** Linda Lee Drive  
Gautier, Mississippi

GRAPHIC LOG	LOCATION See <a href="#">Exploration Plan</a> Latitude: 30.428° Longitude: -89.7135°  Surface Elev.: 25 (Ft.)	DEPTH (FT.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS		
							LL-PL-PI	PERCENT FINES	
DEPTH		ELEVATION (FT.)							
0.2	<b>ASPHALT</b> , (1-in limestone/1-in asphalt)	25							
	<b>SILTY SAND (SM)</b> , gray and brown, loose  - very loose below 2'		X		17-7-2 N=9	5			
4.0		21			WOH N=0	18			
	<b>CLAYEY SAND (SC)</b> , brown and gray, very loose		X		0-1-1 N=2	27		42	
			X		WOH N=0	26			
			X		3-2-1 N=3	26			
11.0		14	▽						
	<b>SILTY SAND (SM)</b> , gray, very loose  - trace organics to 16'		X		WOH N=0	40			
			X		WOH N=0	31		23	
			X		WOH N=0	34			
22.0		3							
	<b>LEAN CLAY WITH SAND (CL)</b> , gray, very soft to soft								
24.0		1							
	<b>Boring Terminated at 24 Feet</b>				0.25 (HP)	25			

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:  
Solid-Flight Auger: 0' - 17'  
Rotary Wash: 15' - 24'

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (if any).

Notes:

Abandonment Method:  
Boring backfilled with auger cuttings upon completion.

See [Supporting Information](#) for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

▽ While drilling



859 S Pear Orchard Rd  
Ridgeland, MS

Boring Started: 01-16-2017

Boring Completed: 01-16-2017

Drill Rig: Tractor

Driller: J. Bradshaw

Project No.: EB175118

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO-WELL SLOGS.EB175118.GPJ TERRACON\_DATATEMPLATE.GDT 2/2/18

# BORING LOG NO. B-04

**PROJECT:** MDOT Maintenance Building

**CLIENT:** Garver, LLC  
Jackson, Mississippi

**SITE:** Linda Lee Drive  
Gautier, Mississippi

GRAPHIC LOG	LOCATION See <a href="#">Exploration Plan</a> Latitude: 30.4284° Longitude: -88.714°  Surface Elev.: 23 (Ft.) ELEVATION (FL.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS	PERCENT FINES
							LL-PL-PI	
DEPTH								
0.8	<b>TOPSOIL</b> , (10-in Topsoil)	22						
4.0	<b>SILTY SAND (SM)</b> , brown, very loose - trace organics to 2'	19		X	1-1-1 N=2	21		
6.0	<b>CLAYEY SAND (SC)</b> , gray and red, loose	17		X	2-2-1 N=3	19		23
6.0	<b>SILTY SAND (SM)</b> , gray, medium dense  - very loose, dark gray below 8'	17		X	2-2-2 N=4	21		
10.0		13		X	3-4-9 N=13	17		
10.0	<b>Boring Terminated at 10 Feet</b>	13		X	0-1-1 N=2	20		

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:  
Solid-Flight Auger: 0' - 10'

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (if any).

Notes:

Abandonment Method:  
Boring backfilled with auger cuttings upon completion.

See [Supporting Information](#) for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

No free water observed



859 S Pear Orchard Rd  
Ridgeland, MS

Boring Started: 01-16-2017

Boring Completed: 01-16-2017

Drill Rig: Tractor

Driller: J. Bradshaw

Project No.: EB175118

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL\_SLOGS.EB175118.GPJ TERRACON\_DATATEMPLATE.GDT 2/2/18

# BORING LOG NO. B-05

**PROJECT:** MDOT Maintenance Building

**CLIENT:** Garver, LLC  
Jackson, Mississippi

**SITE:** Linda Lee Drive  
Gautier, Mississippi

GRAPHIC LOG	LOCATION See <a href="#">Exploration Plan</a> Latitude: 30.4283° Longitude: -88.714°  Surface Elev.: 24.5 (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS	PERCENT FINES
							LL-PL-PI	
DEPTH	ELEVATION (Ft.)							
0.1	<b>ASPHALT</b> , (1-in Asphalt)	24.5						
	<b>SILTY SAND (SM)</b> , brown, loose				1-1-3 N=4	18		
4.0		20.5			3-2-2 N=4	13		
	<b>CLAYEY SAND (SC)</b> , red and brown, loose				2-2-4 N=6	20	23-15-8	33
					2-2-5 N=7	17		
	- very loose below 8'				2-1-1 N=2	20		
10.0	<b>Boring Terminated at 10 Feet</b>	14.5						

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:  
Solid-Flight Auger: 0' - 10'

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (if any).

Notes:

Abandonment Method:  
Boring backfilled with auger cuttings upon completion.

See [Supporting Information](#) for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*No free water observed*



859 S Pear Orchard Rd  
Ridgeland, MS

Boring Started: 01-16-2017

Boring Completed: 01-16-2017

Drill Rig: Tractor

Driller: J. Bradshaw

Project No.: EB175118

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL\_SLOGS.EB175118.GPJ TERRACON\_DATATEMPLATE.GDT 2/2/18



# BORING LOG NO. B-06

**PROJECT: MDOT Maintenance Building**

**CLIENT: Garver, LLC  
Jackson, Mississippi**

**SITE: Linda Lee Drive  
Gautier, Mississippi**

GRAPHIC LOG	LOCATION See <a href="#">Exploration Plan</a> Latitude: 30.4281° Longitude: -88.714°  Surface Elev.: 24.5 (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS	
							LL-PL-PI	PERCENT FINES
DEPTH	ELEVATION (Ft.)							
0.3	<b>TOPSOIL</b> , (4-in Topsoil)	24						
	<b>SILTY SAND (SM)</b> , brown, loose  - very loose below 2'			X	1-2-2 N=4	17		24
				X	0-0-1 N=1	19		
		5		X	1-1-1 N=2	21		
6.0	<b>CLAYEY SAND (SC)</b> , red and brown, loose	18.5		X	2-3-4 N=7	25		
				X	3-3-3 N=6	24		
10.0	<b>Boring Terminated at 10 Feet</b>	14.5						

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:  
Solid-Flight Auger: 0' - 10'

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (if any).

Notes:

Abandonment Method:  
Boring backfilled with auger cuttings upon completion.

See [Supporting Information](#) for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

No free water observed



859 S Pear Orchard Rd  
Ridgeland, MS

Boring Started: 01-16-2017

Boring Completed: 01-16-2017

Drill Rig: Tractor

Driller: J. Bradshaw

Project No.: EB175118

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL SLOGS.EB175118.GPJ TERRACON\_DATATEMPLATE.GDT 2/2/18

# BORING LOG NO. B-07

**PROJECT:** MDOT Maintenance Building

**CLIENT:** Garver, LLC  
Jackson, Mississippi

**SITE:** Linda Lee Drive  
Gautier, Mississippi

GRAPHIC LOG	LOCATION See <a href="#">Exploration Plan</a> Latitude: 30.4279° Longitude: -88.714°  Surface Elev.: 25 (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS	
							LL-PL-PI	PERCENT FINES
DEPTH ELEVATION (Ft.)								
0.4	<b>ASPHALT</b> , (1-in limestone/4-in asphalt)	24.5						
	<b>SILTY SAND (SM)</b> , brown and gray, loose			X	1-2-4 N=6	17		
4.0		21						
	<b>CLAYEY SAND (SC)</b> , gray and brown, loose			X	1-1-1 N=2	16		
5		15						
				X	2-3-5 N=8	20	30-15-15	32
10.0		10						
	<b>Boring Terminated at 10 Feet</b>			X	3-4-4 N=8	19		
				X	3-3-5 N=8	22		

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:  
Solid-Flight Auger: 0' - 10'

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (if any).

Notes:

Abandonment Method:  
Boring backfilled with auger cuttings upon completion.

See [Supporting Information](#) for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*No free water observed*



859 S Pear Orchard Rd  
Ridgeland, MS

Boring Started: 01-16-2017

Boring Completed: 01-16-2017

Drill Rig: Tractor

Driller: J. Bradshaw












Project No.: EB175118

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO.WELL\_SLOGS.EB175118.GPJ TERRACON\_DATATEMPLATE.GDT 2/2/18

**APPENDIX B**  
**SUPPORTING DOCUMENTS**

# GENERAL NOTES

## DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

<b>SAMPLING</b>			<b>WATER LEVEL</b>		Water Initially Encountered	<b>FIELD TESTS</b>	(HP) Hand Penetrometer
	<b>Auger</b>	<b>Split Spoon</b>			Water Level After a Specified Period of Time		(T) Torvane
					Water Level After a Specified Period of Time		(b/f) Standard Penetration Test (blows per foot)
	<b>Shelby Tube</b>	<b>Macro Core</b>		Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.			(PID) Photo-Ionization Detector
							(OVA) Organic Vapor Analyzer
							
<b>Grab Sample</b>	<b>No Recovery</b>						

## DESCRIPTIVE SOIL CLASSIFICATION

Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

## LOCATION AND ELEVATION NOTES

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

<b>STRENGTH TERMS</b>	<b>RELATIVE DENSITY OF COARSE-GRAINED SOILS</b> (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance Includes gravels, sands and silts.			<b>CONSISTENCY OF FINE-GRAINED SOILS</b> (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance		
	Descriptive Term (Density)	Standard Penetration or N-Value Blows/Ft.	Ring Sampler Blows/Ft.	Descriptive Term (Consistency)	Unconfined Compressive Strength, Qu, tsf	Standard Penetration or N-Value Blows/Ft.
Very Loose	0 - 3	0 - 6	Very Soft	less than 0.25	0 - 1	< 3
Loose	4 - 9	7 - 18	Soft	0.25 to 0.50	2 - 4	3 - 4
Medium Dense	10 - 29	19 - 58	Medium-Stiff	0.50 to 1.00	4 - 8	5 - 9
Dense	30 - 50	59 - 98	Stiff	1.00 to 2.00	8 - 15	10 - 18
Very Dense	> 50	≥ 99	Very Stiff	2.00 to 4.00	15 - 30	19 - 42
			Hard	> 4.00	> 30	> 42

## RELATIVE PROPORTIONS OF SAND AND GRAVEL

<u>Descriptive Term(s) of other constituents</u>	<u>Percent of Dry Weight</u>
Trace	< 15
With	15 - 29
Modifier	> 30

## GRAIN SIZE TERMINOLOGY

<u>Major Component of Sample</u>	<u>Particle Size</u>
Boulders	Over 12 in. (300 mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm)
Silt or Clay	Passing #200 sieve (0.075mm)

## RELATIVE PROPORTIONS OF FINES

<u>Descriptive Term(s) of other constituents</u>	<u>Percent of Dry Weight</u>
Trace	< 5
With	5 - 12
Modifier	> 12

## PLASTICITY DESCRIPTION

<u>Term</u>	<u>Plasticity Index</u>
Non-plastic	0
Low	1 - 10
Medium	11 - 30
High	> 30

# UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests <sup>A</sup>				Soil Classification		
				Group Symbol	Group Name <sup>B</sup>	
<b>Coarse Grained Soils:</b> More than 50% retained on No. 200 sieve	<b>Gravels:</b> More than 50% of coarse fraction retained on No. 4 sieve	<b>Clean Gravels:</b> Less than 5% fines <sup>C</sup>	$Cu \geq 4$ and $1 \leq Cc \leq 3^E$	GW	Well-graded gravel <sup>F</sup>	
		<b>Gravels with Fines:</b> More than 12% fines <sup>C</sup>	Fines classify as ML or MH	GP	Poorly graded gravel <sup>F</sup>	
			Fines classify as CL or CH	GM	Silty gravel <sup>F,G,H</sup>	
		<b>Sands:</b> 50% or more of coarse fraction passes No. 4 sieve	<b>Clean Sands:</b> Less than 5% fines <sup>D</sup>	$Cu \geq 6$ and $1 \leq Cc \leq 3^E$	GC	Clayey gravel <sup>F,G,H</sup>
	<b>Sands with Fines:</b> More than 12% fines <sup>D</sup>		Fines classify as ML or MH	SW	Well-graded sand <sup>I</sup>	
			Fines classify as CL or CH	SP	Poorly graded sand <sup>I</sup>	
	<b>Silts and Clays:</b> Liquid limit less than 50		<b>Inorganic:</b>	$PI > 7$ and plots on or above "A" line <sup>J</sup>	SM	Silty sand <sup>G,H,I</sup>
		$PI < 4$ or plots below "A" line <sup>J</sup>		SC	Clayey sand <sup>G,H,I</sup>	
<b>Fine-Grained Soils:</b> 50% or more passes the No. 200 sieve	<b>Silts and Clays:</b> Liquid limit 50 or more	<b>Inorganic:</b>	$PI \geq 4$ and plots on or above "A" line	CL	Lean clay <sup>K,L,M</sup>	
			$PI < 4$ or plots below "A" line	ML	Silt <sup>K,L,M</sup>	
		<b>Organic:</b>	Liquid limit - oven dried	< 0.75	OL	Organic clay <sup>K,L,M,N</sup>
			Liquid limit - not dried			Organic silt <sup>K,L,M,O</sup>
	<b>Silts and Clays:</b> Liquid limit 50 or more	<b>Inorganic:</b>	$PI$ plots on or above "A" line	CH	Fat clay <sup>K,L,M</sup>	
			$PI$ plots below "A" line	MH	Elastic Silt <sup>K,L,M</sup>	
		<b>Organic:</b>	Liquid limit - oven dried	< 0.75	OH	Organic clay <sup>K,L,M,P</sup>
			Liquid limit - not dried			Organic silt <sup>K,L,M,Q</sup>
<b>Highly organic soils:</b>	Primarily organic matter, dark in color, and organic odor			PT	Peat	

<sup>A</sup> Based on the material passing the 3-inch (75-mm) sieve

<sup>B</sup> If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

<sup>C</sup> Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

<sup>D</sup> Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

$$E \quad Cu = D_{60}/D_{10} \quad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$$

<sup>F</sup> If soil contains  $\geq 15\%$  sand, add "with sand" to group name.

<sup>G</sup> If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

<sup>H</sup> If fines are organic, add "with organic fines" to group name.

<sup>I</sup> If soil contains  $\geq 15\%$  gravel, add "with gravel" to group name.

<sup>J</sup> If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

<sup>K</sup> If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

<sup>L</sup> If soil contains  $\geq 30\%$  plus No. 200 predominantly sand, add "sandy" to group name.

<sup>M</sup> If soil contains  $\geq 30\%$  plus No. 200, predominantly gravel, add "gravelly" to group name.

<sup>N</sup>  $PI \geq 4$  and plots on or above "A" line.

<sup>O</sup>  $PI < 4$  or plots below "A" line.

<sup>P</sup>  $PI$  plots on or above "A" line.

<sup>Q</sup>  $PI$  plots below "A" line.

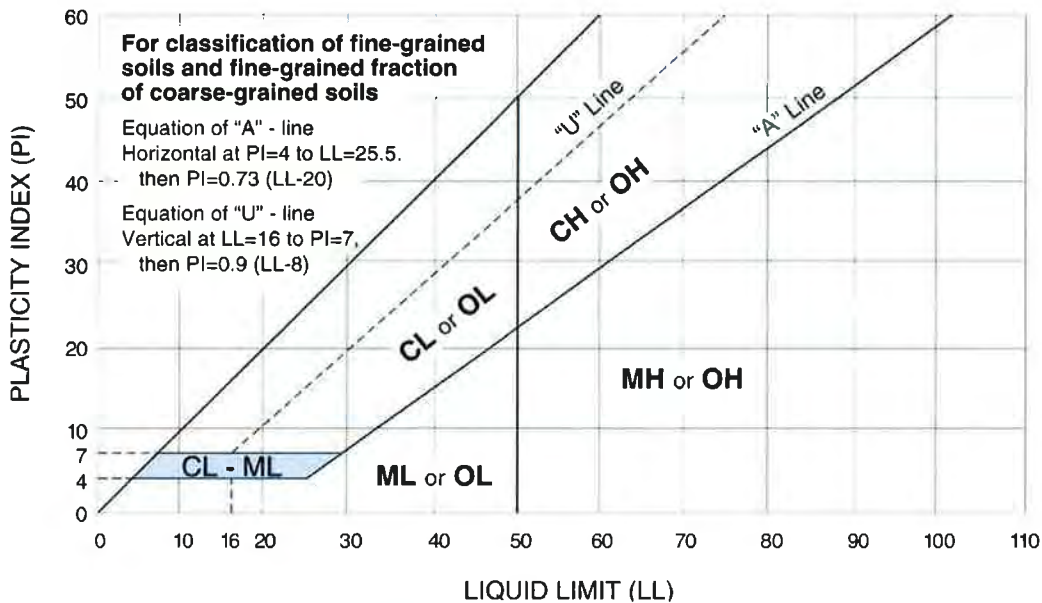


Exhibit B-2

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

## General Conditions of the Contract for Construction

### for the following PROJECT:

*(Name and location or address)*

MAINTENANCE AREA HEADQUARTERS AT OCEAN SPRINGS, JACKSON COUNTY, MISSISSIPPI

BWO-6241-30(001) 503010

LWO-6037-30(002) 503010

### 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)*

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### ADDITIONS AND DELETIONS:

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

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User Notes:

15 CLAIMS AND DISPUTES

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User Notes:



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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 performed on Legal Holidays, Sundays or after 5:00 P.M. on week days without prior written approval from the Project Engineer.

#### § 3.5 WARRANTY

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

#### § 3.6 TAXES

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

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

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections by government agencies necessary for proper

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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.

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### § 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.

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### § 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.

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## 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.

*(Paragraph Deleted)*

§ 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.

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§ 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;

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- .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.

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## ARTICLE 8 TIME

### § 8.1 DEFINITIONS

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Completion is the date certified by the Project Engineer and approved by the Owner in accordance with Section 9.8.

§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

### § 8.2 PROGRESS AND COMPLETION

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, prematurely commence operations on the site or elsewhere prior to the effective date of insurance required by Article 11 to be furnished by the Contractor and Owner. The date of commencement of the Work shall not be changed by the effective date of such insurance.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

### § 8.3 DELAYS AND EXTENSIONS OF TIME

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by any act of neglect of the Owner or Project Engineer, or by any employee or either, or by changes ordered in the Work, or by labor disputes, fire, unusual delay in deliveries, unavoidable casualties or any causes beyond the Contractor's control, or by any other causes which the Project Engineer determines may justify the delay, then the Contract time may be extended by Change Order for such reasonable time as the Project Engineer may determine, subject to the Owner's approval. The Contractor's sole and exclusive right and remedy for delay by any cause whatsoever is an extension of the Contract Time but no increase in the Contract Sum. Any claim for loss or any delay occasioned by any separate Contractor, or Subcontractor, shall be settled between the Contractor and such other separate Contractor, or Subcontractors.

§ 8.3.2 No delay, interference, hindrance or disruption, from whatever source or cause, in the progress of the Contractor's Work shall be a basis for an extension of time unless the delay, interference hindrance or disruption is (1) without the fault and not the responsibility of the Contractor, its subcontractors and suppliers and (2) directly affects the overall completion of the Work as reflected on the critical path of the updated Construction Schedule. The contractor expressly agrees that the Owner shall have the benefit of any float in the construction schedule and delay in construction activities which do not affect the overall completion of the work does not entitle the Contractor to any extension in the Contract Time.

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

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.

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§ 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

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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.

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§ 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.

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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

§ 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.

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### § 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

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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;

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- .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 (Combined Single Limit)	\$500,000.00	Per Occurrence
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:**

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(Umbrella on projects over \$500,000) Bodily Injury & Property Damage (Combined Single Limit)	\$1,000,000.00	Aggregate
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**.5 WORKERS' COMPENSATION:**

(As required by Statute)

<b>EMPLOYERS' LIABILITY</b>		
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.

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*(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

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**§ 11.4 PERFORMANCE BOND AND PAYMENT BOND**

**§ 11.4.1** The Owner shall have the right to require the Contractor to furnish bonds covering faithful performance of the Contract and payment of obligations arising thereunder as stipulated in bidding requirements or specifically required in the Contract Documents on the date of execution of the Contract.

**§ 11.4.2** Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

**ARTICLE 12 UNCOVERING AND CORRECTION OF WORK**

**§ 12.1 UNCOVERING OF WORK**

**§ 12.1.1** If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

**§ 12.1.2** If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, costs of uncovering and replacement shall, by appropriate Change Order, be at the Owner's expense. If such Work is not in accordance with the Contract Documents, such costs and the cost of correction shall be at the Contractor's expense unless the condition was caused by the Owner or a separate contractor in which event the Owner shall be responsible for payment of such costs.

**§ 12.2 CORRECTION OF WORK**

**§ 12.2.1 BEFORE OR AFTER DATE OF COMPLETION**

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, whether discovered before or after Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

**§ 12.2.2 AFTER DATE OF COMPLETION**

**§ 12.2.2.1** In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of an applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.4.

**§ 12.2.2.2** The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Date of Completion by the period of time between Date of Completion and the actual completion of that portion of the Work.

**§ 12.2.2.3** The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

**§ 12.2.3** The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

**§ 12.2.4** The Contractor shall bear the cost of correcting destroyed or damaged construction, whether completed or partially completed, of the Owner or separate contractors caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

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§ 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.

.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.

§ 15.1.5.4 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

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### § 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.

#### § 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.

*(Paragraph Deleted)*

§ 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.

DOCUMENT 00 91 13          ADDENDA

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 construct a Maintenance Area Headquarters at Ocean Springs, Jackson County, Mississippi. Separate Lump Sums as described in these Specifications and Drawings are to be given for each of the following separate descriptions:
1. Pay Item 907-242-A006 Construction of Maintenance Area Headquarters.
  2. Other Pay Items on Drawings Site Improvements.
- B. Time of Completion: The completion of this Work is to be on or before the time indicated on the Owner and Contractor Agreement.
- C. Contractor's Duties:
1. Except as specifically noted, provide and pay for:
    - a. Labor, materials, equipment.
    - b. Tools, construction equipment, and machinery.
    - c. Other facilities and services necessary for proper execution and completion of the Work.
  2. Pay legally required sales, consumer, use, payroll, privilege and other taxes.
  3. Secure and pay for, as necessary for proper execution and completion of Work, and as applicable at time of receipt of bids:
    - d. Permits.
    - e. Government Fees.
    - f. Licenses.
  4. Give required notices
  5. Comply with codes, ordinances, rules, regulations, orders and other legal requirements of public authorities that bear on performance of Work.
  6. Promptly submit written notice to Project Engineer of observed variance of Contract Documents from legal requirements. Appropriate modifications to Contract Documents will adjust necessary changes. Assume responsibility for Work known to be contrary to such requirements, without notice.
  7. Enforce strict discipline and good order among employees. Do not employ on Work, unfit persons or persons not skilled in assigned task.
  8. Schedule of Values: Submit 8 copies to the MDOT Architectural Services Unit a Schedule of Values as described in Section 01 29 73 of these Specifications. This submittal will be recorded as submittal number one for this Project. When this submittal is approved, a copy will be transmitted to Construction Administration to be used to review and compare to amounts submitted on the CAD-720 form. Other copies will be kept by Architectural Services Unit and distributed to Project Engineer, MDOT Consultants, and Contractor.

9. Sub-Contractor List: Submit 8 copies of a list, acceptable to the MDOT, of all subcontractors to be used on the Project within seven (7) days after written notice of Contract award by the MDOT. The list shall include the Firm's name, contact person, street address, e-mail address, telephone and fax numbers. Submit original to Contract Administration Division Form CAD-720 – REQUEST FOR PERMISSION TO SUBCONTRACT for each subcontractor before they are allowed to perform any Work. Contract Administration Division will provide copies of approved subcontractors to Project Engineer and Architectural Services.
10. Coordination: The Contractor is responsible for the coordination of the total Project. All subcontractors will cooperate with the Contractor so as to facilitate the general progress of the Work. Each trade shall afford all other trades every reasonable opportunity for the installation of their Work. Refer to Section 01 31 00– Project Management & Coordination.

#### 1.02 CONTRACTOR'S USE OF PREMISES

- A. Confine operations at the site to areas permitted by:
  1. Law
  2. Ordinances
  3. Permits
  4. Contract Documents
  5. Owner
- B. Do not unreasonably encumber site with materials or equipment.
- C. Do not load structure with weight that will endanger structure.
- D. Assume full responsibility for protection and safekeeping of products stored on premises.
- E. Move stored products which interfere with operations of MDOT or other Contractors
- F. Obtain and pay for use of additional storage of work areas needed for operations.
- G. Limit use of site for work and storage to the area indicated on the Drawings.

#### 1.03 ACCESS TO SITE

- A. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.
- B. Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
  1. Driveways, Walkways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
    - a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
    - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

#### 1.04 COORDINATION WITH OCCUPANTS

- A. Partial Owner Occupancy: Owner will occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations.
- B. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Final Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.
  - 1. Architect will prepare a Certificate of Completion for each specific portion of the Work to be occupied prior to Owner acceptance of the completed Work.
  - 2. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited Owner occupancy.
  - 3. Before limited Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of Work.
  - 4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of Work.

#### 1.05 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 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.





PRODUCT SUBSTITUTION REQUEST FORM

PROJECT: \_\_\_\_\_ PROJECT NO. \_\_\_\_\_

OWNER: \_\_\_\_\_

CONTRACTOR: \_\_\_\_\_

ARCHITECT: \_\_\_\_\_

CONTRACTOR'S REQUEST, WITH SUPPORTING DATA

1. Section of the Specifications to which this request applies:

\_\_\_\_\_

Product data for specified item and proposed substitution is attached (description of product, reference standards, performance and test data).

Sample is attached

2. Itemized comparison of proposed substitution with product specified.

ORIGINAL PRODUCT

SUBSTITUTION

Name, brand \_\_\_\_\_

Catalog No. \_\_\_\_\_

Manufacturer \_\_\_\_\_

Significant variations: \_\_\_\_\_

Reason for Substitution:

\_\_\_\_\_  
\_\_\_\_\_

3. Proposed change in Contract Sum:

Credit to Owner: \$ \_\_\_\_\_

Additional Cost to Owner: \$ \_\_\_\_\_

4. Effect of the proposed substitution on the Work:

Contract Time: \_\_\_\_\_

CONTRACTORS STATEMENT OF CONFORMANCE OF PROPOSED  
SUBSTITUTION TO CONTRACT REQUIREMENTS

I / We have investigated the proposed substitution. I / We

1. Believe that it is equal or superior in all respects to originally specified product, except as stated in 2. above;
2. Will provide same warranty as required in Contract Documents;
3. Have included all cost data and cost implications of proposed substitution; including, if required, costs to other contractors, and redesign and special inspection costs caused by use of proposed substitution;
4. Will coordinate incorporation of proposed substitution in the Work;
5. Will modify other parts of the Work as may be needed, to make all parts of the Work complete and functioning;
6. Have verified that use of this substitution conforms to all applicable codes.
7. Waive future claims for added cost to Owner caused by proposed substitution.

CONTRACTOR \_\_\_\_\_ DATE: \_\_\_\_\_  
Signature

MDOT ARCHITECT'S REVIEW AND ACTION

- Accepted
- Not Accepted
- Provide more information in the following categories and resubmit \_\_\_\_\_
- Sign Contractor's Statement of Conformance and resubmit
- Proposed substitution is accepted, with the following conditions:  
\_\_\_\_\_  
\_\_\_\_\_

Change Order (Supplemental Agreements) will make the following changes:

(Add to) (Deduct from) Contract Sum: \$ \_\_\_\_\_

(Add to) (Deduct from) Contract Time: \_\_\_\_\_ days

ARCHITECT: \_\_\_\_\_ DATE \_\_\_\_\_

OWNER: \_\_\_\_\_ DATE \_\_\_\_\_

Accepted  Not accepted

END OF SECTION

## SECTION 01 26 00

## CONTRACT MODIFICATION PROCEDURES

## PART 1 - GENERAL

## 1.01 SUMMARY

- A. Section includes administrative and procedural requirements for handling and processing Contract modifications (Supplemental Agreements) by the Project Engineer and the Contractor.

## 1.02 CHANGE ORDER (SUPPLEMENTAL AGREEMENT) PROCEDURES

- A. Change Proposed by the Project Engineer: The Project Engineer may issue a Proposal Request to the Contractor which includes a detailed description of a proposed change with supplementary or revised Drawings and Specifications and a change in Contract Time for executing the change. The Contractor shall prepare and submit an estimate within 10 days.
- B. Change Proposed by the Contractor: The Contractor may propose a change by submitting a request for change to the Project Engineer, describing the proposed change and its full effect on the Work, with a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation and a statement describing the effect on Work by separate or other Contractors. Document requested substitutions in accordance with Section 01 25 00 Substitution Procedures and Section 01 60 00 Product Requirements.
- C. Contractor's Documentation:
  - 1. Maintain detailed records of Work completed on a time and material basis. Provide full information required for evaluation of proposed changes, and substantiate costs of changes in the Work.
  - 2. Document each quotation for a change in cost or time with sufficient data allowing evaluation of the quotation.
  - 3. On request, provide additional data to support computations:
    - a. Quantities of products, labor, and equipment.
    - b. Taxes, insurance and bonds.
    - c. Overhead and profit.
    - d. Justification for change in Contract Time.
    - e. Credit for deletions from Contract, similarly documented.
  - 4. Support each claim for additional costs, and for work completed on a time and material basis, with additional information:
    - a. Origin and date of claim.
    - b. Dates and time work was performed and by whom.
    - c. Time records and wage rates paid.
    - d. Invoices and receipts for products, equipment, and subcontracts, similarly documented.
- D. Construction Change Directive: The Project Engineer may issue a document, approved by the Owner, instructing the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order (Supplemental Agreement). The document will describe changes in the Work, and will designate method of determining any change in the Contract Sum or Contract Time. The change in Work will be promptly executed.

- E. Format: The Project Engineer will prepare 5 originals of the Change Order (Supplemental Agreement) using the Mississippi Department of Transportation's Change Order (Supplemental Agreement) Form.
- F. Types of Change Orders (Supplemental Agreements):
1. Stipulated Sum Change Orders: Based on Proposal Request and Contractor's fixed price quotation, or Contractor's request for a Change Order (Supplemental Agreement) as approved by the Project Engineer and the MDOT Architect.
  2. Unit Price Change Order: For pre-determined unit prices and quantities, the Change Order (Supplemental Agreement) will be executed on a fixed unit price basis. For unit costs or quantities of units of work, which are not pre-determined, execute Work under a Construction Change Directive. Changes in Contract Sum or Contract Time will be computed as specified for Time and Material Change Order (Supplemental Agreement).
  3. Time and Material Change Order (Supplemental Agreement): Submit itemized account and supporting data after completion of change, within time limits indicated in the Standard Form of Agreement Between the Owner and the Contractor. The Project Engineer will determine the change allowable in Contract Sum and Contract Time as provided in the Contract Documents. The Contractor shall maintain detailed records of Work accomplished on Time and Material basis and shall provide full information required for evaluation of proposed changes, and to substantiate costs for changes in the Work.
- G. Execution of Change Order (Supplemental Agreement): The Project Engineer will issue Change Orders (Supplemental Agreements) for signatures of parties as provided in the Standard Form of Agreement Between the Owner and the Contractor. Final execution of all Change Orders (Supplemental Agreements) requires approval by the Owner.
- H. Correlation of Contractor Submittals: The Contractor shall promptly revise Schedule of Values and the Application for Payment forms to record each authorized Change Order (Supplemental Agreement) as a separate line item and adjust the Contract Sum. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust time for other items of Work affected by the change and resubmit. Promptly enter changes in Project Record Documents.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

## SECTION 01 29 00

## PAYMENT PROCEDURES

## PART 1 - GENERAL

## 1.01 SUMMARY

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Requirements:
  - 1. Section 01 26 00 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
  - 2. Section 01 32 00 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

## 1.02 SCHEDULE OF VALUES

- A. Scope: Submit electronic pdf copy of the Schedule of Values to the MDOT Architect, with a copy 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. This copy of the Schedule of Values will be reviewed as Submittal No.1. A copy of this submittal will be reviewed by the MDOT Architect, Civil/Structural Consultants and Mechanical / Electrical Consultants. One copy will be retained by MDOT Architectural Services Unit, one by Civil/Structural Consultants, Mechanical / Electrical Consultants, one sent to Contract Administration for use in reviewing requests for Permission to Sub-Contract (CAD-720 Form), one sent to the Project Engineer, and one returned to the Contractor.
- C. Form of Submittal: Submit typewritten Schedule of Values on AIA Document G703-1992, using Table of Contents of this Specification as basis for format for listing costs of Work for Sections under Divisions 02 - 49. Identify each line item with number and title as listed in Table of Contents of this Specification.
- D. Preparing Schedule of Values:
  - 1. Itemize separate line item costs for each of the following general cost items: Performance and Payment Bonds, field supervision and layout, temporary facilities and controls, and closeout documents.
  - 2. Itemize separate line item cost for Work required by each Section of this specification. Breakdown installed cost with overhead and profit.
  - 3. Each line item, which has installed value of more than \$20,000, break down costs to list major products for operations under each item; rounding figures to nearest dollar. Make sum of total costs of all items listed in schedule equal to total Contract Sum.
  - 4. Group line items to show subtotal of Description A with the same amounts indicated on the Bid Forms and a total equal to the Contract amount indicated on the Bid Form.

## E. Preparing Schedule of Unit Material Values:

1. Submit separate schedule of unit prices for materials to be stored on which progress payments will be made. Make form of submittal parallel to Schedule of Values with each line item identified same as line item in Schedule of Values. Include in unit prices only: Cost of material, delivery and unloading site, and sales tax.
2. Make sure unit prices (if required) multiplied by quantities equal material cost of that item in Schedule of Values.

## F. Review and Re-submittal: After Project Engineer / MDOT Architect's review, if requested, revise and resubmit schedule in same manner

## 1.03 METHOD FOR PAYMENT

- A. The method of measurement and payment shall conform to the applicable provisions of Article 9 of the AIA Document A201-2007 General Conditions of the Contract for Construction.

## 1.04 APPLICATIONS FOR PAYMENT

## A. Format:

1. Applications for Payments will be prepared on AIA forms G702-Application and Certificate for payment and G703-Continuation Sheet; or, a computer generated form containing similar data may be used.

## B. Preparation of Application:

1. Present required information in type written form.
2. Execute certification by signature of authorized officer.
3. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of Work performed and for stored products.
4. List each authorized Change Order (Supplemental Agreement) as an extension on continuation sheet, listing Change Order (Supplemental Agreement) number and dollar amount as for an original Item of Work.
5. Prepare Application for Final Payment as specified in Section 01 77 00-Closeout Procedures.

## C. Submittal Procedures:

1. Submit electronic pdf copy 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 Maintenance Area Headquarters Building in Ocean Springs, Jackson 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-6241-30(001) 503010  
Maintenance Area Headquarters Building  
In Ocean Springs, Jackson County

lump sum

TOTAL PROJECT CONTRACT SUM

---

LUMP SUM

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

## SECTION 01 31 00

## PROJECT MANAGEMENT AND COORDINATION

## PART 1 - GENERAL

## 1.01 SUMMARY

- A. Scope: Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
1. Project Management.
  2. Requests for Information (RFIs).
  3. Project meetings.
- B. Project Coordinator: The General Contractor shall designate one individual as Project Coordinator (Superintendent), as referred to in the General Conditions. Prior to beginning Work his name, qualifications and address shall be submitted, in writing, to the MDOT Executive Director with copies to the Construction Engineer, Contract Administration Engineer, District Engineer, Project Engineer and MDOT Architect. Upon approval, he will remain until the Project is completed and cannot be removed during construction without just cause and without the written consent of the Project Engineer.
- C. Related Requirements:
1. Section 01 73 00 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.

## 1.02 DEFINITIONS

- A. RFI: Request from Project Engineer, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

## 1.03 INFORMATIONAL SUBMITTALS

- A. Key Personnel List: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site.
1. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home and office telephone numbers.
  2. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project
- B. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Use CSI Form 1.5A. Include the following information in tabular form:
1. Name, address, and telephone number of entity performing subcontract or supplying products.
  2. Number and title of related Specification Section(s) covered by subcontract.
  3. Drawing number and detail references, as appropriate, covered by subcontract.

## 1.04 DUTIES OF PROJECT COORDINATOR (SUPERINTENDENT)

- A. General: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
1. Coordination: Coordinate the work of all subcontractors and material suppliers.
  2. Supervision: Supervise the activities of every phase of Work taking place on the project.
  3. Contractor's Daily Job Diary: Submit copy of daily job diary to Project Engineer and MDOT Architect each Monday for previous week.
  4. Electrical: Take special care to coordinate and supervise the Work of electrical and other subcontractors.
  5. Communication: Establish lines of authority and communication at the job site.
  6. Location: The Project Coordinator (Superintendent) must be present on the job site at all times while work is in progress. Superintendent shall advise Project Engineer of an intended absence from the work and designate a person to be in charge of the Work during such absence.
  7. Permits: Assist in obtaining building and special permits required for construction.
- B. Interpretations of Contract Documents:
1. Consultation: Consult with Project Engineer to obtain interpretations.
  2. Assistance: Assist in resolution of questions.
  3. Transmissions: Transmit written interpretations to concerned parties.
- C. Cessation of Work: Stop all Work not in accordance with the requirements of the Contract Documents.
- D. Division 01: Coordinate and assist in the preparation of all requirements of Division 01 and specifically as follows:
1. Enforce safety requirements.
  2. Schedule of Value: Assist in preparation and be knowledgeable of each entry in the Schedule of Values.
  3. Cutting and Patching: Supervise and control all cutting and patching of other trades work.
  4. Project Meetings: Schedule with Project Engineer's approval and attend all project meetings.
  5. Construction Schedules: Prepare and submit all construction schedules. Supervise Work to monitor compliance with schedules.
  6. Shop Drawings, Product Data and Samples: Administer the processing of all submittals required by the Project Manual.
  7. Testing: Coordinate all required testing.
  8. Temporary Facilities and Controls: Allocate, maintain and monitor all temporary facilities.
  9. Substitutions: Administer the processing of all substitutions.
  10. Cleaning: Direct and execute a continuing (daily) cleaning program throughout construction, requiring each trade to dispose of their debris.
  11. Project Closeout: Collect and present all closeout documents to the Project Engineer.
  12. Project Record Documents: Maintain up-to-date Project Record Documents.
- E. Changes: Recommend and assist in the preparation of requests to the Project Engineer for any changes in the Contract.

- F. Application for Payment: Assist in the preparation and be knowledgeable of each entry in the Application and Certificate for Payment.

#### 1.05 COORDINATION AND PROJECT CONDITIONS

- A. Coordinate scheduling, submittals, and Work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- B. Verify utility requirements and characteristics of operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- C. Coordinate space requirements, supports, and installation of Mechanical and Electrical Work that are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- D. Coordinate completion and clean-up of Work of separate sections in preparation for Substantial Completion and for portions of Work designated for Owner's partial occupancy, if required.
- E. After Owner occupancy of premises, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

#### 1.06 SUBCONTRACTOR'S DUTIES

- A. The Subcontractor is responsible to coordinate and supervise his employees in the Work accomplished under his part of the Contract.
- B. Schedules: Conduct Work to assure compliance with construction schedules.
- C. Suppliers: Transmit all instructions to his material suppliers.
- D. Cooperation: Cooperate with the Project Coordinator and other subcontractors.

#### 1.07 REQUESTS FOR INFORMATION (RFIs)

- A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
  - 1. MDOT Architect will return RFIs submitted to MDOT Architect by other entities controlled by Contractor with no response.
  - 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
  - 1. Project name.
  - 2. Project number.
  - 3. Date.
  - 4. Name of Contractor.

5. Name of Architect
  6. RFI number, numbered sequentially.
  7. RFI subject.
  8. Specification Section number and title and related paragraphs, as appropriate.
  9. Drawing number and detail references, as appropriate.
  10. Field dimensions and conditions, as appropriate.
  11. Contractor's suggested resolution. If Contractor's solution(s) impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
  12. Contractor's signature.
  13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
  14. RFI Forms: CSI Form 13.2A. Identify each page of attachments with the RFI number and sequential page number.
- C. MDOT Architect's Action: MDOT Architect will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by MDOT Architect after 1:00 p.m. will be considered as received the following working day.
1. The following RFIs will be returned without action:
    - a. Requests for approval of submittals.
    - b. Requests for approval of substitutions.
    - c. Requests for coordination information already indicated in the Contract Documents.
    - d. Requests for adjustments in the Contract Time or the Contract Sum.
    - e. Requests for interpretation of Architect's actions on submittals.
    - f. Incomplete RFIs or inaccurately prepared RFIs.
  2. MDOT Architect's action may include a request for additional information, in which case MDOT Architect's time for response will date from time of receipt of additional information.
  3. MDOT Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 01 26 00 "Contract Modification Procedures."
    - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify MDOT Architect in writing within 7 days of receipt of the RFI response.
- D. On receipt of MDOT Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.
- E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log the first week of each month. Use CSI Log Form 13.2B. Include the following:
1. Project name.
  2. Name and address of Contractor.
  3. Name and address of Architect.
  4. RFI number including RFIs that were dropped and not submitted.
  5. RFI description.
  6. Date the RFI was submitted.
  7. Date MDOT Architect's response was received.

- F. On receipt of MDOT Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify MDOT Architect within seven days if Contractor disagrees with response.
  - 1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
  - 2. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

#### 1.08 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated. Project Meetings shall be held for the following reasons:
  - 1. Establish an understanding of what is expected from everyone involved.
  - 2. Enable an orderly Project review during the progress of the Work.
  - 3. Provide for systematic discussion of problems and effect remedies and clarifications.
  - 4. Coordination of the Work.
  - 5. Review installation procedures and schedules.
- B. Scheduling and Administration: The Project Engineer shall schedule and preside over all meetings throughout the progress of the Work. Duties include the following:
  - 1. Review, modify / approve minutes of the previous meeting.
  - 2. Discuss items that have been done the previous month and anticipated work to be done within the next month.
  - 3. Review Contractor's Pay Request and resolve questions or conflicts with Construction Documents.
- C. Scheduling and Administration: The Contractor shall attend and administer all meetings throughout the progress of the Work. Duties include the following:
  - 1. Preparation of agenda for meetings.
  - 2. Distribution of agenda and written notice 7 days in advance of date for each regularly scheduled meeting.
  - 3. Make physical arrangements for meetings.
  - 4. Record the minutes which shall include list of all participants and all significant proceedings and, in particular, all decisions, agreements, clarifications, and other data related to Project cost, time, and modifications.
  - 5. Distribute copies of minutes within 7 calendar days to all parties affected by decisions made at the meeting.
  - 6. Follow-up unresolved matters discussed at meetings and promptly effect final resolution, especially for work in progress. Advise all affected parties of result and include report of activities in next scheduled meeting.
- D. Scheduling and Administration: Representatives of Contractor's, Subcontractor's, and Supplier's attending the meetings shall be qualified and authorized to act on behalf of the entity each represents.
- E. Scheduling and Administration: Consultants may attend meetings to ascertain work is expedited consistent with Contract Documents and construction schedules.

- F. Preconstruction Conference: The Project Engineer, with the assistance of the MDOT Architect, will preside over and administer this meeting.
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 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 material 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 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 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. Paper Submittals are required for sheets larger than 11 by 17 inches.
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: Electronic pdf submittals are required for pages smaller than 11 by 17 inches. 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 / color charts 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 for 8 1/2 by 11 inches and 11 by 17 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 11 by 17 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 or one electronic pdf copy 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 electronic pdf file.
- 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 11 by 17 inches, but no larger than 24 by 36 inches.
  3. Submit Shop Drawings in the following format:
    - a. 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.
  3. 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.
  4. 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.

5. 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 pdf file for sheets less than 11 by 17 inches.
    - b. Four paper copies (for sheets larger than 11 by 17 inches) 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 one (or the remainder (if paper submittal) to the Contractor. MDOT Architect / Consultants will stamp each submittal with an action stamp and will mark appropriately to indicate action. Consultants will retain one copy of reviewed submittals.
- C. Informational Submittals: MDOT Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. MDOT Architect will forward each submittal to appropriate party.
- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION



## SECTION 01 40 00

## QUALITY REQUIREMENTS

## PART 1 - GENERAL

## 1.01 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
  - 1. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
  - 2. Requirements for Contractor to provide quality-assurance and -control services required by MDOT Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
  - 3. Specific test and inspection requirements are not specified in this Section.
- C. MDOT will provide the following inspections, sampling and testing at no cost to the Contractor:
  - 1. Section 03 20 00 "Concrete Reinforcing".
  - 2. Section 03 30 00 "Cast-In-Place Concrete".
  - 3. Section 31 23 11 "Excavation, Fill and Grading for Building".
- 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 indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."

- B. 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; <a href="http://www.aabc.com">www.aabc.com</a> .
AAMA	American Architectural Manufacturers Association; <a href="http://www.aamanet.org">www.aamanet.org</a> .
AASHTO	American Association of State Highway and Transportation Officials <a href="http://www.transportation.org">www.transportation.org</a> .
ACI	American Concrete Institute (Formerly: ACI International); <a href="http://www.concrete.org">www.concrete.org</a>
ACPA	American Concrete Pipe Association; <a href="http://www.concrete-pipe.org">www.concrete-pipe.org</a> .
AEIC	Association of Edison Illuminating Companies, Inc. (The); <a href="http://www.aeic.org">www.aeic.org</a> .
AGA	American Gas Association; <a href="http://www.aga.org">www.aga.org</a> .
AHAM	Association of Home Appliance Manufacturers; <a href="http://www.aham.org">www.aham.org</a> .
AHRI	Air-Conditioning, Heating, and Refrigeration Institute (The); <a href="http://www.ahrinet.org">www.ahrinet.org</a> .
AI	Asphalt Institute; <a href="http://www.asphaltinstitute.org">www.asphaltinstitute.org</a> .
AIA	American Institute of Architects (The); <a href="http://www.aia.org">www.aia.org</a> .
AISC	American Institute of Steel Construction; <a href="http://www.aisc.org">www.aisc.org</a> .
AISI	American Iron and Steel Institute; <a href="http://www.steel.org">www.steel.org</a> .
AMCA	Air Movement and Control Association International, Inc.; <a href="http://www.amca.org">www.amca.org</a> .
ANSI	American National Standards Institute; <a href="http://www.ansi.org">www.ansi.org</a> .
AOSA	Association of Official Seed Analysts, Inc.; <a href="http://www.aosaseed.com">www.aosaseed.com</a> .
APA	APA - The Engineered Wood Association; <a href="http://www.apawood.org">www.apawood.org</a> .
APA	Architectural Precast Association; <a href="http://www.archprecast.org">www.archprecast.org</a> .
API	American Petroleum Institute; <a href="http://www.api.org">www.api.org</a> .
ARI	Air-Conditioning & Refrigeration Institute (See AHRI)
ARI	American Refrigeration Institute (See AHRI)
ASCE	American Society of Civil Engineers; <a href="http://www.asce.org">www.asce.org</a> .
ASCE/SEI	American Society of Civil Engineers / Structural Engineering Institute (See ASCE)
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers; <a href="http://www.ashrae.org">www.ashrae.org</a> .
ASME	ASME International (American Society of Mechanical Engineers); <a href="http://www.asme.org">www.asme.org</a> .
ASSE	American Society of Sanitary Engineering; <a href="http://www.asse.org">www.asse.org</a> .
ASTM	ASTM International (American Society for Testing and Materials International); <a href="http://www.astm.org">www.astm.org</a> .
AWI	Architectural Woodwork Institute; <a href="http://www.awinet.org">www.awinet.org</a> .
AWPA	American Wood Protection Association (Formerly: American Wood-Preservers' Association); <a href="http://www.awpa.com">www.awpa.com</a> .
AWS	American Welding Society; <a href="http://www.aws.org">www.aws.org</a> .
AWWA	American Water Works Association; <a href="http://www.awwa.org">www.awwa.org</a> .
BHMA	Builders Hardware Manufacturers Association; <a href="http://www.buildershardware.com">www.buildershardware.com</a> .
CFSEI	Cold-Formed Steel Engineers Institute; <a href="http://www.cfsei.org">www.cfsei.org</a> .
CGA	Compressed Gas Association; <a href="http://www.cganet.com">www.cganet.com</a> .
CIMA	Cellulose Insulation Manufacturers Association; <a href="http://www.cellulose.org">www.cellulose.org</a> .
CISCA	Ceilings & Interior Systems Construction Association; <a href="http://www.cisca.org">www.cisca.org</a> .
CLFMI	Chain Link Fence Manufacturers Institute; <a href="http://www.chainlinkinfo.org">www.chainlinkinfo.org</a> .
CRI	Carpet and Rug Institute (The); <a href="http://www.carpet-rug.org">www.carpet-rug.org</a> .
CRRC	Cool Roof Rating Council; <a href="http://www.coolroofs.org">www.coolroofs.org</a>
CRSI	Concrete Reinforcing Steel Institute; <a href="http://www.crsi.org">www.crsi.org</a> .
CSA	CSA International (Formerly: IAS - International Approval Services); <a href="http://www.csa-international.org">www.csa-international.org</a>
CSI	Construction Specifications Institute (The); <a href="http://www.csinet.org">www.csinet.org</a> .
DASMA	Door and Access Systems Manufacturers Association; <a href="http://www.dasma.com">www.dasma.com</a> .

DHI	Door and Hardware Institute; <a href="http://www.dhi.org">www.dhi.org</a> .
ECA	Electronic Components Association; (See ECIA).
FM Approvals	FM Approvals LLC; <a href="http://www.fmglobal.com">www.fmglobal.com</a> .
FM Global	FM Global (Formerly: FMG - FM Global); <a href="http://www.fmglobal.com">www.fmglobal.com</a> .
GA	Gypsum Association; <a href="http://www.gypsum.org">www.gypsum.org</a> .
GANA	Glass Association of North America; <a href="http://www.glasswebsite.com">www.glasswebsite.com</a> .
HMMA	Hollow Metal Manufacturers Association (See NAAMM)
HPVA	Hardwood Plywood & Veneer Association; <a href="http://www.hpva.org">www.hpva.org</a> .
ICBO	International Conference of Building Officials (See ICC)
ICC	International Code Council; <a href="http://www.iccsafe.org">www.iccsafe.org</a> .
ICRI	International Concrete Repair Institute, Inc.; <a href="http://www.icri.org">www.icri.org</a> .
IES	Illuminating Engineering Society (Formerly: Illuminating Engineering Society of North America); <a href="http://www.ies.org">www.ies.org</a> .
IGMA	Insulating Glass Manufacturers Alliance; <a href="http://www.igmaonline.org">www.igmaonline.org</a> .
IGSHPA	International Ground Source Heat Pump Association; <a href="http://www.igshpa.okstate.edu">www.igshpa.okstate.edu</a> .
ISO	International Organization for Standardization; <a href="http://www.iso.org">www.iso.org</a> .
LPI	Lightning Protection Institute; <a href="http://www.lightning.org">www.lightning.org</a> .
MBMA	Metal Building Manufacturers Association; <a href="http://www.mbma.com">www.mbma.com</a> .
MCA	Metal Construction Association; <a href="http://www.metalconstruction.org">www.metalconstruction.org</a> .
MFMA	Metal Framing Manufacturers Association, Inc.; <a href="http://www.metalframingmfg.org">www.metalframingmfg.org</a> .
MIA	Marble Institute of America; <a href="http://www.marble-institute.com">www.marble-institute.com</a> .
MMPA	Moulding & Millwork Producers Association (Formerly: Wood Moulding & Millwork Producers Association); <a href="http://www.wmmpa.com">www.wmmpa.com</a> .
MPI	Master Painters Institute; <a href="http://www.paintinfo.com">www.paintinfo.com</a> .
NAIMA	North American Insulation Manufacturers Association; <a href="http://www.naima.org">www.naima.org</a> .
NCMA	National Concrete Masonry Association; <a href="http://www.ncma.org">www.ncma.org</a> .
NEBB	National Environmental Balancing Bureau; <a href="http://www.nebb.org">www.nebb.org</a> .
NECA	National Electrical Contractors Association; <a href="http://www.necanet.org">www.necanet.org</a> .
NEMA	National Electrical Manufacturers Association; <a href="http://www.nema.org">www.nema.org</a> .
NETA	InterNational Electrical Testing Association; <a href="http://www.netaworld.org">www.netaworld.org</a> .
NFPA	NFPA (National Fire Protection Association); <a href="http://www.nfpa.org">www.nfpa.org</a> .
NFRC	National Fenestration Rating Council; <a href="http://www.nfrc.org">www.nfrc.org</a> .
NHLA	National Hardwood Lumber Association; <a href="http://www.nhla.com">www.nhla.com</a> .
NLGA	National Lumber Grades Authority; <a href="http://www.nlga.org">www.nlga.org</a> .
NSPE	National Society of Professional Engineers; <a href="http://www.nspe.org">www.nspe.org</a> .
NSSGA	National Stone, Sand & Gravel Association; <a href="http://www.nssga.org">www.nssga.org</a> .
NTMA	National Terrazzo & Mosaic Association, Inc. (The); <a href="http://www.ntma.com">www.ntma.com</a> .
PDI	Plumbing & Drainage Institute; <a href="http://www.pdionline.org">www.pdionline.org</a> .
RFCI	Resilient Floor Covering Institute; <a href="http://www.rfci.com">www.rfci.com</a>
SDI	Steel Deck Institute; <a href="http://www.sdi.org">www.sdi.org</a> .
SDI	Steel Door Institute; <a href="http://www.steeldoor.org">www.steeldoor.org</a> .
SEI/ASCE	Structural Engineering Institute/American Society of Civil Engineers (See ASCE)
SJI	Steel Joist Institute; <a href="http://www.steeljoist.org">www.steeljoist.org</a> .
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association; <a href="http://www.smacna.org">www.smacna.org</a> .
SPIB	Southern Pine Inspection Bureau; <a href="http://www.spib.org">www.spib.org</a> .
SRCC	Solar Rating and Certification Corporation; <a href="http://www.solar-rating.org">www.solar-rating.org</a> .
SSINA	Specialty Steel Industry of North America; <a href="http://www.ssina.com">www.ssina.com</a> .
SSPC	SSPC: The Society for Protective Coatings; <a href="http://www.sspc.org">www.sspc.org</a> .
SWPA	Submersible Wastewater Pump Association; <a href="http://www.swpa.org">www.swpa.org</a> .
TCNA	Tile Council of North America, Inc.; <a href="http://www.tileusa.com">www.tileusa.com</a> .

TIA	Telecommunications Industry Association (Formerly: TIA/EIA – Telecommunications Industry Association/Electronic Industries Alliance); <a href="http://www.tiaonline.org">www.tiaonline.org</a> .
TMS	The Masonry Society; <a href="http://www.masonrysociety.org">www.masonrysociety.org</a> .
TPI	Truss Plate Institute; <a href="http://www.tpinst.org">www.tpinst.org</a> .
TPI	Turfgrass Producers International; <a href="http://www.turfgrasssod.org">www.turfgrasssod.org</a> .
UL	Underwriters Laboratories Inc.; <a href="http://www.ul.com">http://www.ul.com</a> .
WCMA	Window Covering Manufacturers Association; <a href="http://www.wcmanet.org">www.wcmanet.org</a> .
WDMA	Window & Door Manufacturers Association; <a href="http://www.wdma.com">www.wdma.com</a> .
WWPA	Western Wood Products Association; <a href="http://www.wwpa.org">www.wwpa.org</a> .

- C. 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.

ICC	International Code Council; <a href="http://www.iccsafe.org">www.iccsafe.org</a> .
ICC-ES	ICC Evaluation Service, LLC; <a href="http://www.icc-es.org">www.icc-es.org</a> .

- D. 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 <a href="http://www.usace.army.mil">www.usace.army.mil</a> . ;
CPSC	Consumer Product Safety Commission; <a href="http://www.cpsc.gov">www.cpsc.gov</a> .
DOC	Department of Commerce National Institute of Standards and Technology; <a href="http://www.nist.gov">www.nist.gov</a> .
DOE	Department of Energy; <a href="http://www.energy.gov">www.energy.gov</a> .
EPA	Environmental Protection Agency; <a href="http://www.epa.gov">www.epa.gov</a> .
FG	Federal Government Publications; <a href="http://www.gpo.gov/fdsys">www.gpo.gov/fdsys</a> .
GSA	General Services Administration; <a href="http://www.gsa.gov">www.gsa.gov</a> .
HUD	Department of Housing and Urban Development; <a href="http://www.hud.gov">www.hud.gov</a> .
LBL	Lawrence Berkeley National Laboratory Environmental Energy Technologies Division; <a href="http://www.eetd.lbl.gov">www.eetd.lbl.gov</a> .
OSHA	Occupational Safety & Health Administration; <a href="http://www.osha.gov">www.osha.gov</a> .
TRB	Transportation Research Board; National Cooperative Highway Research Program; <a href="http://www.trb.org">www.trb.org</a> .
USDA	Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; <a href="http://www.ars.usda.gov">www.ars.usda.gov</a> .
USDA	Department of Agriculture; Rural Utilities Service; <a href="http://www.usda.gov">www.usda.gov</a> .
USPS	United States Postal Service; <a href="http://www.usps.com">www.usps.com</a> .

- E. 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; <a href="http://www.gpo.gov/fdsys">www.gpo.gov/fdsys</a> .
DOD	Department of Defense; Military Specifications and Standards Available from Department of Defense Single Stock Point; <a href="http://www.quicksearch.dla.mil">www.quicksearch.dla.mil</a> .

- FS Federal Specification;  
Available from DLA Document Services; [www.quicksearch.dla.mil](http://www.quicksearch.dla.mil).  
Available from Defense Standardization Program; [www.dsp.dla.mil](http://www.dsp.dla.mil)  
Available from General Services Administration; [www.gsa.gov](http://www.gsa.gov).  
Available from National Institute of Building Sciences/Whole Building Design Guide;  
[www.wbdg.org/ccb](http://www.wbdg.org/ccb).
- MILSPEC Military Specification and Standards (See DOD)
- USAB United States Access Board; [www.access-board.gov](http://www.access-board.gov).
- USATBCB U.S. Architectural & Transportation Barriers Compliance Board (See USAB)

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 Requirements:

1. Individual specifications sections contain specific tests and inspections to be preformed.
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 D3666, E329, and E543.
2. Authorized to operate in State of Mississippi

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 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

**1SECTION 01 45 29 TESTING AND INSPECTION 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 03 20 00, Concrete Reinforcing.
  - 2. Section 03 30 00, Cast-In-Place Concrete.
  - 3. Section 31 23 12, Excavation, Fill and Grading for Building.

**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 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, or fabricator
  - 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 method specified 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 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 system indicated 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 Substantial 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 Substantial 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 Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.
  - K. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
    - 1. Where heating or cooling is needed and permanent enclosure is not complete, insulate temporary enclosures.
  - L. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner from fumes and noise.
    - 1. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire-retardant-treated plywood on construction operations side.
    - 2. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
    - 3. Insulate partitions to control noise transmission to occupied areas.
    - 4. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
    - 5. Protect air-handling equipment.
    - 6. Provide walk-off mats at each entrance through temporary partition.
  - M. 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 Date of 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.

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. Temporary Support: Provide temporary support of work to be cut.
- C. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- D. Adjacent Occupied Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- E. 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.
- F. 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.
- G. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

### 3.07 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
  2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
  3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
1. Remove liquid spills promptly.
  2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways.
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

### 3.08 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: Comply with qualification requirements in Section 01 40 00 "Quality Requirements"

### 3.09 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION

**SECTION 01 74 19 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section includes administrative and procedural requirements for the following:
  - 1. Recycling nonhazardous construction waste.
  - 2. Disposing of nonhazardous construction waste.
- B. Related Requirements:
  - 1. Section 04 22 00 "Concrete Unit Masonry" for disposal requirements for masonry waste.
  - 2. Section 31 23 11 "Excavation, Fill and Grading for Building" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

**1.02 DEFINITIONS**

- A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
- C. Recycle: Recovery of 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. Plan shall consist of waste identification and waste reduction work plan.

- B. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or 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. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. Coordinator shall be present at Project site full time for duration of Project.
- C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.
1. Distribute waste management plan to everyone concerned within five days of submittal return.
  2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.
- D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
  2. Comply with Section 01 50 00 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

### 3.02 RECYCLING CONSTRUCTION WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers.



- B. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.
1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
    - a. Inspect containers and bins for contamination and remove contaminated materials if found.
  2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
  3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
  4. Store components off the ground and protect from the weather.
  5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor.

### 3.03 RECYCLING CONSTRUCTION WASTE

- A. Packaging:
1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
  2. Polystyrene Packaging: Separate and bag materials.
  3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
  4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
- B. Wood Materials:
1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
  2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
- C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.
1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.

3.04 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
  - 1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
  - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn waste materials.
- C. Disposal: Remove waste materials from Owner's property and legally dispose of them.

END OF SECTION

## SECTION 01 77 00

## CLOSEOUT PROCEDURES

## PART 1 - GENERAL

## 1.01 SUMMARY

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
1. Final completion procedures.
  2. Warranties.
  3. Final cleaning.
  4. Repair of the Work.
- B. Related Requirements:
1. Section 01 32 33 "Photographic Documentation" for submitting final completion construction photographic documentation.
  2. Section 01 78 23 "Operation and Maintenance Data" for operation and maintenance manual requirements.
  3. Section 01 78 39 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
  4. Section 01 79 00 "Demonstration and Training" for requirements for instructing Owner's personnel.

## 1.02 FINAL INSPECTIONS

- A. Engineer and Architect's Inspection: The Contractor shall make written request for a Final Inspection to the Project Engineer and MDOT Architect. Notice is to be given 10 calendar days prior to this inspection. At the day of inspection, the Contractor shall have in hand 6 copies of the HVAC Test and Balance Report, Reference Specification Sections in Division 23 and 6 copies of a list prepared by the Contractor of deficiencies, which will be edited by the Project Engineer, MDOT Architect and Consultants. A copy of these composite lists will be given to the Contractor for correcting the Work. Within 15 calendar days after this revised list is received, the Contractor shall make all corrections of the items listed. If, in the Project Engineer and MDOT Architect's judgment, the Project is not ready for an Inspection, the Project Engineer may schedule another inspection.
- B. Owner's Inspection: After the Project Engineer and MDOT Architect have determined the Project to be Complete and all punch list items have been corrected, an Owner's Inspection will be scheduled. The Contractor shall submit a letter that states all items have been corrected and submit required closeout Documents. The Owners may add to the punch list items; if it is determined that corrective work still needs to be done. Within 15 calendar days after this revised list is received, the Contractor shall make all corrections of the items listed.
- C. Correction of Work before Final Payment: Contractor shall promptly remove from the Owner's premises, all materials condemned for failure to conform to the Contract, whether incorporated in Work or not, and Contractor shall, at his own expense, replace such condemned materials with those conforming to the requirements of the Contract. Failure to remedy such defects after 10 days written notice will allow the Owner to make good such defects and such costs shall be deducted from the balance due the Contractor or charged to the Contractor in the event no payment is due.

- D. Should additional inspections by the MDOT Architect's Consultants of the Work be required due to failure of the Contractor to remedy defects listed, the Project Engineer may deduct the expense of additional Consultants inspections from the Contract Sum in the Owner / Contractor Agreement. The additional expense will be based on the rate shown for services in the Consultants' Architect or Engineering Services Contract.

#### 1.03 FINAL ACCEPTANCE

- A. The Mississippi Department of Transportation does not recognize the term "Substantial Completion". The Project Engineer shall determine when the building is complete to the point it can be used for its intended purpose and occupied. This date shall be the Date of Completion.
- B. Final Payment shall not be made until items covered in Closeout Procedures are satisfied. This date shall be the Date of Final Acceptance.

#### 1.04 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: All Warranties and Extended Warranties shall use this Date of Completion as the starting date of Warranty Period.
- B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
  2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
  3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
  4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
- C. Provide additional copies of each warranty to include in operation and maintenance manuals.

#### 1.05 CLOSEOUT DOCUMENTS

- A. Unless otherwise notified, the Contractor shall submit to the Owner through the Project Engineer to the MDOT Architect 2 copies the following before final payment is made:
1. Request for Final Payment: AIA Document G702, current edition, completed in full or a computer generated form having similar data.
  2. Contractor's Affidavit of Payment of Debts and Claims: AIA Document G706, current edition, completed in full.
  3. Release of Liens and Certification that all Bills Have Been Paid: AIA Document G706A, current edition, completed in full or a sworn statement and affidavit from the Contractor to the Owner stating that all bills for this project have been paid and that the Owner is released from any and all claims and / or damages.
  4. Consent of Surety Company to Final Payment: AIA Document G707, current edition, completed in full by the Bonding Company.

5. Power of Attorney: Closeout Documents should be accompanied by an appropriate Power of Attorney.
6. Guarantee of Work: Sworn statement that all Work is asbestos free and guaranteed against defects in materials and workmanship for one year from Date of Completion, except where specified for longer periods.
  - a. Word the guaranty as follows: "We hereby guarantee all Work performed by us on the above captioned Project to be free from asbestos and defective materials. We also guarantee workmanship for a period of one (1) year or such longer period of time as may be called for in the Contract Documents for such portions of the Work".
  - b. All guarantees and warranties shall be obtained in the Owner's name.
  - c. Within the guaranty period, if repairs or changes are requested in connection with guaranteed Work which, in the opinion of the Owner, is rendered necessary as a result of the use of materials, equipment, or workmanship which are inferior, defective, or not in accordance with the terms of the Contract, the Contractor shall promptly, upon receipt of notice from and without expense to the Owner, place in satisfactory condition in every particular, all such guaranteed Work, correct all defects wherein and make good all damages to the building, site, equipment or contents thereof which, in the opinion of the Owner, is the result of the use of materials, equipment, or workmanship which are inferior, defective or not in accordance with the terms of the Contract; and make good any Work or materials or the equipment and contents of said buildings or site disturbed in fulfilling any such guaranty.
  - d. If, after notice, the Contractor fails to proceed promptly to comply with the terms of the guaranty, the Owner may have the defects corrected and the Contractor and his sureties shall be liable for all expense incurred.
  - e. All special guaranties applicable to definite parts of the Work stipulated in the Project Manual or other papers forming part of the Contract shall be subject to the terms of this paragraph during the first year of the life of such special guaranty.
7. Project Record Documents: Furnish all other record documents as set forth in Section 01 78 39 - Project Record Documents.
  - a. Provide all certificates, warranties, guarantees, bonds, or documents as called for in the individual Sections of the Project Manual. The Contractor is responsible for examining the Project Manual for these requirements.
8. Additional Documents Specified Within the Project Manual:
  - a. General Provide all Operational and Maintenance documents as called for in the individual Sections of the Project Manual. The Contractor is responsible for examining the Project Manual for these requirements.
  - b. Maintenance Stock: Deliver to Owner all required additional maintenance materials as required in the various Sections of the Specifications.

## PART 2 - PRODUCTS

### 2.01 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

## PART 3 - EXECUTION

## 3.01 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
1. Complete the following cleaning operations before requesting Engineer and Architect final inspection.
    - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
    - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
    - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
    - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
    - e. Remove snow and ice to provide safe access to building.
    - f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
    - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
    - h. Sweep concrete floors broom clean in unoccupied spaces.
    - i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
    - j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
    - k. Remove labels that are not permanent.
    - l. Wipe surfaces of mechanical and electrical equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
    - m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
    - n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
    - o. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
    - p. Leave Project clean and ready for occupancy.
- C. Pest Control: Comply with pest control requirements in Section 01 50 00 "Temporary Facilities and Controls." Prepare written report.

3.02 REPAIR OF THE WORK

- A. Complete repair and restoration operations before requesting Final Inspection.
- B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
  - 1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
  - 2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration.
    - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
  - 3. Replace 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:
  - 1. Section 01 78 23 "Operation and Maintenance Data" for operation and maintenance manual requirements.

## 1.02 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
  - 1. Number of Copies: Submit copies of record Drawings as follows:
    - a. Submittal:
      - 1) Submit PDF electronic files of scanned record prints and two set(s) of marked-up record prints.
      - 2) Print each drawing, whether or not changes and additional information were recorded.
- B. Record Project Manual (Proposal): Submit two paper copies and one annotated PDF electronic files of Project Manual (Proposal), including addenda and contract modifications.
- C. Record Product Data: Submit two paper copies and one annotated PDF electronic files and directories of each submittal.

## PART 2 - PRODUCTS

## 2.01 RECORD DRAWINGS

- A. Record Prints: Maintain two sets of marked-up paper copies of the Contract Drawings (half-size) and Shop Drawings, incorporating new and revised Drawings as modifications are issued.
  - 1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
    - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.

- b. Record data as soon as possible after obtaining it.
    - c. Record and check the markup before enclosing concealed installations.
  - 2. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
  - 3. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
  - 4. Note Construction Change Directive numbers, alternate numbers, Change Order (Supplemental Agreements) numbers, and similar identification, where applicable.
- B. Record Digital Data Files: Immediately before inspection for Final Completion review marked-up record prints with Project Engineer and MDOT Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
  - 1. Format: Annotated PDF electronic file.
  - 2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
  - 3. Refer instances of uncertainty to Project Engineer and MDOT Architect for resolution.
- C. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
  - 1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
  - 2. Format: Annotated PDF electronic file.
  - 3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
  - 4. Identification: As follows:
    - a. Project name.
    - b. Date.
    - c. Designation "PROJECT RECORD DRAWINGS."
    - d. Name of Consulting Architect (if applicable).
    - e. Name of Contractor.

## 2.02 RECORD PROJECT MANUAL (PROPOSAL)

- A. Preparation: Mark Project Manual (Proposal) to indicate the actual product installation where installation varies from that indicated in the Technical Specifications, addenda, and contract modifications.
  - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  - 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
  - 3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
  - 4. Note related Change Orders (Supplemental Agreements), record Product Data, and record Drawings where applicable.



- B. Format: Submit record Project Manual (Proposal) as scanned PDF electronic file(s) of marked-up paper copy of Project Manual (Proposal).

### 2.03 RECORD PRODUCT DATA

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
  - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  - 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
  - 3. Note related Change Orders (Supplemental Agreements), record Specifications, and record Drawings where applicable.
- B. Format: Submit record Product Data as scanned PDF electronic file(s) of marked-up paper copy of Product Data.

## PART 3 - EXECUTION

### 3.01 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.
- B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Project Engineer's and MDOT Architect's reference during normal working hours.
- C. The information, except Contract Drawings, shall be arranged and labeled by corresponding Specification Section, neatly bound in three ring binders, indexed, and all shop drawings readable without being removed or unstapled.
- D. The name and address of each subcontractor and material supplier shall be listed in front of each binder along with the Project Manual (Proposal).
- E. Sufficient information, such as as-built control drawings for air handling system and variable drive controls, shall be furnished to allow qualified personnel to service equipment.

END OF SECTION

## SECTION 01 79 00

## DEMONSTRATION AND TRAINING

## PART 1 - GENERAL

## 1.01 SUMMARY

- A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
  - 1. Demonstration of operation of systems, subsystems, and equipment.
  - 2. Training in operation and maintenance of systems, subsystems, and equipment.
  - 3. Demonstration and training video recordings.

## 1.02 INFORMATIONAL SUBMITTALS

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
  - 1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

## 1.03 CLOSEOUT SUBMITTALS

- A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.
  - 1. At completion of training, submit complete training manual(s) for Owner's use prepared and bound in format matching operation and maintenance manuals.

## 1.04 QUALITY ASSURANCE

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
- B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 01 40 00 "Quality Requirements," experienced in operation and maintenance procedures and training.
- C. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination." Review methods and procedures related to demonstration and training.

## 1.05 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

- B. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

## PART 2 - PRODUCTS

### 2.01 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
  1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
    - a. System, subsystem, and equipment descriptions.
    - b. Performance and design criteria if Contractor is delegated design responsibility.
    - c. Operating standards.
    - d. Regulatory requirements.
    - e. Equipment function.
    - f. Operating characteristics.
    - g. Limiting conditions.
    - h. Performance curves.
  2. Documentation: Review the following items in detail:
    - a. Emergency manuals.
    - b. Operations manuals.
    - c. Maintenance manuals.
    - d. Project record documents.
    - e. Identification systems.
    - f. Warranties and bonds.
    - g. Maintenance service agreements and similar continuing commitments.
  3. Emergencies: Include the following, as applicable:
    - a. Instructions on meaning of warnings, trouble indications, and error messages.
    - b. Instructions on stopping.
    - c. Shutdown instructions for each type of emergency.
    - d. Operating instructions for conditions outside of normal operating limits.
    - e. Sequences for electric or electronic systems.
    - f. Special operating instructions and procedures.
  4. Operations: Include the following, as applicable:
    - a. Startup procedures.
    - b. Equipment or system break-in procedures.
    - c. Routine and normal operating instructions.
    - d. Regulation and control procedures.
    - e. Control sequences.
    - f. Safety procedures.
    - g. Instructions on stopping.
    - h. Normal shutdown instructions.
    - i. Operating procedures for emergencies.
    - j. Operating procedures for system, subsystem, or equipment failure.

- k. Seasonal and weekend operating instructions.
- l. Required sequences for electric or electronic systems.
- m. Special operating instructions and procedures.
- 5. Adjustments: Include the following:
  - a. Alignments.
  - b. Checking adjustments.
  - c. Noise and vibration adjustments.
  - d. Economy and efficiency adjustments.
- 6. Troubleshooting: Include the following:
  - a. Diagnostic instructions.
  - b. Test and inspection procedures.
- 7. Maintenance: Include the following:
  - a. Inspection procedures.
  - b. Types of cleaning agents to be used and methods of cleaning.
  - c. List of cleaning agents and methods of cleaning detrimental to product.
  - d. Procedures for routine cleaning
  - e. Procedures for preventive maintenance.
  - f. Procedures for routine maintenance.
  - g. Instruction on use of special tools.
- 8. Repairs: Include the following:
  - a. Diagnosis instructions.
  - b. Repair instructions.
  - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
  - d. Instructions for identifying parts and components.
  - e. Review of spare parts needed for operation and maintenance.

### PART 3 - EXECUTION

#### 3.01 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 01 78 23 "Operation and Maintenance Data."

#### 3.02 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
  - 1. Owner will furnish Contractor with names and positions of participants.
- C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
  - 1. Schedule training with Owner, through Project Engineer, with at least seven days' advance notice.
- D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

- E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.

3.03 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

- A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
  - 1. At beginning of each training module, record each chart containing learning objective and lesson outline.
- B. Video Recording Format: Provide high-quality color video recordings with menu navigation in format acceptable to Project Engineer and MDOT Architect.
- C. Narration: Describe scenes on video recording by dubbing audio narration off-site after video recording is recorded. Include description of items being viewed.
- D. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

END OF SECTION

SECTION 02 41 16

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.
- B. Types of Demolition Work include, but are not limited to the following items:
  - 1. Complete building structure indicated on Drawings and as required to accommodate new construction.
  - 2. Removal of all exterior building or site items indicated on Drawings.

1.02 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
  - 1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.03 INFORMATIONAL SUBMITTALS

- A. Schedule of building demolition with starting and ending dates for each activity.
- B. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician.

1.04 QUALITY ASSURANCE

- A. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.
- B. Predemolition Conference: Conduct conference at Project site, unless noted otherwise.

1.05 PROJECT CONDITIONS

- A. Buildings to be demolished will be vacated and their use discontinued before start of the Work.

- B. Buildings immediately adjacent to demolition area will be occupied. Conduct building demolition so operations of occupied buildings will not be disrupted.
  - 1. Provide not less than 72 hours' notice of activities that will affect operations of adjacent occupied buildings.
  - 2. Maintain access to existing walkways, exits, and other facilities used by occupants of adjacent buildings.
    - a. Do not close or obstruct walkways, exits, or other facilities used by occupants of adjacent buildings without written permission from authorities having jurisdiction.
- C. Owner assumes no responsibility for buildings and structures to be demolished.
  - 1. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
  - 2. Before building demolition, Owner will have remove all salvaged items.
- 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 materials suspected of containing 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. Arrange demolition schedule so as not to interfere with Owner's on-site operations.

## PART 2 - PRODUCTS

### 2.01 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ASSE A10.6 and NFPA 241.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting demolition operations.
- B. Inventory and record the condition of items to be removed and salvaged.

### 3.02 PREPARATION

- A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

- B. Existing Utilities: Locate, identify, disconnect, and seal or cap off indicated utilities serving buildings and structures to be demolished.
1. Owner will arrange to shut off indicated utilities when requested by Contractor.
  2. If removal, relocation, or abandonment of utility services will affect adjacent occupied buildings, then provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings and structures.
  3. Cut off pipe or conduit a minimum of 24 inches below grade. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing according to requirements of authorities having jurisdiction.
  4. Do not start demolition work until utility disconnecting and sealing have been completed.

### 3.03 PROTECTION

- A. Existing Facilities: Protect adjacent walkways, loading docks, building entries, and other building facilities during demolition operations. Maintain exits from existing buildings.
- B. Existing Utilities: Maintain utility services to remain and protect from damage during demolition operations. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction.
- C. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction and as indicated. Comply with requirements in Section 01 50 00 "Temporary Facilities and Controls."
1. Protect adjacent buildings and facilities from damage due to demolition activities.
  2. Protect existing site improvements, appurtenances, and landscaping to remain.
  3. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
  4. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
  5. Provide protection to ensure safe passage of people around building demolition area and to and from occupied portions of adjacent buildings and structures.
  6. Protect walls, windows, roofs, and other adjacent exterior construction that are to remain and that are exposed to building demolition operations.
  7. Erect and maintain dustproof partitions and temporary enclosures to limit dust, noise, and dirt migration to occupied portions of adjacent buildings.
- D. Remove temporary barriers and protections where hazards no longer exist. Where open excavations or other hazardous conditions remain, leave temporary barriers and protections in place.

### 3.04 DEMOLITION

- A. General: Demolish indicated building completely. Use methods required to complete the Work within limitations of governing regulations.



- B. Site Access and Temporary Controls: Conduct building demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
  - 1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
  - 2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations.
- C. Explosives: Use of explosives is not permitted.
- D. Demolish foundation walls and other below-grade construction within footprint of new construction and extending 5 feet outside footprint indicated for new construction.
- E. Existing Utilities: Demolish existing utilities and below-grade utility structures within 5 feet outside footprint indicated for new construction. Cut utilities flush with grade.
- F. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades.
- G. Promptly repair damage to adjacent buildings caused by demolition operations.

### 3.05 CLEANING

- A. Remove demolition waste materials from Project site and legally dispose of them in an EPA-approved landfill acceptable to authorities having jurisdiction. See Section 01 74 19 "Construction Waste Management and Disposal" for recycling and disposal of demolition waste.
- B. Do not burn demolished materials.
- C. Clean adjacent structures and improvements of dust, dirt, and debris caused by building demolition operations. Return adjacent areas to condition existing before building 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 thick 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 1/8 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 16 inches, girts not more than 24 inches and ties not more than 27 inches, on center.
  - D. Lightly oil wood forms prior to placing reinforcing, and with oil not permitted on the reinforcing. Where oil form is used, remove excess before pouring concrete.
  - E. Unless indicated otherwise, chamfer exterior corners and edges of permanently exposed concrete.
  - F. Comply with recommendations of "Recommended Practice for Concrete Form work" ACI 347 unless indicated otherwise.
- 3.02 INSERTS AND FASTENING DEVICES FOR OTHER WORK
- A. Provide for installation of inserts, hangers, metal ties, anchors, bolts, dowels, nailing strips, grounds and other fastening devices required for attachment of other Work
  - B. Locate partitions for other trades prior to pouring concrete in order that conduits, sleeves and inserts required by others will be installed in the proper locations.
  - C. Do not install sleeves in any concrete beams or piers except upon approval of the Project Engineer.
  - D. Do not install aluminum conduits in concrete.
- 3.03 VAPOR RETARDERS
- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
    - 1. Lap joints 6 inches and seal with manufacturer's recommended tape. Refer to Section 07 26 00 – Vapor Retarders.
- 3.04 FORM REMOVAL
- A. Grade beam and column forms may be removed 24 hours after a pour is completed.
  - B. Floor slab wood forms may be removed 10 days after pour, providing compressive strength has reached a minimum of 2500 psi based on job cast cylinders.

END OF SECTION

## SECTION 03 20 00

## CONCRETE REINFORCING

## PART 1 - GENERAL

## 1.01 SUMMARY

- A. Section includes all concrete reinforcing and the related items necessary to complete the Project indicated by the Contract Documents unless specifically excluded.
- B. Related Sections:
  - 1. Section 03 10 00 – Concrete Forming and Accessories.
  - 2. Section 03 30 00 – Cast-in-Place Concrete.

## 1.02 SUBMITTALS

- A. Submit reinforcing steel shop drawings and materials list prior to placement for MDOT Architect's approval.
  - 1. Shop drawings shall include complete DIMENSIONED placing plans including control joint locations, order lists, bend diagrams, and DETAILS SHOWING DIMENSIONS WITH CLEARANCES.
  - 2. Submittals not including this requirement will be considered as an incomplete submittal and will be returned to Contractor for re-submittal.
- B. Furnish mill certificates for steel bar reinforcement, to the Project Engineer certifying that each shipment meets specifications. The fabricator will furnish certificates with bar lists to designate location of shipment and the time steel is delivered to the project.

## 1.03 QUALITY ASSURANCE

- A. Reinforcing bars shall conform to ASTM A 615 "Deformed Billet-Steel Bars for Concrete".
- B. Mesh reinforcement shall conform to ASTM A 185 "Welded Steel Wire Fabric for Concrete Reinforcement".
- C. Accessories shall conform to American Concrete Institute ACI 301 "Specifications for Structural Concrete for Buildings".
- D. Placement shall be in accordance with approved shop drawings and ACI 318 "Standard Building Code Requirements for Reinforced Concrete".
- E. Comply with ACI 315 "Manual of Standard Practice of Detailing Reinforced Concrete Structures".

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Reinforcing bar steel and mesh shall be handled, shipped and stored in a manner that will prevent distortion or other damage.
- B. Materials shall be stored in a manner to prevent excessive rusting and fouling with dirt, grease, or other bond-breaking coatings.

1.05 PROJECT CONDITIONS

- A. Examine the substrate over which concrete forms are installed and advise the Project Engineer of conditions detrimental to the installation of concrete formwork. Do not proceed until unsatisfactory conditions have been corrected.
- B. Coordinate placement of concrete reinforcing with installation of concrete formwork, vapor barriers, concrete inserts, conduit and all other items occurring in the area.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Steel Bar Reinforcement: Bar reinforcement shall conform to ASTM A 615, grade 60, of domestic manufacture. Bars shall be new; free from rust, scale, oil, or other coatings that will prevent bond.
- B. Welded Steel Wire Fabric: Fabric shall conform to ASTM A 185, new, free from rust and other coatings that will prevent bond.
- C. Accessories: Metal accessories as required shall support reinforcing bars and comply with ACI 315. Chairs and bolsters for use in exposed concrete shall have plastic coated or stainless steel legs or shall be plastic.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Fabricate and place reinforcement in accordance with the latest requirements of the American Concrete Institute and the approved shop drawings. Fabrication shall not proceed until MDOT Architect's approval is obtained.
- B. Reinforcing for one day's pour shall be completely placed and an inspection made by the Project Engineer / MDOT Architect prior to starting the pour.
- C. Concrete Protection for Reinforcement: Minimum coverage shall be as follows unless shown otherwise on drawings:
 

1.	Footings (bottom of steel)	3 inches clear
2.	Slabs	1-1/2 inches clear top and 3/4 inch clear bottom
3.	Beams	1-1/2 inch clear to stirrups
4.	Walls	2-1/2 inches clear
5.	Columns	2 inches clear to verticals

- D. Steel Dowels for successive work shall be wired in correct position before placing concrete. The "sticking" of dowels after placing concrete will not be permitted.
- E. Lap all bars 24 bar diameters at corners, splices and intersections.
- F. Interrupt Reinforcing steel at control joints in floor slabs.
- G. Do not weld reinforcing steel unless specifically approved by the Project Engineer.

END OF SECTION

## SECTION 03 30 00 CAST-IN-PLACE CONCRETE

## PART 1 - GENERAL

## 1.01 SUMMARY

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, finishes, and other related items necessary to complete Project indicated by Contract Documents unless specifically excluded
- B. Related Sections:
  - 1. Section 03 10 00 - Concrete Forming and Accessories.
  - 2. Section 03 20 00 - Concrete Reinforcing.
  - 3. Section 07 26 00 - Vapor Retarders.
  - 4. Section 09 90 00 – Painting and Coating.

## 1.02 SUBMITTALS

- A. Submit concrete mix design, concrete compression test reports and product data and manufacturer's installation instructions for concrete curing compound.

## 1.03 TESTING LABORATORY SERVICES

- A. The Owner will provide testing as specified in Section 01 45 29.

## 1.04 QUALITY ASSURANCE

- A. Concrete work shall conform to all requirements of ACI 301, Specifications for Structural Concrete for Buildings and ACI 318 Building Code Requirements for Reinforced Concrete, latest editions, except as modified by supplemental requirements herein.
- B. Mix Design: Concrete mix design proportioning shall be by a certified MDOT Class III technician and submitted to the Project Engineer prior to placing concrete. Mix proportions shall meet the requirements of the 804.02.10 Section of the MDOT's Standard Specifications, 2017 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, 2017 Edition.
- C. The Owner will mold and cure compression test cylinders (two cylinders per set) from concrete at the job site from the first placement of each mix design placed each day and additionally for each 75 cubic yards, or fraction thereof, of each mix design placed in a single day. In addition to sampling concrete in accordance with ASTM C 172, the Owner will follow the sampling requirements Paragraph 6.1.2 in the latest edition of the Department's *Concrete Field Manual*.
  - 1. Cylinders will be tested in accordance with ASTM C 39. The Owner will mold one set of cylinders for ensuring the concrete meets the minimum 28-day acceptance requirements.

2. The Owner will mold three sets of cylinders for form removal in accordance with Subsection 907-804.03.15. Forms may be removed when the compressive strength of the field cured cylinders reaches 2000 psi.
3. In addition to determining the slump, temperature, and total air content of the concrete used for molding the test cylinders, the Owner will determine the yield of each mix design during the first placement of each mix design.
4. Copies of all test reports shall be furnished to the ready mixed concrete producer and as directed by the Project Engineer.

#### 1.05 COORDINATION

- A. Verify that all pipes under grade have been installed and tested before being covered. Check and verify materials and locations of inserts, anchors, and items required by other trades before pouring concrete. Concerned subcontractors shall be notified of date of pour in sufficient time to allow for completion of their work.
- B. The Contractor shall notify the Project Engineer upon completing formwork and all reinforcing steel for the next intended pour, and shall not commence pouring operation until all forms and reinforcing steel are approved by the Project Engineer.
- C. Project Engineer shall have free access to all materials used, and the required samples are to be furnished by the Contractor, as directed.
- D. Inspection and written approval from the floor-covering subcontractor is required for slab finish receiving floor covering.

### PART 2 - PRODUCTS

#### 2.01 CONCRETE, GENERAL

- A. All concrete, unless otherwise specifically approved in writing by the Project Engineer, shall be transit-mixed in accordance with ASTM C94. Control of concrete shall be under supervision of testing laboratory as described in Section 01 45 29.
- B. All concrete, unless noted otherwise, shall be Class B.
- C. Maximum slump for normal weight concrete shall be 4 inches. Slump may be increased to 8 inches with an approved water reducer.

#### 2.02 CONCRETE MATERIALS

- A. Portland Cement: ASTM C-150, Type I.
- B. Water: From an approved source.
- C. Structural Concrete Aggregate: Coarse aggregate size number 57 or 67 shall be used and shall meet the requirements of MDOT Standard Specifications, 2017 Edition.
- D. Admixtures: Admixtures shall be from the MDOT Approved List. Non-uniform addition of mixtures that result in erratic setting of the concrete will cause rejection of the concrete with subsequent removal from the structure at the concrete producer's expense.



### 2.03 RELATED MATERIALS

- A. Preformed Expansion Joint Fillers: Provide pre-molded, asphalt impregnated board in widths and thickness required by conditions (1/2-inch minimum). Joint fillers shall conform to ASTM D994, D1751 or D1752.
- B. Chemical Hardener (Sealer): Colorless aqueous solution containing a blend of magnesium fluosilicate and zinc fluosilicate combined with a wetting agent containing not less than 2 pounds of fluosilicates per gallon. Sealer shall not interfere with floor finish. Refer to Section 09 90 00 for Concrete Floor Coating and Sealer in main shop area and as scheduled on Drawings.
- C. Curing Compound: Clear bond, manufactured by Guardian Chemical Co., Kure-N-Seal, manufactured by BASF / Sonneborn, Safe-Cure, manufactured by Dayton Superior Corp. or approved equal. Compound shall not interfere with bonding or floor finish.
- D. Non-Shrink Grout: Shall be one part Portland cement to 2-1/2 parts of fine aggregate or Cement grout ASTM C 387 Dry Package mixtures similar and equal to Masterflow 713 Plus, manufactured by BASF / Master Builders; Five Star Grout, U.S. Grout Company or approved equal.

### 2.04 CONCRETE MIXES

- A. Ready-Mixed Concrete: Ready-mix concrete shall be mixed and delivered in accordance with requirements of ASTM C 94. Uniformly and accurately control proportions of material weight. Slump tolerances given in ASTM C 94 apply. Calcium chloride shall not be used.
- B. Failure of concrete to meet the specified requirements may result in rejection with subsequent removal and replacement or re-testing (including coring, load test, etc.) at the supplier's expense.
  - 1. Concrete exhibiting adverse reaction as a result of the presence of deleterious substances shall be removed and replaced or repaired in a manner completely satisfactory to the Project Engineer.
  - 2. All cost of such corrective action, including all necessary testing, shall be borne by the concrete producer.
- C. The Contractor may request adjustment to concrete mix design when characteristics of materials, job conditions, weather, test results, or circumstances warrant, at no additional cost to the Owner and as approved by the Project Engineer. Laboratory test data for revised mix designs and strength results must be submitted to and approved before using in the Work.

## PART 3 - EXECUTION

### 3.01 CONCRETE PLACEMENT

- A. Concrete shall be placed so as to avoid segregation of materials and to prevent cold joints by avoiding re-handling, by keeping pours generally level, and by adequate vibration. Placing is not to be started during rain or snow, and if placing is underway when such conditions occur, continue operations only long enough to provide a suitable construction joint.

- B. During hot weather or periods of low humidity combined with a definite breeze, rapid loss of moisture shall be discouraged by thorough wetting of forms and by using a fine fog spray when finishing. At these times particular attention shall be given to providing an adequate number of finishers to expedite this operation. During cold weather fresh concrete shall be protected from freezing.
- C. Prior to placing, forms shall be cleaned free of foreign material and shall be washed down with water. Placing shall be a continuous operation between planned construction joints with fresh cement mixed only with plastic concrete already in place. Avoid cold joints.
- D. Vibration shall be thorough, using vibrators small enough to work within reinforcing. The vibrator shall be inserted at many points about 24 inches apart. Avoid over-vibration and transporting concrete in form by vibration. A spare vibrator, which will operate, shall be kept on the job during all placing operations.

### 3.02 CONSTRUCTION JOINTS

- A. Locate construction joints and provide shear keys as directed by the Project Engineer / MDOT Architect. Allow concrete to set for 24 hours before an adjoining pour is started. Slabs across the joint shall be level and the surface shall be level and shall not be feathered. Before proceeding with the following pour at a joint, thoroughly clean the joint, remove all loose material, and brush in a thick cement slurry.

### 3.03 CURING

- A. Keep all concrete moist for 5 days after placing by covering with concrete curing paper, by leaving forms in place or by using curing compound. All combined with regular wetting as necessary.

### 3.04 PATCHING

- A. Honeycombed and defective concrete shall be removed and replaced, or repaired, as directed by the Project Engineer. Form tie holes and minor areas, as determined by the Project Engineer, shall be repaired as follows:
  - 1. Completed patch shall be indistinguishable from surrounding surfaces in color and texture.
  - 2. Patching mixture, using same cement sand as used in concrete shall consist of 1 part cement to 2-parts sand, with just enough mixing water to permit placing. Premix mixture, allow standing at least 30 minutes before using, stirring with trowel during this period.
  - 3. Remove material to sound concrete, dampen surface and brush thick 1 to 1 cement sand bond coat into surface.
  - 4. When bond coat begins to lose water sheen, thoroughly pack patching mixture in place, leaving it somewhat higher than adjacent surface. Embed pieces of gravel by hand into patch.

### 3.05 FINISHES FOR FLATWORK

- A. Trowel finish floor surfaces scheduled as concrete finish walking surfaces, or floor surfaces scheduled to receive floor covering. Trowel finished surfaces shall be true planes within 1/8 inch in 10 feet as determined by a 10 foot straightedge placed anywhere on the slab in any direction.

- B. Smooth trowel finish after the surface is screeded and floated. Start troweling when all water has disappeared from the surface to first level the surface, then start final troweling when concrete has set where it no longer shows indentation from finger pressure. Trowel to a hard, smooth surface free of marks. Dusting of cement or cement and sand will not be permitted.
- C. Interior floors, with concrete finish scheduled, shall receive an application of hardener compound applied according to manufacturer's published instructions. Concrete surfaces to receive ceramic floor tile or brick shall receive float finish.
- D. Exterior walks and ramps shall have smooth trowel and fine broom finish.
- E. Exterior sign base shall have a Class 2, Rubbed Finish as follows:
  - 1. After removal of forms, the Class 1 finish shall be completed and the rubbing of concrete shall be started as soon as its condition will permit. Immediately before starting this work, the concrete shall be kept thoroughly saturated with water for at least three hours.
  - 2. Surface shall be rubbed with a medium course Carborundum stone using a small amount of mortar on its face. The mortar shall be composed of cement and sand mixed in the proportions used in the concrete being finished. Rubbing shall be continued until all form marks, projections, and irregularities have been removed, all voids filled, and a uniform surface has been obtained.
  - 3. The final finish shall be obtained by rubbing with a fine Carborundum stone and water. This rubbing shall continue until the entire surface is a smooth texture and uniform color.
  - 4. After the final rubbing is completed and the surface has dried, it shall be rubbed with burlap to remove loose powder and objectionable marks.

### 3.06 FINISHES FOR GRADE BEAMS

- A. Exposed grade beam faces shall have a smooth form finish obtained by using selected form facing plywood, arranged orderly and symmetrically with a minimum of seams.
  - 1. Repair and patch defective areas with all fins or other projections completely removed and smoothed. Provide grout cleaned finish consisting of 1 part Portland Cement to 1-1/2 parts fine sand by column, and mix with water to the consistency of thick paint.
  - 2. Blend standard Portland cement and white Portland cement, amounts determined by trial patches, so that the final color of dry grout will closely match adjacent concrete surfaces.
- B. Thoroughly wet concrete surfaces and apply grout immediately to coat surfaces and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least 36 hours after rubbing.

END OF SECTION

## SECTION 04 22 00 CONCRETE UNIT MASONRY

## PART 1 - GENERAL

## 1.01 SUMMARY

- A. Section Includes:
  - 1. Concrete masonry units.
  - 2. Mortar and grout.
  - 3. Steel reinforcing bars.
  - 4. Masonry-joint reinforcement.
  - 5. Miscellaneous masonry accessories.
  - 6. Masonry-cell fill.

## 1.02 DEFINITIONS

- A. CMU(s): Concrete masonry unit(s).
- B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

## 1.03 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

## 1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For the following:
  - 1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
  - 2. Reinforcing Steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315.
  - 3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

## 1.05 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For each type and size of the following:
  - 1. Masonry units.
    - a. Include data on material properties and material test reports substantiating compliance with requirements.
  - 2. Cementitious materials. Include name of manufacturer, brand name, and type.
  - 3. Mortar admixtures.
  - 4. Grout mixes. Include description of type and proportions of ingredients.
  - 5. Reinforcing bars.
  - 6. Joint reinforcement.
  - 7. Anchors, ties, and metal accessories.

- B. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
  - 1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91/C 91M for air content.
  - 2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

#### 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

#### 1.07 FIELD CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
  - 1. Extend cover a minimum of 24 inches down both sides of walls, and hold cover securely in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
  - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
  - 2. Protect sills, ledges, and projections from mortar droppings.
  - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
  - 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.
  - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

- A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

### 2.02 UNIT MASONRY, GENERAL

- A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6 except as modified by requirements in the Contract Documents.
- B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work.

### 2.03 CONCRETE MASONRY UNITS

- A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
  - 1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
  - 2. Provide square-edged units for outside corners unless otherwise indicated.
- B. CMUs: ASTM C 90.
  - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2800 psi
  - 2. Density Classification: Lightweight.
  - 3. Size (Width): Manufactured to dimensions 3/8 inch less-than-nominal dimensions.
  - 4. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.

### 2.04 MASONRY LINTELS

- A. Masonry Lintels: Built-in-place masonry lintels made from bond beam CMUs matching adjacent CMUs in color, texture, and density classification, with reinforcing bars placed as indicated and filled with fine grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

**2.05 MORTAR AND GROUT MATERIALS**

- A. Portland Cement: ASTM C 150/C 150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
  - 1. Alkali content shall not be more than 0.1 percent when tested according to ASTM C 114.
- B. Masonry Cement: ASTM C 91/C 91M.
- C. Aggregate for Mortar: ASTM C 144.
  - 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
- D. Aggregate for Grout: ASTM C 404.
- E. Water: Potable.

**2.06 REINFORCEMENT**

- A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.
- B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.
- C. Masonry-Joint Reinforcement, General: Ladder type complying with ASTM A 951/A 951M.
  - 1. Interior Walls: Hot-dip galvanized carbon steel.
  - 2. Exterior Walls: Hot-dip galvanized carbon steel.
  - 3. Wire Size for Side Rods: 0.148-inch diameter.
  - 4. Wire Size for Cross Rods: 0.148-inch diameter.
  - 5. Spacing of Cross Rods: Not more than 16 inches on center.
  - 6. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

**2.07 MISCELLANEOUS MASONRY ACCESSORIES**

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene, urethane or PVC.
- B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 or PVC, complying with ASTM D 2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
- C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D 226/D 226M, Type I (No. 15 asphalt felt).

## 2.08 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
  - 1. Do not use calcium chloride in mortar or grout.
  - 2. Use masonry cement mortar unless otherwise indicated.
- B. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated.
  - 1. For masonry below grade or in contact with earth, use Type S.
  - 2. For reinforced masonry, use Type S.
- C. Grout for Unit Masonry: Comply with ASTM C 476.
  - 1. Use grout of type indicated or, if not otherwise indicated, of type fine that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
  - 2. Proportion grout in accordance with ASTM C 476, Table 1.
  - 3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
  - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
  - 2. Verify that foundations are within tolerances specified.
  - 3. Verify that reinforcing dowels are properly placed.
  - 4. Verify that substrates are free of substances that would impair mortar bond.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 INSTALLATION, GENERAL

- A. Build chases and recesses to accommodate items specified in this and other Sections.
- B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.



- C. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

### 3.03 TOLERANCES

#### A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.
2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

#### B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet, or 1/2-inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2-inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch.

#### C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch.

### 3.04 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.
- C. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- E. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- F. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.
- G. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

### 3.05 MORTAR BEDDING AND JOINTING

- A. Lay hollow CMUs as follows:
  - 1. Bed face shells in mortar and make head joints of depth equal to bed joints.
  - 2. Bed webs in mortar in all courses of piers, columns, and pilasters.
  - 3. Bed webs in mortar in grouted masonry, including starting course on footings.
  - 4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
- B. Lay solid CMUs with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

### 3.06 MASONRY-JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
  - 1. Space reinforcement not more than 16 inches on center.
  - 2. Unless otherwise indicated provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.

### 3.07 CONTROL AND EXPANSION JOINTS

- A. General: Install control- and expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form control joints in concrete masonry using one of the following methods:
  - 1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout, and rake out joints in exposed faces for application of sealant.
  - 2. Install preformed control-joint gaskets designed to fit standard sash block.
  - 3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar, or rake out joint for application of sealant.
  - 4. Install temporary foam-plastic filler in head joints, and remove filler when unit masonry is complete for application of sealant.

### 3.08 LINTELS

- A. Provide masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.
- B. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

### 3.09 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
  - 1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
  - 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
  - 1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
  - 2. Limit height of vertical grout pours to not more than 60 inches.

### 3.10 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Contractor will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

- B. Testing Prior to Construction: One set of tests.
- C. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.
- D. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.
- E. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.
- F. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for compressive strength.
- G. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.
- H. Prism Test: For each type of construction provided, according to ASTM C 1314 at 28 days.

### 3.11 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
  - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
  - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
  - 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
  - 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
  - 5. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

### 3.12 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

END OF SECTION

## SECTION 05 12 00 STRUCTURAL STEEL FRAMING

## PART 1 - GENERAL

## 1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.02 SUMMARY

- A. Section Includes:

- 1. Structural steel.

- B. Related Requirements:

- 1. Section 13 34 19 "Metal Building Systems" for structural steel.

## 1.03 DEFINITIONS

- A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

- B. Heavy Sections: Rolled and built-up sections as follows:

- 1. Shapes included in ASTM A 6/A 6M with flanges thicker than 1-1/2 inches.
  - 2. Welded built-up members with plates thicker than 2 inches.
  - 3. Column base plates thicker than 2 inches.

## 1.04 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

- B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

## 1.05 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

## 1.06 ACTION SUBMITTALS

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

- B. Shop Drawings: Show fabrication of structural-steel components.

- 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
  - 2. Include embedment Drawings.

3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.

#### 1.07 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

#### 1.08 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Comply with applicable provisions of the following specifications and documents:
  1. AISC 303.
  2. AISC 341 and AISC 341s1.
  3. AISC 360.
  4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

#### 1.09 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
  1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
  1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
  2. Clean and relubricate bolts and nuts that become dry or rusty before use.
  3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 3125/F 3125M, Grade F1852 bolt assemblies and for retesting bolt assemblies after lubrication.

### PART 2 - PRODUCTS

#### 2.01 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A 992/A 992M.
- B. Channels, Angles: ASTM A 36/A 36M.
- C. Plate and Bar: ASTM A 36/A 36M.

- D. Cold-Formed Hollow Structural Sections: ASTM A 500/A 500M, Grade B, structural tubing.
  - E. Steel Pipe: ASTM A 53/A 53M, Type E or Type S, Grade B.
    - 1. Weight Class: As indicated on drawings.
    - 2. Finish: Black except where indicated to be galvanized.
  - F. Welding Electrodes: Comply with AWS requirements.
- 2.02 BOLTS, CONNECTORS, AND ANCHORS
- A. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 3125/F 3125M, Grade F1852, Type 1, heavy-hex head assemblies consisting of steel structural bolts with splined ends; ASTM A 563, Grade DH (ASTM A 563M, Class 10S), heavy-hex carbon-steel nuts; and ASTM F 436/F 436M, Type 1, hardened carbon-steel washers.
    - 1. Finish: Plain.
  - B. Threaded Rods: ASTM A 36/A 36M.
    - 1. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
    - 2. Washers: ASTM F 436, Type 1, hardened carbon steel.
    - 3. Finish: Plain.
- 2.03 PRIMER
- A. Primer: SSPC-Paint 25 BCS, Type I, zinc oxide, alkyd, linseed oil primer.
- 2.04 FABRICATION
- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," and to AISC 360.
    - 1. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
    - 2. Mark and match-mark materials for field assembly.
    - 3. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
  - B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
    - 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
  - C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
  - D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
  - E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 3, "Power Tool Cleaning."

- F. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.
  - 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
  - 2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
  - 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

## 2.05 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
  - 1. Joint Type: Pretensioned.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
  - 1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

## 2.06 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
  - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
  - 2. Surfaces to be field welded.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
  - 1. SSPC-SP 3, "Power Tool Cleaning."
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
  - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
  - 2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.



## PART 3 - EXECUTION

## 3.01 EXAMINATION

- A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
  - 1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.02 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.
  - 1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

## 3.03 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Maintain erection tolerances of structural steel within AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
- C. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
  - 1. Level and plumb individual members of structure.
  - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- D. Splice members only where indicated.
- E. Do not use thermal cutting during erection.
- F. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

### 3.04 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
  - 1. Joint Type: Pretensioned.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
  - 1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
  - 2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
  - 3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," for mill material.

### 3.05 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Bolted Connections: Inspect bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- C. Welded Connections: Visually inspect field welds according to AWS D1.1/D1.1M.

### 3.06 REPAIRS AND PROTECTION

- A. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
  - 1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

END OF SECTION

## SECTION 05 21 00 STEEL JOIST FRAMING

## PART 1 - GENERAL

## 1.01 SUMMARY

- A. Section Includes:
  - 1. KCS-type K-series steel joists.
  - 2. Joist accessories.

## 1.02 DEFINITIONS

- A. SJI's "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."
- B. Special Joists: Steel joists or joist girders requiring modification by manufacturer to support nonuniform, unequal, or special loading conditions that invalidate load tables in SJI's "Specifications."

## 1.03 ACTION SUBMITTALS

- A. Product Data: For each type of joist, accessory, and product.
- B. Shop Drawings:
  - 1. Include layout, designation, number, type, location, and spacing of joists.
  - 2. Include joining and anchorage details; bracing, bridging, and joist accessories; splice and connection locations and details; and attachments to other construction.
  - 3. Indicate locations and details of bearing plates to be embedded in other construction.

## 1.04 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Manufacturer certificates.
- C. Mill Certificates: For each type of bolt.

## 1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables in SJI's "Specifications."
- B. Welding Qualifications: Qualify field-welding procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

## 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle joists as recommended in SJI's "Specifications."
- B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

## PART 2 - PRODUCTS

## 2.01 K-SERIES STEEL JOISTS

- A. Manufacture steel joists of type indicated according to "Standard Specification for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord.
  - 1. Joist Type: KCS-type K-series steel joists.
- B. Provide holes in chord members for connecting and securing other construction to joists.
- C. Camber joists according to SJI's "Specifications."

## 2.02 PRIMERS

- A. Primer: SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.

## 2.03 JOIST ACCESSORIES

- A. Bridging: Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required for stability.
- B. High-Strength Bolts, Nuts, and Washers: ASTM F 3125/F 3125M, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F 436/F 436M, Type 1, hardened carbon-steel washers.
  - 1. Finish: Plain.
- C. Welding Electrodes: Comply with AWS standards.
- D. Furnish miscellaneous accessories including splice plates and bolts required by joist manufacturer to complete joist assembly.

## 2.04 CLEANING AND SHOP PAINTING

- A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by power-tool cleaning, SSPC-SP 3.
- B. Do not prime paint joists and accessories to receive sprayed fire-resistive materials.
- C. Apply one coat of shop primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1 mil thick.

## PART 3 - EXECUTION

## 3.01 EXAMINATION

- A. Examine supporting substrates, embedded bearing plates, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.02 INSTALLATION

- A. Do not install joists until supporting construction is in place and secured.
- B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications," joist manufacturer's written instructions, and requirements in this Section.
  - 1. Before installation, splice joists delivered to Project site in more than one piece.
  - 2. Space, adjust, and align joists accurately in location before permanently fastening.
  - 3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
  - 4. Delay rigidly connecting bottom-chord extensions to columns or supports until dead loads are applied.
- C. Field weld joists to supporting steel bearing plates and framework. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
- D. Bolt joists to supporting steel framework using carbon-steel bolts.
- E. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

## 3.03 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Visually inspect field welds according to AWS D1.1/D1.1M.
- C. Visually inspect bolted connections.
- D. Prepare test and inspection reports.

3.04 PROTECTION

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780/A 780M and manufacturer's written instructions.
- B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists, bearing plates, abutting structural steel, and accessories.
  - 1. Clean and prepare surfaces by hand-tool cleaning according to SSPC-SP 2 or power-tool cleaning according to SSPC-SP 3.
  - 2. Apply a compatible primer of same type as primer used on adjacent surfaces.

END OF SECTION

## SECTION 05 31 00                      STEEL DECKING

## PART 1 - GENERAL

## 1.01        SUMMARY

## A.        Section Includes:

1.        Noncomposite form deck.

## B.        Related Requirements:

1.        MDOT Standard Specs for normal-weight concrete fill over steel deck.

## 1.02        ACTION SUBMITTALS

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

## B.        Shop Drawings:

1.        Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

## 1.03        INFORMATIONAL SUBMITTALS

## A.        Welding certificates.

## B.        Product Certificates: For each type of steel deck.

## C.        Evaluation Reports: For steel deck, from ICC-ES.

## D.        Field quality-control reports.

## 1.04        QUALITY ASSURANCE

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

## B.        Welding Qualifications: Qualify procedures and personnel according to AWS D1.3/D1.3M, "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.

## 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."

## 2.02 NONCOMPOSITE FORM DECK

- A. Noncomposite Form Deck: Fabricate ribbed-steel sheet noncomposite form-deck panels to comply with "SDI Specifications and Commentary for Noncomposite Steel Form Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:
  - 1. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 60 G60 zinc coating.
  - 2. Profile Depth: 9/16 inch.
  - 3. Design Uncoated-Steel Thickness: 0.0295 inch.
  - 4. Span Condition: Double span.
  - 5. Side Laps: Overlapped.

## 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. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 31 for overhang and slab depth.
- G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.
- H. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0598 inch thick, with factory-punched hole of 3/8-inch minimum diameter.
- I. Galvanizing Repair Paint: ASTM A 780/A 780M.
- J. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.



## 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 of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 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. Install temporary shoring before placing deck panels if required to meet deflection limitations.
- C. Locate deck bundles to prevent overloading of supporting members.
- D. 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.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- I. 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 NON-COMPOSITE FORM DECK INSTALLATION

- A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:
  - 1. Weld Diameter: 5/8 inch, nominal.
  - 2. Weld Spacing: Weld edge ribs of panels at each support. Space additional welds an average of 12 inches apart, but not more than 18 inches apart.
  - 3. Weld Washers: Install weld washers at each weld location.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of one-half of the span or 36 inches, and as follows:
  - 1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.

- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
  - 1. End Joints: Lapped.
- D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations unless otherwise indicated.
- E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

3.04 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Field welds will be subject to inspection.
- C. Prepare test and inspection reports.

3.05 PROTECTION

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

END OF SECTION

## SECTION 05 50 00 METAL FABRICATIONS

## PART 1 - GENERAL

## 1.01 SUMMARY

## A. Section Includes:

1. All miscellaneous metal work. The Work includes, but is not limited to, steel pipe railings, pipe bollards, steel lintels and miscellaneous framing & supports.

## B. Related Sections:

1. Section 09 05 15 - Color Design.
2. Section 09 90 00 - Painting and Coating: Painting for all ferrous metal exposed to view and not covered by masonry or concrete.

## 1.02 ACTION SUBMITTALS

## A. Product Data: For the following:

1. Paint products.
2. Grout.

## B. Shop Drawings: Show fabrication and installation details for metal fabrications.

1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

## PART 2 - PRODUCTS

## 2.01 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Structural shapes shall be standard sections conforming to the American Society for Testing Materials Specification A-36. Punch and drill as necessary for work of others. Provide bearing plates and anchors, bolts, and etc. The Work shall be true and free of twists, bends and open joints between component parts. Materials shall be thoroughly straightened in the shop before laid off or worked in any way, care being used to avoid injury to the material.

C. Gray cast iron shall conform to ASTM A 48. Castings shall be of uniform quality, free from blowholes, shrinkage defects, swells, cracks or other defects. Castings shall be free of fins, burrs and slag.

D. Expansion bolts shall be equal to Phillips Red Head or "cinch" bolts as manufactured by the National Lead Company. Hilti Fasteners, Rawlplug Company and Wej-it Corporation are acceptable manufacturers. Use toggle type bolts or similar for all anchorage into hollow construction.

- E. Bolt or weld connections: Provide necessary lugs and brackets for anchorage. Welding shall be in accordance with current "Code of Fusion, Welding and Gas Cutting in Building Construction, Part A - Structural Steel" issued by the American Welding Society, both for fabrication and erection. All welders shall have certification, as a result of tests prescribed by the American Welding Society.
- F. Detail metal Work for ample size, strength and stiffness and as indicated. Countersink and provide reinforcement where necessary; drill or punch holes for bolts and screws. At the proper time furnish the necessary templates, patterns and items of miscellaneous metal, such as sleeves, inserts and similar items to be built into adjoining Work.
- G. Fabricate metal Work with sharp lines and angles, with smooth true surfaces and clean edges. Form exposed joints to exclude water. Furnish certificates from manufacturers stating that materials comply with the specification requirements.
- H. Provide as necessary holes of proper number and spacing for the attachment of Work of other trades. Do not use cutting torch in field without permission of the Project Engineer.
- I. Anchor bolts, washers, nuts and clamps shall be furnished where indicated on the Drawings and where necessary for properly securing Work in place. Bolts and anchors used on the exterior of the building or built into exterior walls shall be cadmium plated. Miscellaneous angles and plates not indicated or specified otherwise shall not be less than 1/4 inch thick.
- J. Shop paint and field touch up shall be ICI Devflex 4020, Rustoleum 769, Tnemec 99, Southern Coatings 476, or approved equal. Shop coat shall be compatible with finish coats specified in Section 09 90 00 – Paints and Coatings

## 2.02 FASTENERS

- A. General: Fastenings shall be invisible where possible. Where exposed, screws, bolts, and the like shall be vandal-proof. All welded exposed joints on steel manufactured items; etc. shall be ground smooth and filled to receive paint
- B. Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls.
  - 1. Provide stainless-steel fasteners for fastening aluminum.
  - 2. Provide stainless-steel fasteners for fastening stainless steel.
  - 3. Provide stainless-steel fasteners for fastening nickel silver.
  - 4. Provide bronze fasteners for fastening bronze.
- C. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.
- D. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
  - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
  - 2. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

## 2.03 PIPE RAILINGS

- A. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
1. Handrails and Top Rails of Guards:
    - a. Uniform load of 50 lbf/ ft. applied in any direction.
    - b. Concentrated load of 200 lbf applied in any direction.
    - c. Uniform and concentrated loads need not be assumed to act concurrently.
  2. Infill of Guards:
    - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
    - b. Infill load and other loads need not be assumed to act concurrently.
- B. Fabricate railings and posts from 1-1/4 inch round tube steel, ASTM A 53, Type F or S, Grade A, Schedule 40 with galvanized finish. Shop prime after fabrication. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to a radius of approximately 1/32-inch, unless otherwise shown.
- C. Expansion: Provide expansion joints at locations indicated, or if not indicated, at intervals not to exceed 40 feet. Provide slip joint with internal sleeve extending 2 inches beyond joint on either side; fasten internal sleeve securely to one side; locate joint within 6 inches of posts.

## 2.04 PIPE BOLLARDS

- A. 8-inch round extra strong steel pipe 1/2-inch thick, 36KSI. Form bent corners to the radius shown without causing grain separation or otherwise impairing the Work.

## 2.05 MISCELLANEOUS FRAMING AND SUPPORTS

- A. Provide miscellaneous steel framing and supports which are not a part of structural steel framework, as required to complete Work.
- B. Fabricate miscellaneous units to sizes, shapes, and profiles indicated, or, if not indicated, of required dimensions to receive adjacent other work to be retained by framing. Except as otherwise indicated, fabricate from structural steel shapes, plates and steel bars of welded construction using mitered joints for field connection. Cut, drill and tap units to receive hardware and similar items.
- C. Galvanize exterior miscellaneous frames and supports.

## 2.06 MISCELLANEOUS MATERIALS

- A. Metal Primers: Where materials come in contact with dissimilar materials which may cause harmful reaction, where exposed to moisture, or such as aluminum to cement mortar or concrete, the surface shall be protected by zinc chromate primer, bituminous paint or other approved paint.
- B. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

- D. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- E. Concrete: Comply with requirements in Section 03 30 00 "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3500 psi.

## 2.07 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Use connections that maintain structural value of joined pieces.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges. Remove sharp or rough areas on exposed surfaces.
- C. Weld corners and seams continuously to comply with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. At exposed connections, finish exposed welds and surfaces smooth and blended.
- D. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Locate joints where least conspicuous.
- E. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- F. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors not less than 24 inches on center.

## PART 3 - EXECUTION

### 3.01 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.
  4. At exposed connections, finish exposed welds and surfaces smooth and blended.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- 3.02 INSTALLING PIPE RAILINGS
- A. Welded Connections: Cope intersections of rails and posts, weld joints and grind smooth. Butt weld end-to-end joints of railings or use welding connectors, at fabricator's option. At connections to steel supports, weld post directly to steel supports, unless otherwise indicated.
- B. Anchorage: Use type of bracket with pre-drilled hole for exposed bolt anchorage. For stud partitions and framing use lag bolts set into wood backing between studs and framing members. Coordinate with stud installations for accurate location of backing members.
- 3.03 INSTALLING METAL BOLLARDS
- A. Anchor bollards in place with concrete footings. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.
- B. Fill bollards solidly with concrete, mounding top surface to shed water.
- 3.04 INSTALLING BEARING AND LEVELING PLATES
- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with nonshrink grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.
- 3.05 ADJUSTING AND CLEANING
- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION

## SECTION 05 51 19 METAL GRATING STAIRS

## PART 1 - GENERAL

## 1.01 SUMMARY

## A. Section Includes:

1. Industrial Class stairs with steel-grating treads.
2. Steel railings attached to metal stairs.
3. Steel handrails attached to walls adjacent to metal stairs.

## 1.02 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for metal stairs and railings.
- C. Schedule installation of railings so wall attachments are made only to completed walls.

## 1.03 ACTION SUBMITTALS

- A. Product Data: For metal grating stairs and grating treads.
- B. Shop Drawings:
  1. Include plans, elevations, sections, details, and attachment to other work.
  2. Indicate sizes of metal sections, thickness of metals, profiles, holes, and field joints.
  3. Include plan at each level.
  4. Indicate locations of anchors, weld plates, and blocking for attachment of wall-mounted handrails.

## 1.04 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

## 1.05 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

## 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification.
  1. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers.



2. Protect steel members and packaged materials from corrosion and deterioration.
3. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures.
  - a. Repair or replace damaged materials or structures as directed.

## PART 2 - PRODUCTS

### 2.01 METALS

- A. Metal Surfaces: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Steel Bars for Grating Treads: ASTM A 36/A 36M or steel strip, ASTM A 1011/A 1011M or ASTM A 1018/A 1018M.
- D. Steel Wire Rod for Grating Crossbars: ASTM A 510/A 510M.
- E. Steel Pipe for Railings: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40).

### 2.02 FASTENERS

- A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941/F 1941M, Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 where built into exterior walls.
  1. Select fasteners for type, grade, and class required.
- B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated.
- C. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
- D. Post-Installed Anchors: As indicated on drawings.
  1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941/F 1941M, Class Fe/Zn 5, unless otherwise indicated.

### 2.03 MISCELLANEOUS MATERIALS

- A. Welding Electrodes: Comply with AWS requirements.
- B. Shop Primers: Provide primers that comply with Section 05 12 00 "Structural Steel Framing."

## 2.04 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, hangers, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
  - 1. Join components by welding unless otherwise indicated.
  - 2. Use connections that maintain structural value of joined pieces.
- B. Assemble stairs and railings in shop to greatest extent possible.
  - 1. Disassemble units only as necessary for shipping and handling limitations.
  - 2. Clearly mark units for reassembly and coordinated installation.
- C. Cut, drill, and punch metals cleanly and accurately.
  - 1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
  - 2. Remove sharp or rough areas on exposed surfaces.
- D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- E. Form exposed work with accurate angles and surfaces and straight edges.
- F. Weld connections to comply with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. Weld exposed corners and seams continuously unless otherwise indicated.
- G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible.
  - 1. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated.
  - 2. Locate joints where least conspicuous.
  - 3. Fabricate joints that are exposed to weather in a manner to exclude water.
  - 4. Provide weep holes where water may accumulate internally.

## 2.05 FABRICATION OF STEEL-FRAMED STAIRS

- A. NAAMM Stair Standard: Comply with NAAMM AMP 510, "Metal Stairs Manual," for Industrial Class, unless more stringent requirements are indicated.
- B. Stair Framing:
  - 1. Fabricate stringers of steel channels.
    - a. Stringer Size: As indicated on Drawings.
    - b. Provide closures for exposed ends of channel stringers.
    - c. Finish: Shop primed and painted.

2. Construct platforms and tread supports of steel headers and miscellaneous framing members as indicated on Drawings.
  - a. Provide closures for exposed ends of channel framing.
  - b. Finish: Shop primed Painted.
- C. Metal Bar-Grating Stairs: Form treads and platforms to configurations shown from metal bar grating; fabricate to comply with NAAMM MBG 531, "Metal Bar Grating Manual."
  1. Fabricate treads and platforms from welded steel grating as indicated on drawings.
    - a. Surface: Plain.
    - b. Finish: Shop primed and painted.
- D. Risers: Open.
- E. Toe Plates: Provide toe plates around openings and at edge of open-sided floors and platforms, and at open ends and open back edges of treads.
  1. Material and Finish: Steel plate to match finish of other steel items.
  2. Fabricate to dimensions and details indicated.

## 2.06 FABRICATION OF STAIR RAILINGS

- A. Comply with applicable requirements in Section 05 52 13 "Pipe and Tube Railings."

## 2.07 FINISHES

- A. Finish metal stairs after assembly.
- B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply SSPC-SP 3, "Power Tool Cleaning."
- C. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Verify elevations of floors, bearing surfaces and locations of bearing plates, and other embedments for compliance with requirements.
  1. For wall-mounted railings, verify locations of concealed reinforcement within gypsum board and plaster assemblies.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 INSTALLING METAL STAIRS

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction.
  - 1. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.
- C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- D. Fit exposed connections accurately together to form hairline joints.
  - 1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
  - 2. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
  - 3. Comply with requirements for welding in "Fabrication, General" Article.

### 3.03 INSTALLING RAILINGS

- A. Adjust railing systems before anchoring to ensure matching alignment at abutting joints with tight, hairline joints.
  - 1. Space posts at spacing indicated or, if not indicated, as required by design loads.
  - 2. Plumb posts in each direction, within a tolerance of 1/16 inch in 3 feet.
  - 3. Align rails so variations from level for horizontal members and variations from parallel with rake of stairs for sloping members do not exceed 1/4 inch in 12 feet.
  - 4. Secure posts and rail ends to building construction as follows:
    - a. Anchor posts to steel by welding to steel supporting members.
    - b. Anchor handrail ends to concrete and masonry with steel round flanges welded to rail ends and anchored with post-installed anchors and bolts.
- B. Attach handrails to wall with wall brackets.
  - 1. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
  - 2. Secure wall brackets to building construction as follows:
    - a. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.

### 3.04 REPAIR

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
  - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

END OF SECTION

## SECTION 05 75 30 COLUMN COVERS

## PART 1 - GENERAL

## 1.01 SUMMARY

- A. Section includes, but is not limited to, manufactured aluminum column cover and miscellaneous framing & supports.

## 1.02 ACTION SUBMITTALS

- A. Product Data: Column cover manufacturer's data sheets on each product to be used, including thickness, physical characteristics, and finish, and:
  - 1. Storage and handling requirements and recommendations.
  - 2. Fabrication instructions and recommendations.
- B. Shop Drawings: Show layout and elevations, dimensions and thickness of column cover material, finishes and textures, connections, details and location of joints, sealants, method of anchorage, number of anchors, supports, reinforcements, and accessories.
- C. Samples: Submit 3 selection and verification samples of column cover, 6 inches by 6 inches in size illustrating finish color, sheen, and texture.

## 1.03 INFORMATIONAL SUBMITTALS

- A. Installer's Qualifications: Include a minimum of three (3) projects with similar types of exterior column covers, with facility contact information.
- B. Maintenance Data: Care of finishes and warranty requirements.

## 1.04 QUALITY ASSURANCE

- A. Field Measurements: Verify actual dimensions by field measurement before fabrication; show recorded measurements on shop drawings.
- B. Manufacturer: Provide aluminum column covers produced by a firm with minimum 5 years successful experience in fabricating type(s) required for this Project.
- C. Installer Qualifications: Skilled craftspeople that have demonstrated a successful history of installing column covers for three years and approved by column cover manufacturer.

## 1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products in manufacturer's original, unopened, undamaged containers with identification labels intact.
  - 1. Protect finishes by applying heavy duty removable plastic film during production.
  - 2. Package for protection against transportation damage.
  - 3. Exercise care in unloading, storing and installing column covers to prevent bending, warping, twisting and surface damage.

- B. Store products protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

- A. Drawings and Specifications are based on products manufactured by C.R Laurence Co., Inc., Los Angeles, CA. Tel. (800) 421-6144.
- B. Equivalent products by the following manufacturers are acceptable:
  - 1. MM Systems Corp., Pendergrass, GA. Tel. (800) 241-3460.
  - 2. Pittcon Ind., Riverdale, MD. Tel. (301) 927-1000.
- C. Substitutions shall fully comply with specified requirements and Section 01 25 00 - Substitution Procedures and Section 01 60 00 - Product Requirements.

### 2.02 MANUFACTURED COLUMN COVERS

- A. Column cover: Premier Dry System preformed and prefinished architectural column cover; round, two panel opposing solid metal material, size as indicated on Drawings.
  - 1. Length of column covers as indicated on Drawings.
  - 2. Size of round column covers as indicated on Drawings.

### 2.03 MATERIALS

- A. Aluminum Members:
  - 1. Precoated aluminum sheet; ASTM B 209, 5052-H32 smooth surface texture; continuous-coil-coated on exposed surfaces with specified finish coating and on panel back with specified panel back coating.
  - 2. Thickness: 1/8 inch thick
  - 3. Finish: Satin anodized.
- B. Metal Framing Members: 11 gage galv. steel angles, continuous length full height of column. Select size of angle best suited to size of structural column, and diameter of column cover. (Design to meet Hurricane force winds)
- C. Attachment clips: Aluminum extrusions: ASTM B 221, 6063-T6 alloy, with mill finish as recommended by manufacturer.
  - 1. Provide material strength, dimensions, configuration as required to meet the applied loads applied and in compliance with applicable building code.
- D. Anchors, Clips and Accessories:
  - 1. Stainless steel complying with ASTM A 480/A480M, ASTM A 276 or ASTM A 666.
  - 2. Steel complying with ASTM A 36/A 36M and hot-dipped galvanized to ASTM A153/A153M.

## 2.04 ACCESSORIES

- A. Sealants: Specified in Section 07 92 00. Single component, low modulus, neutral cure silicone. Manufacturer's standard type suitable for use with installation of system; non-staining; color as selected.

## 2.05 FABRICATION

- A. Form column cover sections true to shape, accurate in size, square, and free from distortion or defects.
- B. Form pieces in longest practicable lengths.
- C. Stiffeners are fabricated from same material as column cover.
- D. Return seams on column covers are bent using press brake machine.
- E. Curve forming of column covers is by plate roller.
- F. Form returns at vertical joints to provide uniform reveal as indicated on shop drawings.
- G. Fabricate column covers to allow for thermal movement without sealant failure, buckling, or other deformation of column cover appearance.
- H. Premier dry system: Form seam at vertical joints with keyhole slot and stainless steel shoulder screw attachment to provide a tight (no reveal) dry joint as indicated on shop drawings

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Verify dimensions, tolerances, and interfaces with other work are acceptable for column covers installation.
- B. Verify substrate on-site with Installer present to determine that conditions are acceptable for column cover installation in accordance with manufacturers written instructions.
- C. Notify Project Engineer and MDOT Architect in writing of conditions detrimental to proper and timely completion of work. Do not proceed with erection until unsatisfactory conditions have been corrected.

### 3.02 INSTALLATION

- A. Do not install products that are defective, including warped, bowed, dented, and broken members, and members with damaged finishes.
- B. Comply with instructions and recommendations of column cover manufacturer, as well as with approved shop drawings.
- C. Fasten column covers to metal framing members; aligned, level, and plumb.
- D. Use concealed fasteners.

- E. Do not cut, trim, weld, braze, rout, bend, or otherwise form column covers during erection in a manner that would result in damage to finish, decrease structural integrity of column cover, or result in visual imperfections. Return damaged components to manufacturer's fabrication site.
- F. Separate dissimilar metals; use gasket fasteners, isolation shims, or isolation tape where needed to eliminate possibility of electrolytic action between metals.
- G. Install square, plumb, straight, and true, accurately fitted, with tight joints and intersections.
- H. Replace damaged products.

3.03 TOLERANCES

- A. Maximum Offset From True Alignment Between Adjacent Members Butting or In Line: 1/16 inch.
- B. Maximum Variation from Plane or Location Indicated on Drawings: 1/8 inch.

3.04 CLEANING

- A. Remove site cuttings from finish surfaces.
- B. Clean aluminum surfaces in accordance with recommendations found in AAMA 609 and 610. Do not use aggressive alkaline, TSP, acid cleaners, or abrasive cleaners on aluminum surfaces.

END OF SECTION



## SECTION 06 10 00 ROUGH CARPENTRY

## PART 1 - GENERAL

## 1.01 SUMMARY

- A. Section Includes: Concealed wood grounds and blocking to frame openings, form terminations, to provide anchorage and / or support of other interior and exterior locations; plywood, furring channels and rough hardware.

## 1.02 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product.
  - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements
  - 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.

## 1.03 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.
- B. Evaluation Reports: For the following, from ICC-ES:
  - 1. Wood-preservative-treated wood.
  - 2. Fire-retardant-treated wood.
  - 3. Engineered wood products.
  - 4. Power-driven fasteners.
  - 5. Expansion anchors.
  - 6. Metal framing anchors.

## 1.04 COORDINATION

- A. Fit carpentry Work to other Work; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds and similar supports to allow proper attachment of other Work.

## 1.05 QUALITY CONTROL

- A. Factory mark each piece of lumber and plywood to identify the type, grade, agency providing the inspection service, the producing mill and other qualities as specified.

## 1.06 DELIVERY, STORAGE AND PROTECTION

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

- C. Protection: Protect installed carpentry work from damage by work of other trades until Owner's acceptance of the Work. Contractor shall comply with manufacturer's required protection procedures.

#### 1.07 PROJECT CONDITIONS

- A. Installer shall examine all parts of the supporting structure and the conditions under which the carpentry Work is to be installed, and notify the Contractor in writing of any conditions detrimental to the proper and timely completion of the Work.
- B. Do not proceed with the installation until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

### PART 2 - PRODUCTS

#### 2.01 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
  1. Factory mark each piece of lumber with grade stamp of grading agency.
  2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.
  3. Provide dressed lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.
- C. Engineered Wood Products: Provide engineered wood products acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.
  1. Allowable Design Stresses: Provide engineered wood products with allowable design stresses, as published by manufacturer that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

#### 2.02 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.
  1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- D. Application: Treat items indicated on Drawings, and the following:
  - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
  - 2. Wood sills, sleepers, blocking, furring, and similar concealed members in contact with masonry or concrete.
  - 3. Wood floor plates that are installed over concrete slabs-on-grade.

## 2.03 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
  - 1. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
  - 2. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
- C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
- E. Application: Treat items indicated on Drawings, and the following:
  - 1. Framing for raised platforms.
  - 2. Concealed blocking.
  - 3. Framing for non-load-bearing exterior walls.
  - 4. Plywood backing panels.

## 2.04 DIMENSION LUMBER FRAMING

- A. Non-Load-Bearing Interior Partitions: Construction, Stud, or No. 3 grade.
  - 1. Application: All interior partitions.
  - 2. Species:
    - a. Mixed southern pine; SPIB.
    - b. Northern species; NLGA.
    - c. Eastern softwoods; NeLMA.
    - d. Western woods; WCLIB or WWPA.

- B. Framing Other Than Non-Load-Bearing Interior Partitions: Construction or No. 2 grade.
1. Application: Framing other than interior partitions.
  2. Species:
    - a. Southern pine; SPIB.
    - b. Douglas fir-larch; WCLIB or WWPA.
    - c. Mixed southern pine; SPIB.
    - d. Douglas fir-south; WWPA.
    - e. Hem-fir; WCLIB or WWPA.
    - f. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
- C. Framing Other Than Non-Load-Bearing Interior Partitions: Any species and grade with a modulus of elasticity of at least 1,500,000 psi and an extreme fiber stress in bending of at least 1000 psi for 2-inch nominal thickness and 12-inch nominal width for single-member use.
1. Application: Framing other than interior partitions.

## 2.05 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
1. Blocking.
  2. Nailers.
  3. Furring.
  4. Grounds.
- B. For items of dimension lumber size, provide Construction or No. 2 grade lumber of any species.
- C. For concealed boards, provide lumber with 19 percent maximum moisture content and any of the following species and grades:
1. Mixed southern pine; No. 2 grade; SPIB.
  2. Western woods; Construction or No. 2 Common grade; WCLIB or WWPA.

## 2.06 PLYWOOD PANELS

- A. Plywood General: For each use, comply with the requirements for "Softwood Plywood/Construction and Industrial" PS 1 by the U.S. Department of Commerce.
- B. Exposed Plywood: Where plywood will be exposed to view, provide 1/2 inch minimum thickness Interior Type plywood B-C Plugged Grade, unless otherwise specified or shown on Drawings. Unless specifically stated otherwise, all exposed plywood shall be painted or stained from standard colors as selected by Project Engineer / MDOT Architect.

## 2.07 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners of Type 304 stainless steel.

- B. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- C. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

## 2.08 FURRING CHANNELS

- A. "Hat-Shaped", 7/8 inch by 2-9/16 inches, cold-rolled, 20 gage, galvanized.

## 2.09 MISCELLANEOUS MATERIALS

- A. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.

## PART 3 - EXECUTION

### 3.01 INSTALLATION, GENERAL

- A. Use only sound, thoroughly seasoned materials of the longest practical lengths and sizes to minimize jointing. Use materials free from warp that cannot be easily corrected by anchoring and attachment. Sort out and discard warped material and material with other defects that would impair the quality of the Work.
- B. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- C. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- D. Install fire-retardant treated plywood backing panels with classification marking of testing agency exposed to view.
- E. Do not splice structural members between supports unless otherwise indicated.
- F. Comply with AWWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
- G. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
  - 1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
  - 2. 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. ICC-ES evaluation report for fastener."

### 3.02 ATTACHMENT AND ANCHORAGE

- A. Use finishing nails for finish Work. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting of wood; pre-drill as required.
- B. Exposed Plywood: Panel ends and edges shall have spacing of 1/8 inch maximum, unless otherwise indicated by the panel manufacturer. Fasten 6 inches on center along supported panel edges and 10 inches on center at intermediate supports.
- C. Furring Channels: Fasten to purlins using self-drilling, self-tapping screws. Space furring at 16 inches on center, perpendicular to purlins.

### 3.03 WOOD GROUND, NAILERS, BLOCKING, AND SLEEPERS

- A. Provide wherever shown and where required for screeding or attachment of other work. Form to shapes as shown and cut as required for true line and level of work to be attached. Set true to line and level, plumb with intersections true to required angle. Coordinate location with other Work involved.
- B. Attach to substrates securely with anchor bolts and other attachment devices as shown as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise shown. Building into masonry; anchor to formwork before concrete placement.
- C. Provide grounds of dressed, preservative treated, key-beveled lumber not less than 1-1/2 inch wide and of the thickness required to bring face of ground to exact thickness of finish material involved. Remove temporary grounds when no longer required.

### 3.04 WOOD FURRING

- A. Install plumb and level with closure strips at all edges and openings. Shim with wood as required.
- B. Suspended Furring: Provide of size and spacing shown, complete including hangers and all attachment devices. Level to a tolerance of 1/8 inch in 12 feet

### 3.05 WOOD FRAMING

- A. Set wood framing accurately to required lines and levels. Provide framing members of sizes and on spacing shown, and frame openings as shown, or if not shown, comply with the recommendation of the "Manual for Housing Framing" of the National Forest Products Association. Cut, join, and tightly fit framing around other Work. Do not splice structural members between supports unless otherwise detailed.
- B. Anchor and nail as shown, or if not shown, to comply with Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.

3.06 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes sufficiently wet that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION

## SECTION 06 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. Laminate-Clad Cabinets.
  - 3. Countertops.
  - 4. Solid Surface Materials.
  - 5. Shelving.
  - 6. Hardware.
  - 7. Accessory materials.
  - 8. 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 Standards, ©2014 AWI I WI 2nd Edition, October 1, 2014 including Errata through, April 29, 2016.

## 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: Submit actual samples for color selection from manufacturer's appropriate line for plastic laminate, melamine, and solid surfacing to comply with level of quality of specified color and finish.
  - 1. 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 Standards (AWS) 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. Unless stricter requirements are indicated, comply with the AWS Standards as applicable for (but not limited to) the following types of architectural woodwork:
  - 1. Lumber
  - 2. Standing and running trim
  - 3. Cabinets and Countertops
  - 4. Shelving
  - 5. Miscellaneous work
  - 6. Finishing
  - 7. Installation of woodwork

#### 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.
  - 1. If, due to unforeseen circumstances, woodwork must be stored in other than installation areas, store only in areas meeting requirements specified for installation areas.

#### 1.06 FIELD CONDITIONS

- A. The installer shall examine the substrates and conditions under which the work is to be installed; and notify the Contractor in writing of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer
- B. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

## PART 2 - PRODUCTS

## 2.01 ARCHITECTURAL WOODWORK FABRICATORS

- A. Fabricators: Subject to compliance with requirements available fabricators offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Easley & Easley Millwork, Inc., Jackson, MS. Tel. (601) 372-8881.
  2. Scanlon -Taylor Millwork Company, Jackson, MS. Tel. (601) 362-5333.
  3. Southeastern Constructors, Inc., Brandon, MS. Tel. (601) 825-9791.

## 2.02 BASIC MATERIALS AND FABRICATION METHODS

- A. Except as otherwise indicated, comply with the following requirements for architectural woodwork not specifically indicated as pre-fabricated or pre-finished standard products.
- B. Wood Moisture Content: Provide kiln-dried lumber and maintain optimum 8 to 13 percent range (damp region) moisture content in solid wood (hardwood and softwood) through fabrication, installation, and finishing operations of interior Work.
- C. Wood for Painted Finish: Comply with AWI quality standards for selection of species, grade and cut (fabricator's option, except as otherwise indicated). Wood for trim shall be maple or other closed-grain hardwood subject to Project Engineer/ MDOT Architect's prior approval.
- D. Wood for Stained Finish: Comply with AWS Edition 2 quality standards for selection of species, grade and cut.
- E. Plastic Laminate: Comply with NEMA LD3; type, thickness, color, pattern and finish as indicated for each application.
- F. Solid Surfacing: Provide solid surfacing equal to Surell as manufactured by the Formica Corporation, Corian as manufactured by El Dupont De Nemours & Company, Inc. or Gibraltar as manufactured by Wilsonart International, Inc.
- G. Thermoset melamine resin impregnated paper shall be equal to Duramine at all interior surfaces of cabinets with exterior plastic laminate finish. Cabinet doors, drawers, etc. shall be edge banded in the specified laminate. Cabinet door backs shall be provided in the specified laminate.
- H. 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.
- I. 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.

- J. 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. 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).
1. AWI Type Cabinet Construction: Flush overlay.
  2. Door and Drawer Front Style: Flush overlay.
  3. Horizontal Surfaces: Grade HGS.
  4. Vertical Surfaces: Grade HGS
  5. Edges: Equal to Charter Industries, Inc. (Grand Rapids, MI Tel. 800 538-9088) 90 Durometer PVC T-Mold model No. 4542, size; 1.515 Inch, color, black. Equivalent products by Alibaba and Rehau are acceptable.
  6. Drawer Sides and Backs: Thermoset decorative overlay.
  7. Drawer Bottom: Thermoset decorative overlay.
  8. Composite Wood Products: Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.
  9. Thermoset Decorative Panels: Particleboard finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL.
- B. Plastic Laminate Colors and Patterns: Refer to 09 05 15 Color Design

## 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 Clip Top 120 degree, 71T5550 series with cover caps.
  2. Cabinet Pulls: Equal to Hafele 115.70.003 Stainless Steel Zinc handle.
  3. Grommets: Equal to Doug Mockett, Flip Top Series - 2 inch hole plastic grommet. Provide at all workstation office area counter tops. Locations to be confirmed in submittal. Color to be selected from Manufacturer's full range.
  4. Drawer guides: Equal to Accuride model 2132, 20 inch, side mount, 75 pound rated, black zinc plated.
  5. Adjustable shelf hardware (side support) AWI Quality Standards, 5mm holes at 32mm on center upon approval of sample submitted. Shelf supports shall be equal to Knappe and Vogt 332 ANO.
  6. Wall Cabinet Hangers: Equal to Kingclip as manufactured by Brooklyn Hardware, LLC.

7. Keyboard: Underdeck Adjustable Keyboard Platform equal to Kensington Model K60067. Equivalent products by Fellows and Safco are acceptable
8. Workstation Support Bracket: Equal to Hafele, 287.74.304 sized to provide 500-1000 pound minimum load limit in pairs, installed as pairs 16 inches on center, heavy duty folded steel workstation bracket. Two conduit holes for running power. Architect shall select finish based on location.

## 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 06 83 16

## FIBERGLASS REINFORCED PANELING

## PART 1 - GENERAL

## 1.01 SUMMARY

- A. Section Includes: Prefinished polyester glass reinforced plastic sheets and adhered to unfinished untreated plywood wallboard.
  - 1. PVC trim.
  - 2. PVC wall base
- B. Products Not Furnished or Installed under This Section:
  - 1. Gypsum substrate board.
  - 2. Resilient Base.
- C. Related Sections:
  - 1. Section 06 10 00 - Rough Carpentry (for wood stud framing).
  - 2. Section 09 05 15 - Color Design (for color selected).
  - 3. Section 09 29 00 – Gypsum Board (for gypsum substrate board).

## 1.02 ACTION SUBMITTALS

- A. Product Data: sufficient manufacturer's data to indicate compliance with these specifications, including:
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations.
  - 3. Installation methods.
- B. Shop Drawings: Submit elevations of each wall showing location of paneling and trim members with respect to all discontinuities in the wall elevation.
- C. Samples: Submit manufacturer's standard color pattern selection samples representing manufacturer's full range of available colors and patterns.
  - 1. Provide samples of each type, finish, and color for exposed molding and trim.

## 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.

1. Wall Required Rating – Class A.

- B. Field Measurements: Take field measurements prior to preparation of Shop Drawings and fabrication where possible, to ensure proper fitting of Work..

#### 1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials factory packaged on strong pallets.

- B. Store panels and trim lying flat, under cover and protected from the elements. Allow panels to acclimate to room temperature (range of 60 to 75 deg. F) for 48 hours prior to installation.

#### 1.06 PROJECT CONDITIONS

- A. Environmental Limitations: Building are to be fully enclosed prior to installation with sufficient heat (70 deg. F) and ventilation consistent with good working conditions for finish work

- B. During installation and for not less than 48 hours before, maintain an ambient temperature and relative humidity within limits required by type of adhesive used and recommendation of adhesive manufacturer.

1. Provide ventilation to disperse fumes during application of adhesive as recommended by the adhesive manufacturer.

### PART 2 - PRODUCTS

#### 2.01 ACCEPTABLE MANUFACTURERS

- A. Drawings and Specifications are based on Standard FRP products manufactured by Marlite, Dover, OH. Tel (800) 377-1221

- B. Equivalent products by the following manufacturers are acceptable:

1. Crane Composites, Channahon, IL. Tel (800) 435-0080.  
2. Nudo Products, Springfield, IL. Tel (800) 826-4132.

- C. 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 PANELS

- A. Fiberglass. reinforced thermosetting polyester resin panel sheets complying with ASTM D 5319..
1. Coating: Multi-layer print, primer and finish coats or applied over-layer.
  2. Dimensions:
    - a. Thickness – 0.090 inch nominal.
    - b. Width – 4'-0" nominal.
    - c. Length – As indicated on the Drawings.
  3. Tolerance:
    - a. Length and Width – Plus or minus 1/8 inch.
    - b. Square – Not to exceed 1/8 inch for 8 foot panels or 5/32 inch for 10 foot panels
- B. Properties: Resistant to rot, corrosion, staining, denting, peeling, and splintering.
1. Flexural Strength -  $1.0 \times 10^4$  psi per ASTM D 790. (7.0 kilogram-force/square millimeter)
  2. Flexural Modulus -  $3.1 \times 10^5$  psi per ASTM D 790. (217.9 kilogram-force/square millimeter)
  3. Tensile Strength -  $7.0 \times 10^3$  psi per ASTM D 638. (4.9 kilogram-force/square millimeter)
  4. Tensile Modulus -  $1.6 \times 10^5$  psi per ASTM D 638. (112.5 kilogram-force/square millimeter)
  5. Water Absorption - 0.72 percent per ASTM D 570.
  6. Barcol Hardness (scratch resistance) of 35 55 as per ASTM D 2583.
  7. Izod Impact Strength of 72 ft. lbs./in ASTM D 256
- C. Back Surface: Smooth. Imperfections which do not affect functional properties are not cause for rejection.
- D. Front Finish and Color Selected by MDOT Architect from Manufacturers standards:
1. Surface: Pebbled.
  2. Fire Rating: Class A.
  3. Size: As indicated on Drawings.

## 2.03 MOLDINGS

- A. PVC Trim: Thin-wall semi-rigid extruded PVC.
1. M 350 Inside Corner, length as indicated on Drawings.
  2. Color: As selected by MDOT Architect.

## 2.04 ACCESSORIES

- A. Adhesive: The following construction adhesives complying with ASTM C 557
1. Marlite C-551 FRP Adhesive - Water- resistant, non-flammable adhesive.
- B. Sealant: Marlite Brand MS-250 Clear Silicone Sealant.



## PART 3 - EXECUTION

## 3.01 PREPARATION

- A. Examine backup surfaces to determine that corners are plumb and straight, surfaces are smooth, uniform, clean and free from foreign matter, nails countersunk, joints and cracks filled flush and smooth with the adjoining surface.
  - 1. Verify that stud spacing does not exceed 24 inches on-center.
- B. Repair defects prior to installation. Level wall surfaces to panel manufacturer's requirements. Remove protrusions and fill indentations.
- C. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.

## 3.02 INSTALLATION

- A. Comply with manufacturer's written installation instructions and installation sequence.
- B. Cut sheets to meet supports allowing 1/8 inch clearance for every 8 ft. of panel.
  - 1. Cut with carbide tipped saw blades.
- C. Apply panels to board substrate, above base, vertically oriented with seams plumb and pattern aligned with adjoining panels.
  - 1. Install panels with manufacturer's recommended gap for panel field and corner joints.
    - a. Adhesive trowel and application method to conform to adhesive manufacturer's recommendations.
- D. Apply panel trim complying with manufacturer's written installation instructions.

## 3.03 CLEANING

- A. Clean exposed surfaces of panels using materials and methods recommended by manufacturer, and provide protection as necessary to prevent damage during remainder of construction period.

END OF SECTION

SECTION 07 21 28

CELLULOSE THERMAL INSULATION

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Building insulation for interior walls. .
  - 1. Pneumatically sprayed damp into open wall cavities.
- B. Related Sections: Section 07 21 29 Sprayed Insulation for insulation on underside steel floor deck in Equipment Platform floor space.

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. Substitutions 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.
- D. Standards: Cellulose insulation shall conform to the CPSC standard 16 CFR Parts 1209 and 1404. In addition, the cellulose insulation shall meet or exceed all of the test requirements of ASTM C-739, E-84 and E-119, and UL-723.

## 2.03 MATERIAL CHARACTERISTICS

- A. The following properties were tested by Underwriters Laboratories (R-8078):
  - 1. Settled Density: The maximum density after long-term settling of dry application: 1.6 lb/ft<sup>3</sup>.
  - 2. Thermal Resistance: The average thermal resistance per inch: 3.8 (R-Value/in).
  - 3. Flammability Characteristics: Critical Radiant Flux - greater than or equal to 0.12 watts/cm<sup>2</sup>; Smoldering Combustion - less than or equal to 15 percent.
  - 4. Moisture Vapor Sorption: This requirement assures that normal variations in relative humidity will not adversely affect thermal resistance. Cellulose insulation shall meet the requirements of less than 15 percent for maximum weight gain under the specified test conditions.
  - 5. Surface Burning Characteristics: Flame Spread – 15; Smoke Developed – 5.

## PART 3 - EXECUTION

## 3.01 INSPECTION

- A. Examine the areas and conditions where building insulation is to be installed and notify the Contractor and MDOT Architect of conditions detrimental to the proper and timely completion of the work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

## 3.02 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated. If printed instructions are not available, or do not apply to the project conditions, consult the manufacturer's technical representative for specific recommendations before proceeding with the work

## 3.03 INSTALLATION

- A. Extend insulation full thickness as shown over entire area to be insulated. Fit tightly around obstructions, and fill voids with insulation. Remove projections, which interfere with placement.
- B. Nu-Wool 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 21 29                      SPRAYED INSULATION

PART 1 - GENERAL

1.01      SUMMARY

- A.    Section Includes: Spray-applied cellulose thermal insulation on underside of steel floor deck in building Equipment Platform floor space.
- B.    Related Items:
  - 1.    Ducts, piping conduit or other suspended equipment shall not be positioned until after the application of sprayed insulation.

1.02      ACTION SUBMITTALS

- A.    Product Data:    Submit manufacturer's technical data, installation instructions and manufacturer's certificate that the product meets or exceeds the specified requirements.

1.03      INFORMATIONAL SUBMITTALS

- A.    Product Test Reports: Submit manufacturer's written certification that product contains no asbestos, fiberglass or other man made mineral fiber and copy of manufacturer's ISO 9001: 2008 Certification.
- B.    Research/evaluation reports.

1.04      QUALITY ASSURANCE

- A.    Manufacturer: Shall be ISO 9001: 2008 Certified and subscribe to independent laboratory follow-up inspection services of Underwriters Laboratories or Factory Mutual. Each bag shall be labeled accordingly.
  - 1.    Manufacturer shall be in compliance with the 2012 International Building Code
- B.    Applicator: Shall be licensed by the manufacturer.

1.05      DELIVERY, STORAGE AND HANDLING:

- A.    Deliver in original, unopened containers bearing the name of the manufacturer, product identification and references to U.L. testing.
- B.    Store materials dry, off the ground and under cover. Protect liquid adhesive from freezing.

## PART 2 - PRODUCTS

## 2.01 ACCEPTABLE MANUFACTURERS:

- A. Specifications are based on products manufactured by International Cellulose Corporation, 12315 Robin Boulevard, Houston, TX 77045, Phone: (800) 444-1252 Fax: (713) 433-2029. Contact International Cellulose Corporation for approved applicators.
- B. Equivalent products by the following manufacturers are acceptable:
  - 1. Fiberlite Technologies, Inc., Joplin, MO. Tel. (800) 641-4296
  - 2. ThermoCon, Inc., Monroe, LA. Tel: (800) 854-1907.
- C. 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 SPRAY-APPLIED CELLULOSE INSULATION

- A. Self-Supported, Spray-Applied Cellulose Insulation:
  - 1. Type: K-13 Spray-On-System.
  - 2. Color: One of seven standard colors as selected by MDOT Architect
  - 3. R-Value: 3.75 per inch per ASTM C518.
  - 4. Application: At minimum thickness to provide an R-value of 6.3 continuous. .
  - 5. Cohesive Strength: At time of application per Method WS-2000: > 700 Grams.
  - 6. ASTM Requirements:
    - a. Comply with ASTM E-84/U.L. 723, Tested at minimum of 5 inch thickness Class 1, Class A Flame Spread 5, Smoke Development 5
    - b. Comply with ASTM E-1042.
    - c. Non corrosive per ASTM C-739.
    - d. Bond Deflection per ASTM E-759: 6 inches Deflection in 10 feet Span; No Spalling or Delamination.

## PART 3 - EXECUTION

## 3.01 EXAMINATION

- A. Examine surfaces and report unsatisfactory conditions in writing. Do not proceed until unsatisfactory conditions are corrected.

## 3.02 PREPARATION

- A. Provide masking, drop cloths or other satisfactory coverings for materials/surfaces that are not to receive insulation to protect from over-spray.
- B. Coordinate installation of sprayed cellulose fiber with work of the other trades.
- C. Prime surfaces as required by the manufacturers' instructions or as determined by examination.

3.03 INSTALLATION

- A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.
- B. Thickness will be determined as the minimum thickness measured as per ASTM E-605 field test procedure.
- C. Extend insulation to envelop entire area to be insulated.
- D. Cure insulation with continuous natural or mechanical ventilation.
- E. Remove and dispose of over-spray and all debris caused by the application.

3.04 PROTECTION

- A. Protect finished installation until properly cured and inspected by the Project Engineer.

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 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 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) = 0.01 perms.
  2. Dry Tensile Strength: ASTM D-882 = (80 lbf/in min)-MD & (78 lbf/in min.) CD.
  3. Puncture Resistance: ASTM D-1709, Method B = 4,900 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 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:

1. Section 09 05 15 – Color Design (for color selection.)

## 1.02 PREINSTALLATION MEETINGS

## 1.03 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.

## 1.04 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.

## 1.05 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.06 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.

1.07 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 Completion as determined by MDOT.

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.

## 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. Through-Wall Flashing: Installation of through-wall flashing is specified in Section 04 20 00 - Unit Masonry.
- C. 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 81 20

## SPRAY APPLIED FIREPROOFING

## PART 1 - GENERAL

## 1.01 SUMMARY

- A. Section Includes Sprayed-Applied Fire-Resistive Materials (SFRMs) to underside of metal floor deck and steel joist framing.

## 1.02 PREINSTALLATION MEETING

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Review products, design ratings, restrained and unrestrained conditions, densities, thicknesses, bond strengths, and other performance requirements.

## 1.03 ACTION SUBMITTALS

- A. Product Data: Submit manufacturer's product data, specifications and installation procedures for each type of fireproofing and accessory required.
- B. Shop Drawings: Framing plans, schedules, or both, indicating the following:
  - 1. Extent of fireproofing for each construction and fire-resistance rating.
  - 2. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
  - 3. Minimum fireproofing thicknesses needed to achieve required fire-resistance rating of each structural component and assembly.

## 1.04 INFORMATIONAL SUBMITTALS

- A. Qualifications Data: For Installer and testing agency.
- B. Product Certificates: For each type of fireproofing.
- C. Evaluation Reports: For fireproofing, from third party.
- D. Field quality-control reports.

## 1.05 QUALITY ASSURANCE

- A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by fireproofing manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements.
- B. It is required that industry guidelines as noted in National Fireproofing Contractors Association (NFCA) 100 – Standard Practice for the Application of Spray-Applied Fire Resistive Materials (SFRMs) be maintained on the project site.



## 1.06 FIELD CONDITIONS

- A. Environmental Limitations: Do not apply fireproofing when ambient or substrate temperature is 40 deg F 4.4 deg C or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours prior to, during, and for 24 hours after product application.
- B. Ventilation: Ventilate building spaces during and after application of fireproofing, providing a minimum 4 complete air exchanges per hour and according to manufacturer's written instructions until Spray-Applied Fire Resistive Materials are dried and cured. Use natural means or, if they are inadequate, forced-air circulation until fireproofing dries thoroughly.

## PART 2 - PRODUCTS

## 2.01 MATERIALS, GENERAL

- A. Assemblies: Provide fireproofing, including auxiliary materials, according to requirements of each fire-resistance design and manufacturer's written instructions.
- B. Source Limitations: Obtain fireproofing from single source.
- C. Fire-Resistance Design: Indicated on Drawings, tested according to ASTM E 119/UL 263 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Steel members are to be considered unrestrained unless specifically noted otherwise.
- D. Asbestos: Provide products containing no detectable asbestos.

## 2.02 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. Carboline Company, St. Louis, MO. Tel. (800) 848-4645.
  - 2. Isolatek International, Stanhope, NJ. Tel. (800) 631-9600. (Basis-of-Design)
  - 3. The Schundler Company, Metuchen, NJ. Tel. (732) 287-2244.

## 2.03 SPRAY-APPLIED FIRE RESISTIVE MATERIALS

- A. SFRM: Manufacturer's standard, factory-mixed, lightweight, dry formulation, complying with indicated fire-resistance design and mixed with water at Project site to form a slurry or mortar before conveyance and application or conveyed in a dry state and mixed with atomized water at place of application.
- B. Products: Concealed /Commercial SFRM's
  - 1. Isolatek International: CAFCO® 300 Series.
  - 2. Physical Properties:
    - a. Bond Strength: Minimum 150-lbf/sq. ft. cohesive and adhesive strength based on field testing according to ASTM E 736.

- b. Density: Not less than 15 lb/cu. ft. as specified in the approved fire-resistance design, according to ASTM E 605.
- c. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design. (3-Hour Rating)
- d. Combustion Characteristics: When tested in accordance with ASTM E 136 shall be noncombustible.
- e. Surface-Burning Characteristics: When tested in accordance with ASTM E84 or CAN4-S102, the material shall exhibit the following surface burning characteristics:
  - 1) Flame Spread Index 10 or less.
  - 2) Smoke Developed 10 or less.
- f. Compressive Strength: When tested in accordance with ASTM E761, the material shall not deform more than 10 percent when subjected to a crushing force of 1,440 psf.
- g. Corrosion Resistance: No evidence of corrosion according to ASTM E 937.
- h. Deflection: No cracking, spalling, or delamination according to ASTM E 759.
- i. Effect of Impact on Bonding: No cracking, spalling, or delamination according to ASTM E 760.
- j. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. (0.270 g/sq. m) in 24 hours according to ASTM E 859.
- k. Fungal: When tested in accordance with ASTM G21, the material shall show resistance to mold growth for a minimum period of 28.

#### 2.04 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that are compatible with fireproofing and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.
- B. Substrate Primers: Primers approved by fireproofing manufacturer and complying with one or both of the following requirements:
  - 1. Fireproofing manufacturer shall be contacted for procedures on handling primed/painted steel.
  - 2. Primer's bond strength in required fire-resistance design complies with specified bond strength for fireproofing and with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction, based on a series of bond tests according to ASTM E 736.
- C. Bonding Agent: Product approved by fireproofing manufacturer and complying with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction.
- D. Metal Lath: Expanded metal lath fabricated from material of weight, configuration, and finish required, according to fire-resistance designs indicated and fireproofing manufacturer's written recommendations. Include clips, lathing accessories, corner beads, and other anchorage devices required to attach lath to substrates and to receive fireproofing.

## PART 3 - EXECUTION

## 3.01 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of the Work and according to each fire-resistance design. Verify compliance with the following:
  - 1. Substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, paints, and encapsulants, or other foreign substances capable of impairing bond of fireproofing with substrates under conditions of normal use or fire exposure.
  - 2. Clips, hangers, supports, sleeves and other attachments to the substrate are to be placed by others prior to the application of the fireproofing materials.
  - 3. The installation of ducts, piping, conduit or other suspended equipment shall not take place until the application of the fireproofing is complete in an area.
- B. Fire protection shall not be applied to steel floor decks prior to the completion of concrete work on that deck.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.02 PREPARATION

- A. Cover other work subject to damage from fallout or overspray of fireproofing materials during application.
- B. Clean substrates of substances that could impair bond of fireproofing.

## 3.03 APPLICATION

- A. Construct fireproofing assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports for thickness, primers, sealers, topcoats, finishing, and other materials and procedures affecting fireproofing work.
- B. Comply with fireproofing manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fireproofing as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.
- C. Coordinate application of fireproofing with other construction to minimize need to cut or remove fireproofing.
  - 1. Do not begin applying fireproofing until clips, hangers, supports, sleeves, and other items penetrating fireproofing are in place.
  - 2. Defer installing ducts, piping, and other items that would interfere with applying fireproofing until application of fireproofing is completed.
- D. Metal Decks: Do not apply fireproofing to underside of metal deck substrates until concrete topping has been completed.

- E. Install auxiliary materials as required, as detailed, and according to fire-resistance design and fireproofing manufacturer's written recommendations for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by fireproofing manufacturer.
- F. Spray apply fireproofing to maximum extent possible. Following the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by fireproofing manufacturer.
- G. Extend fireproofing in full thickness over entire area of each substrate to be protected.
- H. Install body of fireproofing in a single course unless otherwise recommended in writing by fireproofing manufacturer.
- I. Provide a uniform finish complying with description indicated for each type of fireproofing material.
- J. Cure fireproofing according to fireproofing manufacturer's written recommendations.
- K. Do not install enclosing or concealing construction until after fireproofing has been applied, inspected, and tested and corrections have been made to deficient applications.
- L. Finishes: Spray-textured finish left as spray-applied with no further treatment.

#### 3.04 FIELD QUALITY CONTROL

- A. Engage a qualified testing agency to perform tests and inspections.
  - 1. Test and inspect as required by the IBC, 1704.10.
  - 2. For reference, utilize AWCI - Inspection Procedure for Field-Applied Sprayed Fire-Resistive Materials, Technical Manual 12-A; an annotated guide
- B. Application will be considered defective if it does not pass tests and inspections.
  - 1. Remove and replace fireproofing that does not pass tests and inspections, and retest.
  - 2. Apply additional fireproofing, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.
- C. Prepare test and inspection reports.

#### 3.05 CLEANING, PROTECTING, AND REPAIRING

- A. Cleaning: Immediately after completing spraying operations in each containable area of project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.
- B. Protect fireproofing, according to advice of manufacturer and installer, from damage resulting from construction operations or other causes, so fireproofing will be without damage or deterioration at time of Substantial Completion.
- C. As installation of other construction proceeds, inspect fireproofing and repair damaged areas and fireproofing removed due to work of other trades.

- D. Repair fireproofing damaged by other work before concealing it with other construction.
- E. Repair fireproofing by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

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 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."
- C. Sealants: Equal to Hilti, Inc. FS-One.
- D. Caulking and Putty: Equal to 3M Brand Fire Barrier CP- 25 Caulk and Putty 303.
- E. Penetration Sealants: Equal to 3M Fire Barrier Penetration Sealing Systems 7902 and 7904 series as required.
- F. Insulation: Equal to United States Gypsum Company "Thermafiber" Safing Insulation, 4 pcf density, unfaced.
- G. Intumescent Firestopping: Equal to Hilti, Inc. FS-One, CP 642 and FS 657 Fire Block as required.

END OF SECTION

## SECTION 07 92 00

## JOINT SEALANTS

## PART 1 - GENERAL

## 1.01 SECTION INCLUDES

- A. Preparation of substrate surfaces to receive materials.
- B. Sealant and joint backing (backer rod) materials and installation in the following general locations (even though not shown on the Drawings):
  - 1. Exterior and interior wall joints, including control / expansion joints and abutting like or similar materials (in walls, ceilings, and roof construction) that have spaces between in excess of 3/16 inch (except where less restrictive tolerances are indicated or where the condition is specifically the responsibility of others).
  - 2. Abutting dissimilar materials, exterior and interior.
  - 3. Interior acoustical joints in vertical surfaces and horizontal nontraffic surfaces.
  - 4. Exterior and interior wall openings (including at perimeter doors, exterior thresholds, windows, louvers, and penetrations required by piping, ducts, and other service and equipment, except for sealants provided by Section 07 84 00-Firestopping).
  - 5. Joints in pavement and walks.
  - 6. Other locations, not included above but, specifically required by manufacturers of installed materials / products (except that sealing materials for glazing are under provision of other Section.).
- C. Accessories: Including, but not limited to, primer, cleaner, backer rod, bond breaker, and masking tape.

## 1.02 RELATED SECTIONS

- A. Section 01 33 00 – Submittal Procedures and Section 09 05 15 – Color Design.

## 1.03 DEFINITIONS

- A. Whenever the words "caulk" or "seal" occur, they shall be interpreted to mean "effectively seal the indicated joint with a material to render it air and watertight." "Caulk" shall indicate the use of the interior materials specified hereinafter and "Seal" shall indicate the use of the exterior materials.

## 1.04 PRECONSTRUCTION TESTING

- A. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates. Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

## 1.05 WORK OF OTHER SECTIONS

- A. Caulking and sealing may be performed as Work of other Sections when specified. However, all Work shall conform to the requirements of this Section.

## 1.06 ACTION SUBMITTALS

- A. Product Data: Submit manufacturer's product data and installation instructions for each type of sealant required. Product data shall include chemical characteristics, limitations, and color availability.
- B. Samples: For each kind and color of joint sealant required.
- C. Joint-Sealant Schedule: Include the following information:
  - 1. Joint-sealant application, joint location, and designation.
  - 2. Joint-sealant manufacturer and product name.
  - 3. Joint-sealant formulation.
  - 4. Joint-sealant color.

## 1.07 INFORMATIONAL SUBMITTALS

- A. Manufacturer's Certificate.
- B. Applicator's experience documentation.
- C. Product test reports.
- D. Preconstruction field-adhesion test reports.
- E. Field-adhesion test reports.
- F. Warranties.

## 1.08 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.
- B. Manufacturer's Certificate: Provide manufacturer's letter of certification that products meet or exceed specified requirements and are appropriate for uses indicated.
- C. Applicator: Company specializing in the work of this Section with minimum 3 years documented satisfactory experience.
- D. Preinstallation Conference: Conduct conference at Project site.

## 1.09 DELIVERY, STORAGE AND HANDLING

- A. Deliver caulking and sealant material to the site in original unopened packages with manufacturer's labels, instructions and product identification and lot numbers intact and legible.
- B. Store materials under cover, protected from inclement weather and adverse temperature extremes, in original containers or unopened packages, in accordance with manufacturer's instructions.

## 1.10 WARRANTY

- A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
  - 1. Warranty Period: Two years from Date of Completion as determined by MDOT.
- B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
  - 1. Warranty Period: Five years from Date of Completion as determined by MDOT.

## 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. Substitutions 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.
  - 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 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. Comply with IBC 2012 and AHJ for Hurricane impact loads.
- C. 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 101 "Life Safety Code", National Fire Protection Association.
- D. 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.

#### 1.05 PRODUCT IDENTIFICATION

- A. Deliver doors and frames and other work of this section properly tagged and identified.

#### 1.06 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 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 FABRICATION, GENERAL

- 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.

## 2.03 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. Prepare exterior HM frames for electric strikes and include conduit to above ceiling and provide cover plate to install conventional strike at this time.
  - 1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
  - 2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.
- E. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with mitered hairline joints.
  - 1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.
  - 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
  - 3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
  - 4. Provide loose stops and moldings on inside of hollow-metal work.
  - 5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

## 2.04 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.

- B. Design and Construction: Frames shall be custom made welded units with integral trim, of the sizes and shapes shown on approved shop drawings. Knocked-down frames WILL NOT be accepted. Finished work shall be strong, rigid, and neat in appearance, square, true and free of defects, warp or buckle. Molded members shall be clean cut, straight and of uniform profile throughout their lengths. Jamb depths, trim, profile and backbends shall be as shown on Drawings. Corner joints shall have contact edges closed tight, with trim faces mitered and continuously welded, and stops mitered. The use of gussets will not be permitted.
1. Stops shall be 5/8 inch deep. Cut-off (sanitary or hospital type) stops, where scheduled, shall be capped at 45 degrees at heights shown on Drawings, and all jamb joints below cut-off stops shall be ground and filed smooth, making them imperceptible. Do not cut off stops on frames for soundproof, lightproof on lead-lined doors.
  2. When shipping limitations so dictate, frames for large openings shall be designed and fabricated for field splicing by others.
  3. Frames for multiple or special openings shall have mullion and / or rail members which are closed tubular shapes having no visible seams or joints. All joints between faces of abutting members shall be securely welded and finished smooth.
  4. Hardware reinforcements: Frames shall be mortised, reinforced, drilled and tapped at the factory for fully templated mortised hardware only, in accordance with approved hardware schedule and templates provided by the hardware supplier. Where surface-mounted hardware is to be applied, frames shall have reinforcing plates. Frames shall be reinforced for closers. Minimum thickness of hardware reinforcing plates shall be as follows:
    - a. Hinge and pivot reinforcements - 7 gage, 1-1/4 inch by 10 inches minimum.
    - b. Strike reinforcements - 12 gage.
    - c. Flush bolt reinforcements - 12 gage.
    - d. Closer reinforcements - 12 gage.
    - e. Reinforcements for surface-mounted hardware - 12 gage.
  5. Floor anchors: Floor anchors shall be securely welded inside jambs for floor anchorage. Where required, provide adjustable floor anchors, providing not less than 2 inches height adjustment. Floor anchors shall be 14-gage minimum.
- C. Finish: After fabrication, tool marks and surface imperfections shall be removed, and exposed faces of welded joints shall be dressed smooth. Frames shall be chemically treated to insure maximum paint adhesion and coated on accessible surfaces with rust-inhibitive primer complying with FS-TT-P-57 (Type II) or FS-TT-P-659 with 2.0 mils minimum thickness. Fully cure before shipment.

## 2.05 HOLLOW METAL DOORS

- A. General: Doors shall be made of commercially quality, level, cold rolled steel conforming to ASTM A366-68 and free of scale, pitting or other surface defects.
- B. Face Sheets:
1. Exterior Doors: Shall be 16-gage minimum with zinc coating conforming to ASTM A653, with a coating designation of A60 or G60 and a minimum coating thickness of 0.60 oz. per sq. ft. minimum.
  2. Interior Doors: Shall be 18 gage minimum.

- C. Design and Construction: Doors shall be custom made, of the types and sizes shown on the approved shop drawings, and shall be fully welded seamless construction with no visible seams or joints on their faces or vertical edges. Door thickness shall be 1-3/4 inches unless otherwise noted. Doors shall be strong, rigid and neat in appearance, free from warp or buckle. Corner bends shall be true, straight and of minimum radius for the gage of metal used.
- D. Face Sheet Stiffeners: Stiffen with continuous vertical formed steel sections spanning the full thickness of the interior space between door faces. These stiffeners shall be 22 gage minimum, spaced 6 inches apart and securely attached to face sheets by spot welds 5 inches on center. Spaces between stiffeners shall be sound-deadened insulated full height of door with an inorganic non-combustible batt-type material.
- E. Welding: Join door faces at their vertical edges by a continuous weld extending full height of door. Welds shall be ground, filled and dressed smooth to make them invisible and provide a smooth flush surface.
- F. Top and Bottom Edges: Edges of doors shall be closed with a continuous recessed 16 gage minimum steel channel, extending the full width of the door and spot welded to both faces. Exterior doors shall have additional flush closing channel at top edges and, where required for attachment of weather-stripping, a flush closure at bottom edges. Provide openings in bottom closure of exterior doors to permit escape of entrapped moisture.
- G. Edge Profile: Shall be provided on both vertical edges of doors as follows:
1. Single-acting swing doors - beveled 1/8 inch in 2 inches.
  2. Double-acting swing doors - rounded on 2-1/8 inch radius.
- H. Hardware Reinforcements: Doors shall be mortised, reinforced, drilled and tapped at the factory for fully templated hardware only, in accord with the approved hardware schedule and templates provided by the hardware supplier. Where surface-mounted hardware (or hardware, the interrelation of which is to be adjusted upon installation - such as top and bottom pivots, floor closures, etc.) is to be applied, doors shall have reinforcing plates. Minimum gages for hardware reinforcing plates shall be as follows:
1. Hinge and pivot reinforcement - 7 gage.
  2. Reinforcement for lock face, flush bolts, concealed holders, concealed or surface-mounted closers - 12 gage.
  3. Reinforcement for all other surface mounted hardware - 16 gage.
- I. Glass Moldings and Stops:
1. Where specified or scheduled, doors shall be provided with hollow metal moldings to secure glazing by others per glass opening sizes shown on Drawings. Fixed moldings shall be securely welded to door on security side.
  2. Loose stops shall be 20-gage steel, with mitered corner joints, secured to the framed opening by cadmium or zinc-coated countersunk screws spaced 8 inches on center. Snap-On attachments will not be permitted. Stops shall be flush with face of door.
- J. Finish: After fabrication, tool marks and surface imperfections shall be dressed, filled and sanded as required to make all faces and vertical edges smooth, level and free of all irregularities. Doors shall be chemically treated to ensure maximum paint adhesion and shall be coated, on all exposed surfaces, with manufacturer's standard rust-inhibitive primer. Fully cure before shipment.

- K. Flatness: Doors shall maintain a flatness tolerance of 1/16 inch maximum in any direction, including a diagonal direction.

## 2.06 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.

## 2.07 STEEL FINISHES

### A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: SDI A250.10.

## 2.08 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.



## 2.09 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.

## 2.10 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.
- 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. Lite openings 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. TruStile Doors, LLC, Denver, CO. Tel. (888) 286-3931.
  2. VT Industries, Inc., Holstein, IA. Tel. (800) 827-1615.
- C. 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 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 mid-rail 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. Openings: Factory cut and trim openings through doors.
  - 1. Light Openings: Trim openings with moldings of material and profile indicated.
  - 2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 08 80 00 "Glazing."

## 2.05 FACTORY FINISHING

- A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing. Finish faces, all four edges, edges of cutouts, and mortises.
- B. Transparent Finish:
  - 1. Grade: Premium.
  - 2. Finish: WDMA TR-4 conversion varnish or WDMA TR-6 catalyzed polyurethane.
  - 3. Staining: As selected by Architect from manufacturer's full range.
  - 4. Sheen: Gloss, unless indicated otherwise.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Installer: Examine doorframes and verify that frames are correct type and have been installed for proper hanging of corresponding doors. Installer shall notify Contractor in writing of conditions detrimental to proper and timely installation of wood doors; do not proceed with installation until unsatisfactory conditions have been corrected.

### 3.02 PREPARATION

- A. Condition doors to average prevailing humidity in installation area prior to hanging.

### 3.03 INSTALLATION

- A. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

- 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: Comply with wind loading shown on Structural Drawing S-001.

## 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 for Hurricane impact loads.
- 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. C.H.I. Overhead Doors, Arthur, IL. Tel. (800) 590-0559
  - 2. Overhead Door Corp., Dallas, TX. Tel. (800) 887-3667.
  - 3. Windsor Door, Little Rock, AR. Tel. (800) 946-3767.
- C. 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 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) Slat.
    - a. Insulation: Polyisocyanurate with R-value 6.24 and U-value 0.160.
    - b. Back Covers: Galvanized steel, 24 gage (0.023 inch) minimum thickness.
- B. Mounting: Face Mounting: fasten to face of wall on each side of door opening, unless indicated otherwise on Drawings.
- C. Color and Finish: One finish coat of ArmorBrite™ Powdercoat applied over one coat of white epoxy primer. Color as selected by MDOT Architect from manufacturer's full selection of 187 RAL 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.
  - 1. Bottom bar shall allow for 2-1/2 inches slope to be flush with sloping concrete slab where indicated on drawings.
- 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: Hurricane Resistant 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. Section 12 21 14 - Horizontal Louver Blinds-Metal: Attachments to framing member.
  - 6. Division 26 Sections for Electrical.

## 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 12 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.

## 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. Wind Loads: Provide framing system; include anchorage, capable of withstanding wind load design pressure as required by IBC 2012 Building Code and local Authorities having jurisdiction, whichever are more stringent.
- D. Air Infiltration: The test specimen shall be tested in accordance with ASTM E 283. Air infiltration rate shall not exceed 0.06 cfm/ft<sup>2</sup> at a static air pressure differential of 6.24 pounds per square foot.
- E. Water Resistance, (Static): 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 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.

## 2.03 MATERIALS

- A. Hurricane Resistant Kawneer series IR 501 - 21/2 inches by 5 inches and 5 inches by 5 inches nominal dimensions; Non-Thermal; Center Glazed; Interior Structural Silicone Glazed; Screw Spline Fabrication.
  1. Material Standard: Extruded Aluminum, ASTM B 221, 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 Storefront: Shall be 300 series Stainless Steel.
- B. Fasteners- Entrances: Where exposed, shall be aluminum, stainless steel or plated steel.
- C. Gaskets: Glazing gaskets shall comply with ASTM C 864 and be extruded of a silicone compatible EPDM rubber that provides for silicone adhesion.
- D. Perimeter Anchors: Aluminum. When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.
- E. Thermal Barrier: Thermal separator shall be extruded of a silicone compatible elastomer that provides for silicone adhesion.

## 2.05 ENTRANCES

- A. Hurricane Resistant Aluminum Entrances: Kawneer Series 350 IR Medium Style Swing Doors. 3-1/2 inches vertical face dimension, 1-3/4 inch depth, interior structural silicone glazed, high traffic/impact resistant application. Coordinate door hardware with Division 26 Sections.

## 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. Exterior Door: 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). Finish No. 17 Clear.
  2. Overhead Closers: Equal to LCN 4040 Parallel Arm with Cush-N-Stop and custom powder coat metal cover.
  3. Locks: Adams-Rite MS 1850A (Refer to Section 08 71 00 for cylinder) mount 41-9/16 inches above bottom of door.
  4. Push / Pull Handles: Architects Classic Hardware Style "CO-9" pull and "CP-11" push bar. Mount pull top attachment 44-3/16 inches above bottom of door and push bar 37 inches above bottom of door. Finish shall be No. 17 clear anodized aluminum.
  5. Weatherstripping: Sealair weathering comprised of a thermoplastic elastomer weathering on a tubular shape with a semi-rigid polymeric backing.
  6. Sill Sweep Strips: EPDM blade gasket sweep strip in an aluminum extrusion applied to the interior exposed surface of the bottom rail with concealed fasteners. Finish shall match door color.
  7. 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.
- C. Interior Door: 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). Finish No. 17 Clear
  2. Overhead Closers: Equal to LCN 4040 Parallel Arm with Cush-N-Stop and custom powder coat metal cover.
  3. Refer to Section 08 71 00 for cylinder.
  4. Weatherstripping: Sealair weathering comprised of a thermoplastic elastomer weathering on a tubular shape with a semi-rigid polymeric backing.
  5. 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.
  6. Electronic Hardware as follows
    - a. EL Paneline exit device with CPN offset pull.
    - b. EPT power transfer unit.
    - c. SP1000 power supply unit (mount in ceiling or closet).
    - d. Provide remote push button Kawneer No. 050401. Locate as directed at reception desk.

## 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. Anodic Finish: Kawneer Permanodic™ AA-M10C21A31, Architectural Class II Clear Anodic Coating (Color No. 17 Clear).

## 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 SUMMARY

## A. Section Includes:

1. The design manufacture and installation of a hurricane resistant 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.
2. Anchors, brackets, and hardware attachments necessary to complete the specified structural assembly, when included within project scope.
3. Weatherability and water-tightness performance as specified.
4. 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.
5. Installation of the system.

## B. Related Sections:

1. Section 07 92 00 - Joint Sealants.
2. Section 09 05 15 - Color Design.
3. Section 13 34 19 – Metal Building System.

## 1.02 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

## 1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product. Submit component dimensions; describe components within assembly, anchorage, fasteners, and translucent sandwich panels.

## B. Shop Drawings:

1. Include plans, elevations, sections, full-size details, and attachments to other work.
2. Flashings, sealants, and anchorage shall be clearly indicated.
3. Show gauges of brake metal, the finish(es) on the framing members, and other information necessary to properly describe and install the system.

- C. Samples: 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.

- D. Delegated-Design Submittal: For aluminum installation system 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. Manufacturer's Qualifications:
  - 1. Material and products shall be manufactured by a company continuously and regularly employed in the manufacture of specified materials for a period of at least ten consecutive years and which can show evidence of those materials being satisfactorily used on at least six projects of similar size, scope and location.
  - 2. At least three of the projects shall have been in successful use for ten years or longer.
  - 3. 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.
- B. Installer Qualifications: Installation shall be by an experienced installer, which has been in the business of installing specified panel systems for at least five years and can show evidence of satisfactory completion of projects of similar size, scope and type.

## 1.07 DELIVERY, STORAGE, AND PROTECTION

- 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.

## 1.08 FIELD CONDITIONS

- A. Ambient Conditions: Do not install sealant or glazing materials when ambient temperature is less than 40 degrees F during and 48 hours after installation.

## 1.09 WARRANTY

- A. The Manufacturer shall furnish 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 shall be provided:
  - 1. Polycarbonate manufacturer's ten (10) year prorated warranty against defective materials, color change and damage.
  - 2. Framing finish applicator's warranty as specified below:
    - a. Anodized Finish: Five (5) years from date of application against chalking, fading, cracking, crazing, and blistering.

## PART 2 - PRODUCTS

## 2.01 MANUFACTURERS

- A. Manufacturer and Product: EXTECH/Exterior Technologies, Inc., 200 Bridge Street, Pittsburgh, PA 15223; Phone (800) 500-8083, Fax (800) 500-8012, website [www.extechinc.com](http://www.extechinc.com) or approved equal. Series No. 3440 Interconnecting Cellular Polycarbonate Translucent Wall System.
- B. Equivalent products by the following manufacturers are acceptable:
  - 1. CPI Daylighting, Inc., Lake Forest, IL. Tel. (800) 759-6985.
  - 2. Major Industries, Inc., Wausau, WI. Tel. (888) 759-2678.
  - 3. Wasco Skylights, Wells, ME., Tel. (800) 388-0293.
- C. 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 SYSTEM DESCRIPTION

- A. An aluminum-framed wall system that is to be glazed with translucent cellular polycarbonate panels that interconnects via extruded tongue and groove edges.

## B. Design Requirements:

1. Support Structure: Constructed from 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. Fasteners: Concealed whenever possible.
4. Glazing: Dry glazed system.
5. Glazing Panels: Bottom edges shall rest on non-continuous supports, which 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. Tape: Air permeable tape shall also be applied to the top edge of the glazing panels.
7. Thermal Movement: Unrestricted thermal movement of the glazing panels shall be allowed to occur within the framing system without compromising its weathertightness.
8. Framing Members: Rabbet depth of framing members shall, at a minimum, be based on a 3/4 inch engagement of the glazing panel, plus 1/8 inch cutting tolerance, plus .005 x the glazing dimension (in inches) that affects that rabbet. For example, a glazing panel that is 100 inches long will require a minimum rabbet depth of 0.75 inch + 0.125 inch + (.005 x 100 inches) = 1.375 inch.

## 2.03 PERFORMANCE REQUIREMENTS

- A. The manufacturer shall be responsible for the configuration and fabrication of the complete unitized panel system:
1. Air Infiltration: Not to exceed 0.072 cfm/sq. ft. of glazing area when tested at a pressure of 6.24 psf in accordance with ASTM E-283.
  2. Water Penetration: None when tested vertically at a pressure equal to 15 percent 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 Structural Drawing S-001.
  4. Testing: Conducted by a certified independent testing laboratory, in accordance with ASTM E-330, shall evidence this.
    - a. In addition, the deflection of all framing members oriented normal to the glazing plane shall not exceed L/175.

## 2.04 PANEL COMPONENTS

- A. General: The system shall comply with IBC 2012 Building Code to resist hurricane force winds and flying debris.
- B. Framing:
1. Extruded aluminum of 6063-T5, 6005-T5 or 6105-T5 alloy and temper; 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.

## C. Glazing Gaskets:

1. Elastomeric type having low friction surfaces where they contact the glazing.
2. Tested for chemical compatibility with the glazing, and test reports evidencing same shall be presented to the Architect.

## D. Fasteners:

1. In general, use concealed fasteners for 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. Where concealed, shall be stainless steel in accordance with ASTM Specifications A165-55.
5. Bolts, anchors and other fastening devices shall be as required for the strength of the connections and shall be suitable for conditions encountered.
6. Washers, same metals as fasteners.

## E. Flashing:

1. Minimum 0.040 thick Aluminum: 5005-H34. clear anodized aluminum finish.
2. Factory formed to required profile(s) in 10-ft lengths, whenever practical, to allow for field trimming to suit as-built conditions.
3. Match finish as closely as possible to that which is on the extruded aluminum framing members.

## F. Polycarbonate Glazing Panels:

1. Appearance:
  - a. 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: 1-9/16 inch, minimum.
  - d. Panel Width: 19-11/16 inches, nominally.
  - e. Panel Weight: 0.82 lbs. per sq. ft., nominally.
  - f. Panels designed and formed with interlocking sides so that multiple panel installations can be achieved without the need to introduce independent mullion framing members.
  - g. Panels 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. Panels extruded in one single length. Transverse connections are not acceptable.
  - i. Free thermal movement of the panels allowed to occur without compromising the weather tightness of the completed system.
  - j. Panels supplied with closed cell, factory applied, and continuous gasket material on the panel tongue.

- k. 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. 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. Install glazing 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 percent): 47 percent.
  - c. Shading Coefficient (SC): 0.52.
  - d. Solar Heat Gain Coefficient (SHGC): 0.45.
- 3. Flammability:
  - a. CC1 fire rating classification when panel tested in accordance with ASTM D-635 or equivalent.
  - b. Class A flame spread and smoke development rating when panel tested in accordance with ASTM E-84.

## 2.05 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. Framing members shall be factory fabricated and assembled to the greatest degree possible, including the following:
  - 1. Cutting members to length.
  - 2. Glazing gaskets 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.

## 2.06 FINISHES

- A. Exposed surfaces of the aluminum framing members shall be clear anodized finish.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Contractor with installer present shall examine substrates, supporting structure and installation conditions. Field verify opening sizes, dimensions and tolerances for field readiness.
- B. Do not proceed with panel installation until unsatisfactory conditions have been corrected.

**3.02 INSTALLATION****A. General:**

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Remove protective coverings on polycarbonate panels during or immediately after installation.
4. Fit joints to produce hairline joints free of burrs and distortion.
5. Rigidly secure non-movement joints.
6. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
7. Seal perimeter and other joints watertight unless otherwise indicated.

B. Metal Protection: Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers

C. Set continuous sill members and flashing in full sealant bed as specified in Section 07 92 00 "Joint Sealants" to produce weathertight installation.

D. Install components plumb and true in alignment with established lines and grades.

**3.03 PROTECTION AND CLEANING**

A. Protection: Protect installed product's finish surfaces from damage during construction. Protect aluminum framing 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 prior to owner's acceptance. Remove construction debris from project site and legally dispose of debris.

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. 08 41 13 – Aluminum Framed Entrances and Storefronts.
  4. Divisions 26 26 Sections for Electrical.

## 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 of 0.3 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/Ruswin, Sargent, Schlage.
  - 4. Flushbolts and Accessories – Hager, Ives, Rockwood.
  - 5. Locksets – Baldwin, Corbin/Ruswin, Sargent, Schlage.
  - 6. Deadbolts – Baldwin, Corbin/Ruswin, Sargent, Schlage.
  - 7. Exit Devices – Precision, Sargent, Von Duprin.
  - 8. Door Closers – Corbin/Ruswin (DC3000), LCN (1460), Sargent (1430).
  - 9. Protective Plates – Hager, Ives, Rockwood.
  - 10. Door Stops – Hager, Ives, Rockwood.
  - 11. Overhead Stops / Holders – Glynn Johnson, Rixson, Sargent.
  - 12. Magnetic Hold Opens – LCN, Rixson, Sargent.
  - 13. Gasketing and Thresholds – National Guard Products, Pemko, Reese.
  - 14. Silencers – Hager, Ives, Rockwood.
  - 15. Power Supplies – Schlage Electronics, Securitron, Von Duprin.
- B. Substitutions: Comply with specified requirements and Section 01 25 00 – Substitution Procedures and Section 01 60 00 – Product Requirements.

## 2.02 SCHEDULED DOOR HARDWARE

- A. Provide door hardware for each door as scheduled **on** Drawings to comply with requirements in this Section.
  - 1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and products equivalent in function and comparable in quality to named products
  - 2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
- B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Schedule" Article. Products are identified by using door hardware designations, as follows:
  - 1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Schedule" Article.
  - 2. References to BHMA Designations: Provide products complying with these designations and requirements for description, quality, and function.

## 2.03 KEYING

- A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference.
  - 1. Master Key System: Change keys and a master key operate cylinders.
  - 2. New Building:
    - a. Master key or grand master key locks to a new key 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 ACCESSORIES FOR PAIRS OF DOORS

- A. Coordinators: BHMA A156.3; consisting of active-leaf, hold-open lever and inactive-leaf release trigger; fabricated from steel with nylon-coated strike plates; with built-in, adjustable safety release.
- B. Carry-Open Bars: BHMA A156.3; prevent the inactive leaf from opening before the active leaf; provide polished brass or bronze carry-open bars with strike plate for inactive leaves of pairs of doors unless automatic or self-latching bolts are used.
- C. Astragals: BHMA A156.22.

## 2.05 FABRICATION

- A. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.
1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
  2. Fire-Rated Applications:
    - a. Wood or Machine Screws: For the following:
      - 1) Hinges mortised to doors or frames.
      - 2) Strike plates to frames.
      - 3) Closers to doors and frames.
    - b. Steel Through Bolts: For the following unless door blocking is provided:
      - 1) Surface hinges to doors.
      - 2) Closers to doors and frames.
      - 3) Surface-mounted exit devices.
  3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
  4. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."
  5. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

## 2.06 FINISHES

- A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

## PART 3 - EXECUTION

## 3.01 INSTALLATION

- A. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
- B. Wood Doors: Comply with DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."
- C. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.
1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
  2. Custom Steel Doors and Frames: HMMA 831.
  3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

- D. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.
1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
  2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- E. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- F. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every 30 inches of door height greater than 90 inches.
- G. Lock Cylinders: Install construction cores to secure building and areas during construction period.
1. Replace construction cores with permanent cores as indicated in keying schedule.
  2. Furnish permanent cores to Owner for installation.
- H. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
- I. 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.
- J. 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.
- K. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- L. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- M. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

N. Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Lubricate moving parts with type lubrication recommended by manufacturer (graphite-type if no other recommended).

3.02 FIELD QUALITY CONTROL

A. Independent Architectural Hardware Consultant: Engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.

3.03 DOOR HARDWARE SCHEDULE

**HW1** (For Exterior Aluminum Storefront Door)  
Each Opening Shall Have:

2 – Each Cylinders As Required  
(Balance of Hardware by Door Manufacturer)

**HW2** (For Interior Aluminum Storefront Door)  
Each Opening Shall Have:

2 – Each Cylinders As Required  
(Balance of Hardware by Door Manufacturer)

**HW3** (For Exterior Single Hollow Metal Doors)  
Each Opening Shall Have:

3 – Each Hinges	McKinney	TA2714 4 1/2 X 4 1/2 X NRP X 626
1 – Lockset	Sargent	10G24LL X 626
1 – Closer	Sargent	1431P9 X TB X EN
1 – Kickplate	Rockwood	8 X 2 LDW 0.050 X 626 (Mounted push side)
1 – Threshold	Pemko	2005AV
1 – W/Strip	Pemko	303DV
1 – Door Bottom	Pemko	2211DV (for Hollow Metal Doors)
1 – Stop	Rockwood	(As Required)
3 – Silencers		

**HW4** (For Interior Wood Doors @ Crew Room to Corridor)  
Each Opening Shall Have:

3 – Each Hinges	McKinney	TA2714 4 1/2 X 4 1/2 X 626
1 – Passage	Sargent	10U15LL X 626
1 – Closer	Sargent	1431P/O X TB X EN LCN
1 – Kickplate	Rockwood	8 X 2 LDW 0.050 X 626 (Mounted push side)
1 – Mop Plate	Rockwood	6 X 1 LDW 0.050 X 626 (Mounted pull side)
1 – Stop	Rockwood	440 X 626
3 – Silencers		

**HW5** (For Interior Wood Door @ Offices)

Each Opening Shall Have:

3 – Each Hinges	McKinney	TA2714 4 1/2 X 4 1/2 X 626
1 – Lockset	Sargent	10G24LL X 626
1 – Cylinder		As Required
1 – Stop	Rockwood	440 X 626
3 – Silencers		

**HW6** (For Interior Hollow Metal Door @ Multiple Toilets & Locker Room)

Each Opening Shall Have:

3 – Each Hinges	McKinney	TA2714 4 1/2 X 4 1/2 X 626
1 – Passage	Sargent	10U15LL X 626
1 – Closer	Sargent	1431P/O X TB X EN LCN
1 – Kickplate	Rockwood	8 X 2 LDW 0.050 X 626 (Mounted push side)
1 – Mop Plate	Rockwood	6 X 1 LDW 0.050 X 626 (Mounted pull side)
1 – Stop	Rockwood	440 X 626
3 – Silencers		

**HW7** (for Interior Wood Door @ Single Toilet and Shower Room)

Each Opening Shall Have:

3 – Each Hinges	McKinney	TA2714 4 1/2 X 4 1/2 X 626
1 – Privacy	Sargent	10U15LL X 626
1 – Indicator Deadbolt	Yale	D291 X 626
1 – Closer	Sargent	1431P/O X TB X EN
1 – Kickplate	Rockwood	8 X 2 LDW 0.050 X 626 (Mounted push side)
1 – Mop Plate	Rockwood	6 X 1 LDW 0.050 X 626 (Mounted pull side)
1 – Stop	Rockwood	440 X 626
3 – Silencers		

**HW8** (For Interior Hollow Metal Door @ Crew Room to Shop, Corridor & Shop Storage Room)

Each Opening Shall Have:

3 – Each Hinges	McKinney	TA2714 4 1/2 X 4 1/2 X 626
1 – Lockset	Sargent	10G24LL X 626
1 – Cylinder		As Required
1 – Closer	Sargent	1431P/O X TB X EN
1 – Kickplate	Rockwood	8 X 2 LDW 0.050 X 626 (Mounted push side)
1 – Stop	Rockwood	440 X 626 (Overhead Stop as Required)
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-45I.
  - 2. Heat-Treated Glass Standard: FS DD-G-I403.
  - 3. Safety Glass Standard: CPSC I6 CFR I20I.
  - 4. GANA Publications: GANA's "Glazing Manual."
  - 5. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."



## 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect glass during transit, storage and handling to prevent scratching or breakage of glass. Replace broken glass.

## 1.07 PROJECT CONDITIONS

- A. Schedule meeting with Glazier and other trades affected by glass installation, prior to beginning of installation.
  1. Do not perform work under adverse weather or job conditions.
  2. Install liquid sealant when temperatures are within lower or middle third of temperature range recommended by manufacturer.

## 1.08 WARRANTY

- A. Manufacturer's Special Warranty on Laminated Glass: Manufacturer's standard form in which laminated-glass manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
  1. Warranty Period: 10 years from date of Completion.
- B. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
  1. Warranty Period: 10 years from date of Completion.

## PART 2 - PRODUCTS

## 2.01 ACCEPTABLE MANUFACTURERS

- A. Equivalent products by the following prime glass manufacturers are acceptable:
  1. Arch Aluminum & Glass Co., Inc., Columbus, OH. Tel No. (800) 870-2519.
  2. Cardinal Glass Industries, Eden Prairie, MN. Tel. (952) 229-2600.
  3. Guardian Industries Corp., Carleton, MI. Tel. (800) 521-9040.
  4. Old Castle Building Envelops, Santa Monica, CA. Tel. (866) 653-2278.
  5. Safti First, San Francisco, CA. Tel. (888) 653-3333.
  6. Viracon, Inc., Owatonna, MN. Tel. (800) 533-2080.
  7. Vitro Architectural Glass (formerly PPG Glass), Tel. (888) 774-4332
- 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 GLASS PRODUCTS, GENERAL

- A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.
- B. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.
- C. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
  - 1. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.
  - 2. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
  - 3. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

## 2.03 GLASS PRODUCTS

- A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.
- B. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.

## 2.04 INSULATING GLASS

- A. Material: Organically sealed panes of glass enclosing a hermetically sealed dehydrated air space and complying with ASTM E 774 for performance classification indicated. Unless shown otherwise on Drawings, use this type glass for all exterior applications.
- B. Characteristics: Other requirements specified for glass characteristics, air space, sealing system, sealant spacer material, corner design and desiccant are as follows:
  - 1. Unit Overall Thickness: 1-5/16 inch.
  - 2. Exterior Pane: Tinted; color – “Solargray” with Solarban 60 MSVD (Sputter) Low-E on 2<sup>nd</sup> (air space) surface by Vitro Arch. Gl.( formally PPG Glass)
  - 3. Outdoor Lite: Class 1 Tint float glass, 1/4 inch minimum thickness.
    - a. Kind Heat Strengthen except where Fully Tempered required.
    - b. Tint Color: Solargray
    - c. Solar Control Low-E Coating: Sputtered on second surface.
    - d. Basis of Design Product: Vitro Arch. Glass (formally PPG Glass)
  - 4. Air Space: 1/2 inch.
  - 5. Indoor Lite: Class 1 (clear) float glass, Overall Thickness: 9/16 inch (Hurricane Resistant) glass.
    - a. Kind Heat Strengthen except where Fully Tempered required.
    - b. Basis of Design Product: Vitro Arch. Glass (formally PPG Glass); Clear.
  - 6. Interlayer: 0.090 inch minimum thick clear equal to SGP by DuPont.
  - 7. Unit Performance Requirements for “Solargray”
    - a. Light Transmission (visible): 35 percent minimum
    - b. U-Value, Summer: 0.28 maximum
    - c. U-Value, Winter: 0.29 maximum
    - d. Relative Heat Gain: 73 BTU per Hour Ft<sup>2</sup> maximum.

- e. Solar Heat Gain Coefficient (SHGC): 0.25 maximum
- f. Shading Coefficient: 0.29 maximum

## 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 UNFRAMED MIRRORS

- A. Number 1 quality, 1/4 inch thick, select float glass mirror electrolytically copper-plated surface, guaranteed against silver spoilage for 10 years. Size as shown on the Drawings. Mirror edges shall be eased. Mounting clips shall be bright polished chrome corrosion resistant metal.

## 2.07 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.

## 2.08 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.

#### 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 16 OPERABLE WALL LOUVERS

## PART 1 - GENERAL

## 1.01 SUMMARY

- A. Section Includes: Extruded aluminum operable wall louvers with insect/bird screens and sill extensions as indicated on the Drawings including indications of sizes and locations.
- B. Related Requirements:
  - 1. Section 07 92 00 – Sealants (for sealant in connection with installations of louvers).
  - 2. Section 08 91 19 – Fixed Louvers
  - 3. Section 09 05 15 – Color Design (for color selection).
  - 4. Divisions 23 and 26 for HVAC and Electrical requirements.

## 1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product; Submit manufacturer's specifications; certified test data, where applicable; and installation instructions for required products, including finishes.
  - 1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.
- B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
- C. Samples: Submit 6-inch square samples of each required finish.
  - 1. Prepare samples on metal of same gage and alloy to be used in Work.
  - 2. Where normal color and texture variations are to be expected, include two or more units in each sample showing limits of such variations.
- D. Delegated-Design Submittal: For louvers indicated to comply with structural and seismic performance requirements, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

## 1.03 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Based on tests performed according to AMCA 500-L.

## 1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials and products in labeled protective packages. Store and handle in strict compliance with manufacturers' instructions and recommendations. Protect from damage from weather, excessive temperatures and construction operations.

## PART 2 - PRODUCTS

## 2.01 ACCEPTABLE MANUFACTURERS

- A. Drawings and Specifications are based on products manufactured by Construction Specialties, Inc., 49 Meeker Ave., Cranford, NJ 07016. Tel. (908) 272-5200.
- B. Equivalent products by the following manufacturers are acceptable:
  - 1. All-Lite Louvers, Mineral Wells, WV. Tel. (304) 489-8113.
  - 2. Ruskin Manufacturing, Kansas City, MO. Tel. (816) 761-7476.
- C. Substitutions 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. Delegated Design: Design louvers, including comprehensive engineering analysis by a qualified professional engineer, using structural and seismic performance requirements and design criteria indicated.
- B. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.
  - 1. Wind Loads: Determine loads based on pressures as indicated on Structural Drawing S-001.
- C. Seismic Performance: Louvers, including attachments to other construction, shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
  - 1. Design earthquake spectral response acceleration, short period (Sds) for Project as required by IBC 2012 and as indicated on Structural Drawing S-001.
- D. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

## 2.03 EXTRUDED-ALUMINUM OPERABLE WALL LOUVERS

- A. Horizontal, Drainable Blade Operating Louver- 6 Inches Deep:
  - 1. Manufacturer and Model: Equal to C/S Model 6917E.
  - 2. Louver Depth: 6 inches.
  - 3. Frame and Blade Nominal Thickness: Not less than 0.081 inch.
  - 4. Operation: Belimo electric operator. (Note: operator shall not protrude beyond face of wall).

5. Louver Performance Ratings based on 4'x4' unit:
  - a. Free Area: Not less than 6.49 sq. ft. for 48-inch- wide by 48-inch- high louver.
  - b. Intake Pressure drop at the point of beginning water penetration 0.33 in. H<sub>2</sub>O
  - c. Exhaust pressure drop at 1000 FPM free area velocity (305 m/min.) 0.22 in. H<sub>2</sub>O.

#### 2.04 LOUVER SCREENS

- A. Provide removable screens for exterior louvers. Fabricate screen frames of same metal and finish as louver units to which secured, unless otherwise indicated. Provide frames consisting of U-shaped metal for permanently securing screen mesh.
- B. Use insect screens of 18X16 aluminum mesh 0.011-inch diameter wire insect screen and additional 5/8-inch sq. mesh, 0.050-inch aluminum expanded and flattened bird screen. Locate screens on inside face of louvers, unless otherwise indicated. Secure screens to louver frames with machine screws, spaced at each corner and at 12 inches on center between.
- C. Use bird screen only for louvers that are connected to duct work.

#### 2.05 MATERIALS

- A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T2. Blade and frame thickness shall be 0.081 inch minimum.
- B. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Fasteners: Use types and sizes to suit unit installation conditions.
  1. Use Phillips flat-head screws for exposed fasteners unless otherwise indicated.
  2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
  3. For color-finished louvers, use fasteners with heads that match color of louvers.
- D. Anchors and Inserts: Use non-ferrous metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

#### 2.06 FABRICATION

- A. Provide louvers and accessories of design, materials, sizes, depth, arrangement, and metal thickness indicated, or if not indicated, as required for optimum performance with respect to airflow; water penetration; air leakage; strength; durability; and uniform appearance.
- B. Fabricate frames including integral sills to suit adjacent construction with tolerances for installation, including application of sealant in joints between louvers and adjoining Work.
- C. Include supports, anchorage, and accessories required for complete assembly.



- D. Sill Extensions: Loose sills made of same material as louvers, where indicated, or required for drainage to exterior and to prevent water penetrating to interior.
  - 1. Setback dimension is 3-3/4 inches to 6 inches.
- E. Join frame members to one another and to stationary louver blades.
  - 1. Maintain equal blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.

## 2.07 ALUMINUM FINISHES

- A. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  - 1. Color and Gloss: As selected by Architect from manufacturer's full range of standard and premium colors. Refer to Section 09 05 15 for color.

## 2.08 SOURCE QUALITY CONTROL

- A. Performance Requirements: Where louvers are indicated to comply with specific performance requirements, provide units whose performance ratings have been determined in compliance with Air Movement and Control Association (AMCA) Standard 500.
- B. SMACNA Recommendations: Comply with SMACNA "Architectural Sheet Metal Manual" recommendations for fabrication, construction details and installation procedures, except as otherwise indicated.
- C. Shop Assembly: Coordinate field measurements and Shop Drawings with fabrication and shop assembly to minimize field adjustments, splicing, mechanical joints and field assembly of units.
  - 1. Pre-assemble units in shop to greatest extent possible and disassemble as necessary for shipping and handling limitations.
  - 2. Clearly mark units for re-assembly and coordinated installation.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

- D. Protect unpainted galvanized and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.
- E. Restore louvers damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

END OF SECTION

SECTION 08 91 19                      FIXED LOUVERS

PART 1 - GENERAL

1.01        SUMMARY

- A.    Section Includes: Extruded aluminum fixed louvers with insect/bird screens and sill extensions as indicated on the Drawings including indications of sizes and locations.
  
- B.    Related Requirements:
  - 1.    Section 07 92 00 – Sealants (for sealant in connection with installations of louvers).
  - 2.    Section 08 91 16 – Operable Wall Louvers
  - 3.    Section 09 05 15 – Color Design (for color selection).

1.02        ACTION SUBMITTALS

- A.    Product Data: For each type of product; Submit manufacturer's specifications; certified test data, where applicable; and installation instructions for required products, including finishes.
  - 1.    For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.
  
- B.    Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
  
- C.    Samples: Submit 6-inch square samples of each required finish.
  - 1.    Prepare samples on metal of same gage and alloy to be used in Work.
  - 2.    Where normal color and texture variations are to be expected, include two or more units in each sample showing limits of such variations.
  
- D.    Delegated-Design Submittal: For louvers indicated to comply with structural and seismic performance requirements, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.03        INFORMATIONAL SUBMITTALS

- A.    Product Test Reports: Based on tests performed according to AMCA 500-L.

1.04        DELIVERY, STORAGE, AND HANDLING

- A.    Deliver materials and products in labeled protective packages. Store and handle in strict compliance with manufacturers' instructions and recommendations. Protect from damage from weather, excessive temperatures and construction operations.

## PART 2 - PRODUCTS

## 2.01 ACCEPTABLE MANUFACTURERS

- A. Drawings and Specifications are based on products manufactured by Construction Specialties, Inc., 49 Meeker Ave., Cranford, NJ 07016. Tel. (908) 272-5200.
- B. Equivalent products by the following manufacturers are acceptable:
  - 1. All-Lite Louvers, Mineral Wells, WV. Tel. (304) 489-8113.
  - 2. Ruskin Manufacturing, Kansas City, MO. Tel. (816) 761-7476.
- C. Substitutions 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. Delegated Design: Design louvers, including comprehensive engineering analysis by a qualified professional engineer, using structural and seismic performance requirements and design criteria indicated.
- B. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.
  - 1. Wind Loads: Determine loads based on pressures as indicated on Structural Drawing S-001.
- C. Seismic Performance: Louvers, including attachments to other construction, shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
  - 1. Design earthquake spectral response acceleration, short period (Sds) for Project as required by IBC 2012 and as indicated on Structural Drawing S-001.
- D. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

## 2.03 FIXED, EXTRUDED-ALUMINUM LOUVERS

- A. Horizontal, Drainable-Blade Fixed Louver-4 Inches Deep:
  - 1. Manufacturer and Model: Equal to C/S Model A4097.
  - 2. Louver Depth: 4 inches.
  - 3. Frame and Blade Nominal Thickness: Not less than 0.081 inch.
  - 4. Mullion Type: Hidden vertical mullions of type and at spacing indicated but not further apart than recommended by manufacturer or 72 inches on center, whichever is less.
    - a. At horizontal joints between louver units provide horizontal mullions except where continuous vertical assemblies are indicated

5. Louver Performance Ratings:
  - a. Free Area: Not less than 50.44 percent for 48-inch- wide by 48-inch- high louver.
  - b. Air Performance: Not more than 0.14-inch wg static pressure drop at 872-fpm free-area intake velocity.
6. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

#### 2.04 LOUVER SCREENS

- A. Provide removable screens for exterior louvers. Fabricate screen frames of same metal and finish as louver units to which secured, unless otherwise indicated. Provide frames consisting of U-shaped metal for permanently securing screen mesh.
- B. Use insect screens of 18X14 aluminum mesh and additional 1/2-inch sq. mesh, 0.050-inch aluminum wire bird screen. Locate screens on inside face of louvers, unless otherwise indicated. Secure screens to louver frames with machine screws, spaced at each corner and at 12 inches on center between.
- C. Use bird screen only for louvers that are connected to duct work.

#### 2.05 MATERIALS

- A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T2. Blade and frame thickness shall be 0.081 inch minimum.
- B. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Fasteners: Use types and sizes to suit unit installation conditions.
  1. Use Phillips flat-head screws for exposed fasteners unless otherwise indicated.
  2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
  3. For color-finished louvers, use fasteners with heads that match color of louvers.
- D. Anchors and Inserts: Use non-ferrous metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

#### 2.06 FABRICATION

- A. Provide louvers and accessories of design, materials, sizes, depth, arrangement, and metal thickness indicated, or if not indicated, as required for optimum performance with respect to airflow; water penetration; air leakage; strength; durability; and uniform appearance.
- B. Fabricate frames including integral sills to suit adjacent construction with tolerances for installation, including application of sealant in joints between louvers and adjoining Work.
- C. Include supports, anchorage, and accessories required for complete assembly.

- D. Sill Extensions: Loose sills made of same material as louvers, where indicated, or required for drainage to exterior and to prevent water penetrating to interior.
  - 1. Setback dimension is 3-3/4 inches to 6 inches.
- E. Join frame members to one another and to stationary louver blades.
  - 1. Maintain equal blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.

## 2.07 ALUMINUM FINISHES

- A. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  - 1. Color and Gloss: As selected by Architect from manufacturer's full range of standard and premium colors. Refer to Section 09 05 15 for color.

## 2.08 SOURCE QUALITY CONTROL

- A. Performance Requirements: Where louvers are indicated to comply with specific performance requirements, provide units whose performance ratings have been determined in compliance with Air Movement and Control Association (AMCA) Standard 500.
- B. SMACNA Recommendations: Comply with SMACNA "Architectural Sheet Metal Manual" recommendations for fabrication, construction details and installation procedures, except as otherwise indicated.
- C. Shop Assembly: Coordinate field measurements and Shop Drawings with fabrication and shop assembly to minimize field adjustments, splicing, mechanical joints and field assembly of units.
  - 1. Pre-assemble units in shop to greatest extent possible and disassemble as necessary for shipping and handling limitations.
  - 2. Clearly mark units for re-assembly and coordinated installation.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

- D. Protect unpainted galvanized and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.
- E. Restore louvers damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

END OF SECTION

SECTION 09 05 15 COLOR DESIGN

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: A coordinated comprehensive Color System in which requirements for materials specified in other Sections of this Specification and / or shown on the Drawings are identified for quality, color, finish, texture and pattern.
- B. Related Sections: Section 01 33 00 – Submittal Procedures.

1.02 MANUFACTURER'S TRADE NAMES

- A. Manufacturer's trade names and number designations used herein identify colors, finishes, textures and patterns for materials and products specified in the technical sections of the Specifications. Wherever such products are referred for selection or approval in other sections, such products shall be understood to be referenced to this Section.
- B. If no selection is listed herein for products, the Project Engineer / MDOT Architect shall be contacted for a color selection.
- C. Subject to approval of the Project Engineer / MDOT Architect, products of other manufacturers will be considered, provided they are equivalent to the quality, colors, finishes, textures and patterns listed and meet the requirements of the Specifications and Drawings.

1.03 SAMPLES

- A. Color samples shall be submitted for approval prior to applying or installing finishes or items that are included in this Section. See appropriate technical Sections for submittal requirements. Upon receipt of samples, the Project Engineer / MDOT Architect may make revisions to the Color schedule.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Materials are specified in other Sections of the Specifications. Reference by trade name or manufacturer shall be considered as establishing a standard of quality and shall in no way limit competition.



2.02 MANUFACTURERS

A. The following manufacturers were used in preparing the Color Schedule:

SECTION / MATERIALS	MANUFACTURER / NUMBER & COLOR NAME
• 03 30 00 - Concrete Floor -Shop	Sealed Concrete
• 04 22 00 - Conc. Unit Masonry	SW7029 Agreeable Gray
• 06 40 00 - Plastic Lam PLAM1	Formica - 5880-58 Earthen Warp
• 06 40 00 - Plastic Lam PLAM2	Formica - 7708-58 Flax Gauze
• 06 40 00 - Plastic Lam PLAM3	Wilsonart - 4846-60 Morrow Zephyr
• 07 92 00 - Joint Sealants	Pecora-Match adjacent lighter color
• 08 11 13 - HM Drs & Frames (Ext)	(P4) SW7674 Peppercorn
• 08 11 13 - HM Drs & Frames (Int)	(P3) SW7025 Backdrop
• 08 41 13 - Alum Fr Ent & Storefront	Kawneer - #17 Clear Anodized
• 08 14 29 - Prefinished Wood Doors	Graham - #425 Cactus
• 08 33 23 - Overhead Coiling Doors	Raynor - RAL 7004
• 08 51 12 - Al Windows (Sing Hung)	Peerless - Clear Anodized
• 08 71 00 - Door Hardware	Satin Chrome
• 08 91 16 - Operable Wall Louvers	C/S Group - #705 Bright Silver (Wall Panel #1)
• 08 91 16 - Operable Wall Louvers	C/S Group - #549 Charcoal (Wall Panel #2)
• 08 91 19 - Fixed Louvers	C/S Group - # 705 Bright Silver (Wall Panel #1)
• 08 91 19 - Fixed Louvers	C/S Group - #549 Charcoal (Wall Panel #2)
• 09 29 00 - Gypsum Board(Walls)	(P1) SW7029 Agreeable Gray
• 09 29 00 - Gypsum Board(Ceilings)	(P2) SW7008 Alabaster
• 09 31 13 - Ceramic Tile Floor	POR-1 American Olean (12x24) Series: Theoretical Absolute Brown TH93
• 09 31 13 - Ceramic Tile Base	POR-1 American Olean (12x24) Series: Theoretical Absolute Brown TH93
• 09 31 13 - Ceramic Tile Wall	POR-2 American Olean (12x24) Series: Theoretical Ideal Beige TH91
• 09 31 13 - Grout (Floors)	Laticrete - Marble Beige
• 09 31 13 - Grout (Walls)	Laticrete - Marble Beige
• 09 65 00 - Lux Vinyl Floor Plank	Mannington Luxury Vinyl Plank (6x36) Series: Amtico Wood Color: Wild Walnut
• 09 65 00 - Rubber Base	Johnsonite -63 Burnt Umber
• 09 68 13 – Modular Textile Flooring	TCF-1 Kinetex by J+J Flooring Pattern: Strata Color: 1848 Feldspar
• 09 68 13 – Modular Walk-Off Flooring	TFC-2 J+J Flooring Pattern: Incognito Color: 1841 Intelligence

- 10 51 13 - Metal Lockers Penco - 723 Light Putty
- 10 56 13 - Metal Shelving Penco - 028 Gray
- 10 73 16 - Canopies Mapes - Clear Anodized
- 11 31 15 - Appliances (Range) GE-Stainless Steel
- 11 31 15 - Appliances (Microwave) GE-Stainless Steel
- 11 31 15 - Appliances (Refrigerator) GE-Stainless Steel
  
- 12 21 14 - Horiz Lvr Blinds - Metal Hunter Douglas - Color TBD
- 12 48 43 - Floor Mats (Carpet) C/S Group - 7325 Wrought Iron
- 12 48 43 - Floor Mats (Rails) C/S Group - Black
- 12 48 43 - Floor Mats (Vinyl Edge) C/S Group - Black
- 12 48 43 - Floor Mats (Frame) C/S Group - Black
  
- 13 34 19 - Roof Panels - Shop Kingspan - Galvalume® Plus
- 13 34 19 - Wall Panels #1 Morin - Galvalume® Plus
- 13 34 19 - Wall Panel #2 Morin - Blue Gray
- 13 34 19 - Trim (Panels) Kingspan/Morin - Match Adjacent Material
- 13 34 19 - Roof Fascia Kingspan - Galvalume® Plus
- 13 34 19 - Gutter & Downspouts Kingspan - Galvalume® Plus

### PART 3 - EXECUTION

#### 3.01 INSTALLATION / APPLICATION, GENERAL

- A. Refer to execution requirements specified in other Sections of this Specification for the specific products listed. Colors, finishes, textures or patterns not included in this Color Design will be selected by the Project Engineer / MDOT Architect upon written notification and subsequent submittals by the Contractor.

END OF SECTION

## SECTION 09 29 00

## GYPSUM BOARD

## PART 1 - GENERAL

## 1.01 SUMMARY

- A. Section Includes: Gypsum board work with a tape-and-compound joint treatment system known as "drywall finishing" work.
- B. The types of Work required include the following:
  - 1. Gypsum board applied to wood framing and furring.
  - 2. Gypsum backing boards for application of other finishes.
  - 3. Drywall finishing (joint tape-and-compound treatment).

## 1.02 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical product data, installation instructions and recommendations for products specified.

## 1.03 QUALITY ASSURANCE

- A. Fire Resistance: Where work is indicated for fire resistance ratings, including those required to comply with governing regulations, provide materials and installations identical with applicable assemblies which have been tested and listed by recognized authorities, including UL.
- B. Industry Standard: Comply with applicable requirements of GA-216 "Application and Finishing of Gypsum Board" by the Gypsum Association, except where more detailed or more stringent requirements are indicated including the recommendations of the manufacturer.
- C. Allowable Tolerances: 1/8 inch offsets between planes of board faces, and 1/4 inch in 8 ft. for plumb, level, warp and bow.
- D. Manufacturer: Obtain gypsum boards, framing and fasteners, trim accessories, adhesives and joint treatment products from a single manufacturer, or from manufacturers recommended by the prime manufacturer of gypsum boards.

## 1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver gypsum drywall materials in sealed containers and bundles, fully identified with manufacturer's name, brand, type and grade; store in a dry, well ventilated space, protected from the weather, under cover and off the ground.

## 1.05 PROJECT CONDITIONS

- A. Installer must examine the substrates and the spaces to receive gypsum drywall, and the conditions under which gypsum drywall is to be installed; and shall notify the Contractor, in writing, of conditions detrimental to the proper and timely completion of the work.
  - 1. Do not proceed with the installation until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.
- B. Maintain ambient temperatures at not less than 55 degrees F., for the period of 24 hours before drywall finishing, during installation and until compounds are dry.

## PART 2 - PRODUCTS

### 2.01 ACCEPTABLE MANUFACTURERS

- A. Obtain gypsum board, framing and fasteners, trim accessories, adhesives and joint treatment products from one of the following:
  - 1. CertainTeed Corporation, PA Tel: (800) 233-8990.
  - 2. Georgia-Pacific Corp, Atlanta, GA, Tel. (800) 327-2344.
  - 3. National Gypsum Company, Charlotte, NC, Tel. (800) 343-4893.
  - 4. United States Gypsum Company, Chicago, IL, Tel. (800) 874-4968.

### 2.02 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

### 2.03 GYPSUM BOARD PRODUCTS

- A. Furnish gypsum board products in maximum lengths available to minimize end-to-end butt joints. To the extent not otherwise indicated, comply with GA-216, as specified and recommended.
- B. Exposed gypsum board shall be Type X, fire rated type with tapered long edges and as follows:
  - 1. Edge Profile: Special rounded or beveled edge.
  - 2. Sheet Size: Maximum length available that will minimize end joints.
  - 3. Thickness: 5/8 inch, except where otherwise indicated.
  - 4. Water-resistant Type (WR-1): Provide at exterior walls and at "Wet" areas without ceramic tile; equal to 5/8 inch thick DensArmor Plus Fireguard by G-P Gypsum.
  - 5. Cement Board: Provide water-resistant cement based backer board as a base for all ceramic wall tiles, equal to 5/8 inch thick Durock by USG.

## 2.04 TRIM ACCESSORIES

- A. Manufacturer's standard galvanized steel beaded units with flanges for concealment in joint compound including corner beads, edge trim and control joints; except provide semi-finishing type (flange not concealed) where indicated.
- B. Where metal moldings are specifically called out on the Drawings, provide the appropriate item from below:
  - 1. Edge Trim: USG No. 200-A.
  - 2. Control Joint: USG No. 093.

## 2.05 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
  - 1. Interior Gypsum Board: Paper, perforated type.
  - 2. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound: On interior work provide chemical hardening type for bedding and filling, ready-mixed vinyl-type or non-case in-type for topping. On exterior work provide water-resistant type.

## 2.06 MISCELLANEOUS MATERIALS

- A. Provide auxiliary materials for gypsum drywall work of the type and grade recommended by the manufacturer of the gypsum board. Gypsum board fasteners shall comply with GA-216. Provide anti-corrosive type at exterior applications.

## PART 3 - EXECUTION

### 3.01 PREPARATION

- A. Install supplementary framing, runners, furring, blocking and bracing at opening and terminations in the Work, and at locations required to support fixtures, equipment, services, heavy trim, furnishings and similar work which cannot be adequately supported directly on gypsum board alone.

### 3.02 GENERAL GYPSUM BOARD INSTALLATION REQUIREMENTS

- A. Meet at the project site with the installers of related work and review the coordination and sequencing of work to ensure that everything to be concealed by gypsum drywall has been accomplished, and that chases, access panels, openings, supplementary framing and blocking and similar provisions have been completed. In addition to compliance with GA-216 and ASTM C 840, comply with manufacturer's instructions and requirements for fire resistance ratings (if any), whichever is most stringent.
- B. Install wall / partition boards vertically to avoid end-butt joints wherever possible. At stairwells and similar high walls, install boards horizontally with end joints staggered over studs. Form control joints and expansion joints with space between edges of boards, prepared to receive trim accessories.

- C. Install sound attenuation blankets and insulation as indicated, prior to gypsum board unless readily installed after board has been installed.
- D. Floating Construction: Where feasible, including where recommended by manufacturer, install gypsum board with "floating" internal corner construction, unless isolation of the intersecting boards is indicated or unless control or expansion joints are indicated.
- E. Space fasteners in gypsum boards in accordance with manufacturer's recommendations.

### 3.03 SPECIAL GYPSUM BOARD APPLICATIONS

- A. Where drywall is base for thin set ceramic tile and similar rigid applied wall finishes, install water-resistant cement based backing board.
- B. At toilets, showers, labs, janitor closets, drinking fountains, kitchen sinks and similar "wet" areas without ceramic tile, install water-resistant gypsum board.
- C. Apply with uncut long edge at bottom of work, and space 1/4 inch above fixture lips. Seal ends, cut-edges and penetrations of each piece with water-resistant sealant before installation.

### 3.04 INSTALLATION OF DRYWALL TRIM ACCESSORIES

- A. Where feasible, use the same fasteners to anchor trim accessory flanges as required to fasten gypsum board to the supports. Otherwise, fasten flanges by nailing or stapling in accordance with manufacturer's instructions and recommendations.
- B. Install metal corner beads at external corners of drywall work.
- C. Install metal edge trim whenever edge of gypsum board would otherwise be exposed or semi-exposed. Provide type with face flange to receive joint compound except where semi-finishing type is indicated. Install L-type trim where work is tightly abutted to other work, and install special kerf-type where other work is kerfed to receive long leg of L-type trim. Install U- type trim where edge is exposed, revealed, gasketed, or sealant-filled (including expansion joints.) Install metal control joint (beaded type) where indicated or required for proper installation.

### 3.05 INSTALLATION OF DRYWALL FINISHING

- A. Apply treatment at gypsum board joints (both directions), flanges of trim accessories, penetrations, fastener heads, surface defects and elsewhere as required to prepare Work for decoration. Pre-fill open joints and rounded or beveled edges, using type of compound specified herein and recommended by manufacturer.
- B. Apply joint tape at joints between gypsum boards, except where a trim accessory is indicated.
- C. Apply joint compound in 3 coats (not including pre-fill of openings in base), and sand between last 2 coats and after last coat.
- D. Base for Ceramic Tile: Do not install drywall finishing where ceramic tile and similar rigid applied finishes are indicated.

- E. Unless otherwise indicated, install drywall finishing at all gypsum board exposed to view and to receive finishes as specified. Where not exposed to view and above ceilings, sanding is not required.
  - F. Finishing Gypsum Board Assemblies: Level 4 finish, unless otherwise indicated; Level 1 finish for concealed areas, unless a higher level of finish is required for fire-resistance-rated assemblies and Level 2 finish where panels form substrates for tile, Level 5 finish is required in areas with a gloss or epoxy finished coating.
- 3.06 PROTECTION OF WORK
- A. Installer shall advise Contractor of required procedures for protection of the gypsum drywall Work from damage and deterioration during the remainder of the construction period.

END OF SECTION

## SECTION 09 31 13

## THIN-SET CERAMIC TILING

## PART 1 - GENERAL

## 1.01 SUMMARY

- A. Section Includes: Thin-set ceramic glazed mosaic floor tile, base, glass mosaic wall tile, special shapes and accessories.
- B. Related Sections:
  - 1. Section 07 26 00 - Vapor Retarders (for floor protection paper).
  - 2. Section 09 29 00 - Gypsum Board (for cement based backer board).
  - 3. Section 09 05 15 - Color Design (for color selections).

## 1.02 ACTION SUBMITTALS

- A. Product Data: Manufacturer's product data and written instructions for recommended installation and maintenance practices for each type of product indicated.
- B. Samples:
  - 1. Two samples of each type and composition of tile and for each color and finish required.
  - 2. Assembled samples, with grouted joints, for each type and composition of tile and for each color and finish required.
    - a. Mount on 24 Inches square plywood or hardboard backing.
  - 3. Stone thresholds in 6-inch lengths.
- C. Contract Closeout: Provide Maintenance Data and Manufacturer's recommendations on cleaning.

## 1.03 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering and identified with labels describing contents.
  - 1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.

## 1.04 QUALITY ASSURANCE

- A. Furnish tile conforming to the Standard Grade Requirements of ANSI A137.1.
  - 1. Coefficient of Friction: Slip resistant in accordance with the Ceramic Tile Institute, i.e. a static coefficient of friction of not less than 0.60 when tested in accordance with ASTM C 1028-89 as modified by the Ceramic Tile Institute
- B. Provide materials obtained from only one source for each type of tile, grout and color to minimize variations in appearance and quality.



## 1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver packaged materials and store in original containers with seals unbroken and labels intact until time of use, in accordance with manufacturer's directions.

## 1.06 PROJECT CONDITIONS

- A. Continuously heat areas to receive tile to 50 degrees F. for at least 48 hours prior to installation, when project conditions are such that heating is required.
  - 1. Maintain 50 degrees F. temperature continuously during and after installation as recommended by tile manufacturer but not less than 7 days.
- B. Maintain a minimum lighting level of 50 fc during installation.

## PART 2 - PRODUCTS

## 2.01 ACCEPTABLE MANUFACTURERS

- A. Equivalent tile products by the following manufacturers are acceptable:
  - 1. American Olean Tile Company, Lansdale, Pennsylvania.
  - 2. Crossville Inc., Crossville, Tennessee
  - 3. Dal-Tile Corporation, Dallas, Texas.
  - 4. Floor Gres Ceramiche, Italy.
  - 5. Florida Tile Industries, Lakeland, Florida.
  - 6. Lone Star Porcelain Mosaic Tile, Dallas, Texas.
  - 7. Mohawk.
  - 8. United States Ceramic Tile Co., East Spatra, Ohio.
- 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 MATERIALS

- A. General: Comply with ANSI standard referenced with products and materials indicated for setting and grouting.
- B. Porcelain Floor Tile: 12 inches by 24 inches by 5/16 inch, cushioned edge, unglazed, color to be selected from standard colors available.
- C. Porcelain Tile Base: 12 inches by 24 inches by 5/16 inch, cushioned edge, unglazed, color to be selected from standard colors available.
- D. Porcelain Wall Tile: Size 12 inches by 24 inches by 5/16 inch, cushioned edge, unpolished, colors to be selected from standard colors available.
- E. Threshold: Stainless Steel transition strip equal to Schluter – Reno-TK.

- F. 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.
- G. Grout: ANSI A 118.3, with Tile Contractor's Association certification of conformance. Equal to Laticrete Type SpectraLOCK Pro Grout.
1. Equivalent products by Custom Building Products and Mapei are acceptable.
  2. Color of grout to be selected by the MDOT Architect from manufacturer's full range of standard colors.
- H. Accessories:
1. Three way cove-shaped profiles made of Textured color-Coated aluminum for inside wall corners and floor to wall transitions equal to Schluter®-DILEX-EKE.
  2. L-shaped profile made of color-coated aluminum with 1/8 inch wide top section and vertical wall section for outside corners equal to Schluter®-JOLLY.
    - a. Equivalent products by Blanke Corp are acceptable.
    - b. 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 Floor Tile: 1/16 inch.
  - 2. Porcelain Wall Tile: 1/16 inch.
- G. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
  - 1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
  - 2. Prepare joints and apply sealants to comply with requirements in Section 07 92 00 "Joint Sealants."
- H. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated.
- I. Accessories: Comply with manufacturer's installation instructions.
- J. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness and bonded securely to substrate.
- 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 07 21 00 – Thermal Insulation.
2.      Section 09 29 00 – Gypsum Board.
3.      Division 23 for Mechanical Requirements.
4.      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.
- 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 10 pounds per cubic 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 I, Direct Hung.
  - 1. Hanger Wires: Galvanized carbon steel, ASTM A 641, soft temper pre-stretched, yield-stress load of at least 3 times design load, but not less than 12 gage (0.106 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 1/8 inch in 12 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 16 inches on center and not more than 3 inches from ends, leveling with ceiling suspension system to tolerance of 1/8 inch in 12 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), 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 Mannington Commercial, Amtico, Hard Surface, Calhoun, GA 30701, Tel. No. (800) 241-2262.
- B. Equivalent products by the following manufacturers are acceptable:
  - 1. Armstrong Commercial Flooring, Lancaster, PA. Tel. No. (800) 292-6308.
  - 2. Johnsonite, Chagrin Falls, OH. Tel. No. (800) 899-8916.
  - 3. Patcraft, Dalton, GA. Tel. No. (800) 241-4014.
- C. 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 LUXURY VINYL FLOOR PLANK

- A. Style / Number: Amtico – Wood 6 inch.
- B. Construction: High Performance Luxury Vinyl Plank.
- C. Class / ASTM F-1700: Class III Printed Film Vinyl Tile.
- D. Finish: Quantum Guard HP.
- 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: 0.039 inches.
- I. Installation Method: Glue down.
- J. Adhesive: XpressStep.
- 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/cm <sup>2</sup> , NFPA Class I. |
| 6. N.B.S. Smoke Chamber (ASTM E-662):       | < 450, Passes.                               |
| 7. FloorScore Indoor Air Quality:           | SCS Certified.                               |

## 2.03 ACCESSORIES

- A. Rubber Base: Comply with ASTM F-1861, Type TP, Group 1 (solid) Standard Specification for Resilient Wall Base, with matching end stops and preformed or molded corner units.
1. Base shall be 4 inches high, 0.125 inch gage, length 120 feet, standard top-set cove.
- B. Resilient Edge Strips: 1/8-inch thick, homogenous vinyl of rubber composition, tapered or bullnose edge, color to match flooring, or as selected by MDOT Architect from standard colors available; not less than 1 inch wide.

## 2.04 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by LVP floor and adhesive manufacturer(s) to suit LVP floor, rubber wall base and substrate conditions indicated.
1. Adhesives shall comply with the following limits for VOC content:
    - a. LVP 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.

## 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 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 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 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.
- 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 ACCESSORIES INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilaster, casework and other permanent fixtures in rooms or areas where base is required. Install base in as long lengths as practicable (continuous between openings and wall to wall), with preformed corner units.
- C. Tightly bond base to backing throughout the length of each piece, with continuous contact at horizontal and vertical surfaces.
- D. Place resilient edge strips tightly butted to flooring and secure with adhesive. Install edging strips at all unprotected edges of flooring, unless otherwise shown.

### 3.05 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.
- D. 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 68 18 TEXTILE COMPOSITE FLOORING

## PART 1 - GENERAL

## 1.01 SUMMARY

- A. Section includes: Textile composite flooring modules, walk-off modular tiles, and accessories as shown on the Drawings and schedules and as indicated by the requirements of this Section.
- B. Related Sections:
  - 1. Division 03 Concrete - not included work this section.
  - 2. Division 07 Thermal and Moisture Protection - not included work this section.
  - 3. Section 09 05 15 Color Design for color selection.
  - 4. Section 09 65 00 Resilient Flooring for rubber base and accessories.

## 1.02 SUBMITTALS

- A. Submit to MDOT Architect two (2) 6-1/2 inches by 6-1/2 inches (minimum size) finished samples of the exact type of flooring proposed, including quality, pattern, color and backing for acceptance prior to shipment.
- B. Submit manufacturer's warranties, installation instructions, and maintenance instructions for acceptance prior to shipment.
  - 1. Do not submit Material Safety Data Sheets to MDOT Architect for approval.
- C. Submit the manufacturer's certification that the flooring has been tested by an independent laboratory and complies with the required flammability tests as well as other testing requirements as listed under 1.03 E

## 1.03 EXTRA MATERIALS

- A. Furnish Owner with overage stock of 5 percent of flooring materials.

## 1.04 QUALITY ASSURANCE AND REGULATORY REQUIREMENTS

- A. Qualifications of flooring installation contractor: The work shall be done by installation firms specializing in commercial flooring and carpet installation. It is required, that the firm or individual shall be a member of the Floor Covering Installation Contractors Association (FCICA) and/or certified by the Certified Floorcovering Installers Association (CFI). Flooring contractor to be specialty contractor normally engaged in this type of work and shall have three (3) years minimum documented experience in commercial installation of similar flooring materials and participation in manufacturer's environmental program including responsible flooring removal, recycling, and installation.
- B. Flooring installer will be responsible for the proper product installation, including floor preparation in all the areas indicated in the Drawings to receive Kinetex modules. The installation standard will be as listed in J+J Flooring Group Kinetex Installation Instructions.
- C. Manufacturer qualifications: Manufacturing facility to ISO 14001 certified and have a minimum of 10 years experience in the manufacture of commercial flooring.

- D. Manufacturer to provide field service personnel to assist in project start-up as required by the job and will notify Owner, Architect, General Contractor, or another designated contact if any installation instructions are not followed.
- E. Flooring materials shall meet the following test performance criteria as tested by a recognized independent testing laboratory. Certified test reports shall be submitted by the manufacturer for each test method. Products submitted for approval shall meet requirements listed below:
  - 1. Pill Test / DOC-FF-1-70 (ASTM D-2589) - Requirement: Pass
  - 2. Flooring Radiant Panel / ASTM E-648 - Requirement: Class I (Above .45 w/cm)
  - 3. CRI VOC Chamber Test/Indoor Air Quality test (CRI-IAQ) Green Label Plus™ Test.
  - 4. Lightfastness: Rating of not less than 5 on International Grey Scale after 40 SFU's when tested in accordance with AATCC Test Method 16E.
  - 5. Crockfastness: Minimum stain rating on International Grey Scale of not less than 5 wet or dry when tested in accordance with AATCC Test Method 165.
  - 6. Atmospheric Fading: Burned Gas shall not be less than 5 on International Grey Scale after two cycles on each test as per AATCC Test Method 129 Ozone and AATCC Test Method 23.
  - 7. Noise Reduction Coefficient (ASTM C 423-02): NRC Rating of 0.30
  - 8. Impact Insulation Classification (ASTM E 492-09): IIC Rating of 64
  - 9. Slip Resistance (ASTM 1028-96): Complies with ADA Guidelines for level surface
  - 10. Thermal Insulation (ASTM C 518): R-4

#### 1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the installation site in the manufacturer's original packaging and in good condition. Packaging to contain manufacturer's name and marks, identification number, shipping and handling instructions and related information. Place pallets of textile composite flooring modules on a flat surface (do not double stack pallets).
- B. Delivered and stored materials shall be available for inspection as required by the Owner, Architect, installer and the manufacturer.
- C. Materials, including adhesives, shall be delivered to the installation site at a minimum of 48 hours prior to the start of installation and stored in a clean and dry room that measures above 65 deg F and below 95 deg F and measures between 10 percent and 65 percent relative humidity (RH).

#### 1.06 ENVIRONMENTAL/FIELD CONDITIONS

- A. To maintain temperature and relative humidity, permanent heating and air conditioning systems (HVAC) shall be in operation. After work is completed, the ambient room temperature should remain at 65 deg F and relative humidity between 10 percent and 65 percent for 48 hours. These materials and related adhesives shall be protected from the direct flow of heat from heating fixtures and appliances such as hot-air registers, radiators, or other. Site conditions shall include those specified in the flooring manufacturer's installation instructions and shall also include sufficient heat, light and power required for effective and efficient working condition.



## 1.07 WARRANTIES

- A. **Manufacturers Warranties:** All warranties shall be issued by the manufacturer as standard published warranties on all types of flooring modules within this document. Second source warranties that involve parties other than the textile composite flooring manufacturer are unacceptable. If the product fails to perform as warranted when installed according to the J+J Flooring Group's Kinetex installation instruction and maintained according to J+J Flooring Group's Kinetex maintenance instructions, the affected area will be repaired or replaced at the expense of the manufacturer. J+J Flooring Group will provide standard published written performance warranties for the following:
1. Lifetime product performance. Will not delaminate along seams or lose more than five (5 percent) percent by weight of fiber during its useful life.
  2. Lifetime static propensity, meaning built-in protection below 3.0 kv as tested under AATCC-134.
  3. Lifetime Stain Removal
  4. Lifetime Colorfastness (Light and Crocking)
- B. **Installers Warranty:** Flooring installer shall provide Owner a written warranty that guarantees the completed installation to be free from defects in materials and workmanship for a period of no less than two (2) years after the Date of Completion.

## PART 2 PRODUCTS

## 2.01 MANUFACTURERS

- A. **Basis of Design:** Equal to Kinetex and Invision brands of J+J Flooring Group, P.O. Box 1287, Dalton, GA, 30722. [\(800\) 241-4586](tel:8002414586). JJ-KINETEX.COM and JJ-INVISION.COM. Please contact Amy Taylor , [\(601\) 317-9919](tel:6013179919), Amy.Taylor@jjflooringgroup.com .
1. **Manufacturers:** Subject to compliance with requirements, the following manufacturers products are acceptable::
    - a. Forbo - Flotex
    - b. Bolyu – Svelte
- 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 FLOORING MATERIALS

- A. **Kinetex Textile Composite Flooring Modules (tiles) TCF-1**
1. Product: Strata Plank 1826
  2. Color: Ref to Section 09 05 15-Color Design
  3. Backing: Polyester Felt Cushion
  4. Dye Method: Solution Dyed
  5. Wear Layer: Universal Fibers Polyester
  6. Total Weight (Nominal Average): 4.5 oz - 5.2 oz / square foot
  7. Pattern Repeat: N/A
  8. Soil Release: Yes
  9. Standard Size: 18 inches by 36 inches

10. Warranties: Lifetime Product Performance, Colorfastness to Light & Crocking, Stain Removal, Static Protection, Protection from Edge Ravel and Delamination Failure; Lifetime Dimensional Stability.
11. Testing Specifications:
  - a. Pill Test: Yes.
  - b. Flooring Radiant Panel: Class 1
  - c. Smoke Density: Less than 450.0 flaming (ASTM E 662)
  - d. Static Test: Less than 3.0kv (AATCC-134)
12. Recycled content: Minimum of 55 percent recycled content
13. NSF/ANSI 140 Platinum Certified
14. Closed-loop recyclable

C. J+J Incognito Walk-off Modular (tiles) TCF-2

1. Product: Incognito Walk-off Modular 7069 manufactured by J&J Flooring Group
2. Color: Ref to Section 09 05 15-Color Design
3. Construction: Textured Patterned Loop
4. Backing: Nexus® Modular
5. Dye Method: Solution Dyed
6. Fiber Type: Encore® SD (with recycled content)
7. Face Weight: 29oz./s(983grams/m<sup>2</sup>)
8. Pile Density: 8717 oz./y<sup>3</sup>. (323.kg/
9. Gauge: 1/12 (4.72 rows/cm)
10. Stitches: 12.00 stitches/in (4.72 stitches/cm)
11. Pattern Repeat: N/A
12. Soil Release: No
13. Stain Resistance: Yes
14. Bleach Resistance: Yes
15. Optional Treatments: Yes
16. Standard Size: 24 inches by 24 inches
- 17.. Warranties: Lifetime Fiber Performance for Wear, Lifetime for Tuft Bind Strength (edge ravel, yarn pulls, zippering), Lifetime Protection from Delamination Failure, Lifetime Fiber Performance for Static, Lifetime Colorfastness to Atmospheric Contaminants, Lifetime Stain Removal
18. Testing Specifications:
  - a. Pill Test: Yes
  - b. Flooring Radiant Panel: Class 1
  - c. Smoke Density: Less than 450.0 flaming (ASTM E 662)
  - d. Static Test: Less than 3.0kv (AATCC-134)
  - e. Lightfastness Test: 1

2.03 ADHESIVES

A. Comply with manufacture's written recommendations.

1. Kinetex® Adhesive, an aggressive, pressure-sensitive adhesive designed for the installation of Kinetex textile composite flooring modules is required.
2. Commercialon® Premium Modular Pressure Sensitive Adhesive, a premium modular flooring adhesive specifically formulated for bonding J+J Flooring Group's Nexus® Modular PVC backed carpet to the floor

## 2.04 ACCESSORIES

- A. Provide transition/reducing strips tapered to meet abutting materials as indicated in the Drawings.
- B. Provide edge strips made of extruded aluminum with a mill finish, unless otherwise noted.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine and verify that sub-floor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive installation of modules.
- B. Verify that floor-mounted utilities are in correct location and that concrete sub-floor surfaces are dry enough and ready for flooring installation by testing for moisture emission rate and alkalinity in accordance with ASTM F 710; obtain instructions if test results are not within limits recommended by carpet manufacturer and adhesive materials manufacturer.
- C. J+J Flooring Group requires that flooring be inspected prior to installation for proper style, color and potential defects. No claims will be honored if the modules are installed with visible defects. Should there be a problem, call J+J Flooring Group's Customer Relations Department at [800.241.4586](tel:800.241.4586).

### 3.02 PREPARATION

- A. Surface Preparation: Dust, dirt, debris and non-compatible adhesive must be removed before the installation begins. Surfaces must be smooth and level with all holes and cracks filled with Portland cement-based patch reinforced with polymers. Adhesive cannot be applied to any substrate where chemical or solvent-based cleaners have been used.
- B. Floor slab preparation is to include all required work to prepare the floor for installation of the product as specified in this document. Floor slab preparation shall meet conditions as specified in J+J Flooring Group's Kinetex textile composite flooring installation instructions.
- C. Concrete Moisture Testing and Ph Testing: Substrate surfaces must be tested for moisture emission. The Contractor shall perform moisture testing prior to starting the installation. ASTM-F 2170-2 relative humidity probe moisture testing is required. Acceptable relative humidity probe testing results are up to 95 percent RH. Alkalinity tests shall also be performed per ASTM F 710. The maximum acceptable pH is 10.0.
- D. New Concrete - New concrete must be fully cured and free of moisture (comply with ASTM F 710). New concrete requires a curing period of approximately 90 days.

### 3.03 INSTALLATION OF FLOORING

- A. Once the temperature and relative humidity in area for installation have been stabilized, loose lay the modules within the installation area and allow them to precondition for 48 hours prior to installation. Module installation shall not commence until painting and finishing work is complete and ceiling and overhead work is tested, approved and completed. Traffic shall be closed during the installation of the textile composite flooring products. Verify concrete slabs are dry per the standards for bond and moisture tests listed in the manufacturer's installation instructions.
- B. Install flooring in strict accordance with the finish drawings and J+J Flooring Group's installation instructions for each type of flooring.
- C. Full Spread Adhesive System: J+J Flooring Group require the use of their adhesives. No substitutions are allowed for adhesive
  - 1. Full Spread Kinetex Adhesive: The spread rate for Kinetex Adhesive is approximately 1080 square feet per four gallon pail and can be spread using a 1/16 inch by 1/32 inch by 1/32 inch U-notched trowel or applied using a 3/8 inch foam or nap roller.
    - a. Allow to dry until transparent or adhesive does not transfer to finger when touched. Drying time will vary with temperature, humidity and air velocity, however modules must be installed within two hours after adhesive has dried.
  - 2. Full spread Commercialon® Premium Modular Pressure Sensitive Adhesive using a 1/32 inch by 1/16 inch by 1/16 inch "U" or "V" notch trowel or spread using a 3/8 inch foam paint roller. Keep the roller saturated and wet with adhesive throughout the installation in order to maintain a constant spread rate. Allow to completely dry so adhesive does not transfer when touched. The spread rate for Commercialon Premium Modular Adhesive is approximately 140 sq. yds. per four gallon bucket. Nexus® Modular Spray Adhesive is available in a 14 lbs cylinder (coverage is approx. 165 sq yds). Note: Inadequate amounts of adhesive can cause modules to shift and move and will not be covered by warranty. Warranty coverage requires the use of Commercialon Premium Modular.
- D. Module Placement: Arrows are printed on the module backing to show pile/machine direction. A tight installation without compression is mandatory for optimum performance and appearance of the modular installation. It is critical that each module uniformly touch each adjoining module without a gap. To ensure a clean tight fit, do not pull/tug or slid-in modules, but instead lay each module into its location against the adjoining module. See specific product specifications for approved installation method(s).
- E. Pallet and Bundle Sequencing: It is very important to install Kinetex and Invision modules in the order they were manufactured; this is easily accomplished by selecting pallets in sequential order and following the numbers located on each bundle of modules. Typically, an installation will begin with the lowest bundle numbers and progress through the highest numbers until the project is complete. Installing modules by bundle sequence will assure the most even uniform look possible. (For layout and installation instructions refer to J+J Flooring Group's Kinetex and Invision Installation Instructions.)

- F. Completing Installation: To avoid dislodging modules, do not walk on or move furniture onto modules until the area is completely anchored. Roll entire area with 75-100 lb. roller in both directions (north-south and east-west) after completion of installation. Protect new modular surface with sheets of plywood or hardboard when transporting heavy furniture on carts or dollies. As a final step, vacuum the entire area with an upright vacuum.

3.04 INSTALLATION OF ACCESSORIES

- A. Install accessories as required by drawings and per manufacturer's specifications.

3.05 CLEANING AND PROTECTION

- A. Follow J+J Flooring Group's maintenance guidelines.
- B. Remove excess adhesive without damage, from floor, base, and wall surfaces.
- C. Clean and vacuum surfaces.

END OF SECTION

## SECTION 09 90 00

## PAINTS AND COATINGS

## PART 1 - GENERAL

## 1.01 SUMMARY

- A. Painting and finishing of exterior and interior exposed items and surfaces throughout the project, except as otherwise indicated. Surface preparation, priming and finish coats specified in this Section are in addition to shop priming and surface treatment specified under other Sections of the Work.

1. The Work includes field painting of exposed bare and covered pipes and ducts (including color coding), and of hangers, exposed steel and iron work, and primed metal surfaces of equipment installed under the mechanical and electrical Work, except as otherwise indicated.
2. "Paint" means all coating systems materials, including primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate or finish coats.
3. Paint all exposed surfaces whether or not colors are designated in "schedules", except where the natural finish of the material is specifically noted as a surface not to be painted. Where items or surfaces are not specifically mentioned, paint these the same as adjacent similar materials or areas. If color or finish is not designated, the Architect will select these from standard colors available for the materials system specified.

- B. Related Sections: Section 09 05 15 – Color Design.

## 1.02 PAINTING NOT INCLUDED

- A. The following categories of Work are not included as parts of the field-applied finish Work, or are included in other Sections of these Specifications.
- B. Shop Priming: Unless otherwise specified, shop priming of ferrous metal items is included under the various Sections for structural steel, miscellaneous metal, hollow metal work, and similar items. Also, for fabricated or factory-built mechanical and electrical equipment or accessories.
- C. Pre-Finished Items: Unless otherwise indicated, do not include painting when factory-finishing or installer finishing is specified for such items as (but not limited to) plastic toilet enclosures, prefinished partition systems, acoustic materials, architectural woodwork and casework, finished mechanical and electrical equipment including light fixture, switch-gear and distribution cabinets, elevator entrance frames, door and equipment.
- D. Concealed Surfaces: Unless otherwise indicated, painting is not required on surfaces such as walls or ceilings in concealed areas and generally inaccessible areas, foundations spaced, furred areas, utility tunnels, pipe spaces, duct shafts and elevator shafts.
- E. Finished Metal surfaces: Metal surfaces of anodized aluminum, stainless steel, chromium plate, copper, bronze and similar finished materials will not require finish painting, unless otherwise indicated.

- F. Operating Parts and Labels: Moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, linkages, sinkages, sensing devices, motor and fan shafts will not require finish painting, unless otherwise indicated. Do not paint over any code-required labels, such as Underwriter's Laboratories and Factory Mutual, or any equipment identification, performance rating, name, or nomenclature plates.

### 1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's technical information including basic materials analysis and application instructions for each coating material specified.
- B. Samples for Initial Selection: For each type of topcoat product indicated. Submit color samples for selection by Architect from manufacturer's full range of colors. Indicate submitted manufacturer's closest STANDARD colors that match colors specified or provide "Custom" color if not match.
- C. Samples for Verification: For each type of paint system and each color and gloss/sheen of topcoat indicated.
  - 1. Submit Samples on rigid backing, **8 inches** square.
  - 2. Step coats on Samples to show each coat required for system.
  - 3. Label each coat of each Sample.
  - 4. Label each Sample for location and application area.
- D. Product List: For each product indicated, include the following:
  - 1. Comply with Articles 3.7 and 3.8 indicating each type of primer, intermediate coat and topcoat required for each substrate by product name and number.
  - 2. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
- E. 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.
  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 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 contaminants from the cleaning process with not fall onto wet, newly painted surfaces.

- B. Ferrous Metals:
  - 1. Clean ferrous surfaces, which are not galvanized or shop-coated, of oil, grease, dirt, loose mill scale and other foreign substances by solvent or mechanical cleaning.
  - 2. Touch-up shop-applied prime coats wherever damaged or bare. Where required by other Sections of these Specifications, clean and touch-up with the same type shop primer.
- C. Galvanized Surfaces: Clean free of oil and surface contaminants with acceptable non-petroleum based solvent.
- D. Wood: Clean wood surfaces to be painted of all dirt, oil, or other foreign substances with scrapers, mineral spirits, and sandpaper, and dust off. Scrape and clean small, dry, seasoned knots and apply a thin coat of white shellac or other recommended knot sealer before application of the priming coat.
  - 1. Prime, stain, or seal wood required being job-painted, as soon as practicable upon delivery to job. Prime edges, ends, faces, under sides, and backsides of such wood, including cabinets, counters, cases, paneling, etc. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood-filler. Sandpaper smooth when dry.
  - 2. When transparent finish is required, use sealer as recommended by manufacturer. Seal tops, bottoms, and cutouts of unprimed wood doors with sealer immediately upon delivery to project.

### 3.03 MATERIALS PREPARATION

- A. Mix and prepare painting materials in accordance with manufacturer's directions. Store materials not in actual use in tightly covered containers. Maintain containers used in storage, mixing and application of paint in a clean condition, free of foreign materials and residue. Stir materials before application to produce a mixture of uniform density, and stir as required during the application of the materials. Do not stir surface film into the material. Remove the film and if necessary, strain the material before using.

### 3.04 APPLICATION

- A. Apply paint in accordance with the manufacturer's directions. Use applications and techniques best suited for the substrate and type of material being applied. Apply additional coats when undercoats, stains or other conditions show through the final coat of paint, until the paint film is of uniform finish, color and appearance. Give special attention to insure that all surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
- B. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Paint surfaces behind permanently fixed equipment or furniture with prime coat only before final installation of equipment. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint. Paint the back-sides of access panels, and removable or hinged covers to match the exposed surfaces.
- C. Finish exterior doors on tops, bottoms and side edges the same as the exterior faces, unless otherwise indicated.
- D. Sand lightly between each succeeding enamel or varnish coat.

- E. Omit the first coat (primer) on metal surfaces that have been shop-primed and touch-up painted, unless otherwise indicated or barrier coat is required for compatibility.
  - F. Scheduling Paint: Apply the first-coat material to surfaces that have been cleaned, pretreated or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration. Allow sufficient time between successive coatings to permit proper drying. Do not re-coat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure and the application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.
  - G. Minimum Coating Thickness: Apply each material at not less than the manufacturer's recommended spreading rate, to establish a total dry film thickness as indicated or, if not indicated, as recommended by coating manufacturer.
  - H. Mechanical and Electrical Work: Painting of mechanical and electrical Work include items exposed to view in mechanical equipment rooms, in occupied spaces and where indicated on Drawings or specified in other Sections. Coordinate with 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
    - 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
- B. Provide the following Ferrell-Calhoun paint systems for the various substrates, as indicated:
  1. Ferrous and Zinc Coated Metal
    - a. Prime Coat: F/C #5-56 Waterborne 100% Acrylic All Purpose Metal Primer (1.8 mils DFT)
    - b. Intermediate Coat: F/C Tuff-Boy 8000 Line Waterborne 100% Acrylic DTM (1.7 mils DFT)
    - c. Topcoat: F/C Tuff-Boy 8000 Line Waterborne 100% Acrylic DTM (1.7 mils DFT)
  2. Steel Shop Primed: Structural steel framing exposed to view including steel lintels
    - a. Prime Coat: F/C #5-56 Waterborne 100% Acrylic All Purpose Metal Primer (1.8 mils DFT)
    - b. Intermediate Coat: F/C Tuff-Boy 8000 Line Waterborne 100% Acrylic DTM (1.7 mils DFT)
    - c. Topcoat: F/C Tuff-Boy 8000 Line Waterborne 100% Acrylic DTM (1.7 mils DFT)

- C. Provide the following PPG 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
    - a. Prime Coat: PPG Pitt Tech DTM Acrylic Primer Finish, 90-712 Series (2.0-3.0 mils dry)
    - b. Intermediate Coat: PPG Pitt Tech DTM Acrylic Gloss Enamel, 90-374 Series (2.0-3.0 mils dry)
    - c. Topcoat: PPG Pitt Tech DTM Acrylic Gloss Enamel, 90-374 Series (2.0-3.0 mils dry)
- D. Provide the following 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)
- 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)

## 3.08 INTERIOR PAINTING SCHEDULE

A. Provide the following Benjamin Moore paint systems for the various substrates, as indicated:

1. Gypsum Drywall (Semi-Gloss)
  - a. Prime Coat: #N534 Ultra Spec 500 Interior Latex Primer
  - b. Intermediate Coat: #N539 Ultra Spec 500 Interior Semi-gloss Enamel
  - c. Topcoat: #N539 Ultra Spec 500 Interior Semi-gloss Enamel
2. 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
3. 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
4. Concrete Masonry Units (Enamel)
  - a. Prime Coat: #206 Super Spec Hi-Build Block Filler
  - b. Intermediate Coat: #N539 Ultra Spec 500 Interior Semi-Gloss Enamel
  - c. Topcoat: #N539 Ultra Spec 500 Interior Semi-Gloss Enamel
5. 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
6. 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
7. 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
8. 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
9. Concrete Floor Sealer (Clear)
  - a. Prime Coat: TuffCrete Solvent Acrylic Stain Clear
  - b. Topcoat: TuffCrete Solvent Acrylic Stain Clear.

B. Provide the following Ferrell-Calhoun paint systems for the various substrates, as indicated:

1. Gypsum Drywall (Semi-Gloss)
  - a. Prime Coat: F/C #380 Perfik-Seal Interior Latex Primer/Sealer (1.8mils DFT)
  - b. Intermediate Coat: F/C #3300 Line Evergreen "Zero Voc" Acrylic Int/Ext Semi-Gloss Enamel (2.0 mils DFT)
  - c. Topcoat: F/C #3300 Line Evergreen "Zero Voc" Acrylic Int/Ext
  - d. Semi-Gloss Enamel (2.0 mils DFT)

2. 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)
3. Gypsum Drywall (in wet areas)
  - a. Prime Coat: F/C#235 Interior/Exterior 100% Acrylic Latex Undercoater (1.7 mils DFT)
  - b. Intermediate Coat: F/C #3300 Line 100% Acrylic Interior Semi-Gloss Enamel (1.6 mils DFT)
  - c. Topcoat: F/C #3300 Line 100% Acrylic Interior Semi-Gloss Enamel (1.6 mils DFT)
4. Concrete Masonry Units (Enamel)
  - a. Prime Coat: F/C #470A Interior/Exterior Acrylic Latex Masonry Block Filler (10 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. 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)
6. 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)
7. 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)
8. 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)
9. 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.



- C. Provide the following PPG Paints, Inc. paint systems for the various substrates, as indicated:
1. Gypsum Drywall (Semi-Gloss)
    - a. Prime Coat: PPG Pure Performance Zero VOC Interior Latex Primer, 9-900 (1.4 mils dry)
    - b. Intermediate Coat: PPG Pure Performance Zero VOC Interior Latex Semi-Gloss, 9-500 (1.4 mils dry)
    - c. Topcoat: PPG Pure Performance Zero VOC Interior Latex Semi-Gloss, 9-500 (1.4 mils dry)
  2. Gypsum Drywall( Egg Shell)
    - a. Prime Coat: PPG Pure Performance Zero VOC Interior Latex Primer, 9-900 (1.4 mils dry)
    - b. Intermediate Coat: PPG Pure Performance Zero VOC Interior Latex Eggshell, 9-300XI (1.4 mils dry)
    - c. Topcoat: PPG Pure Performance Zero VOC Interior Latex Eggshell, 9-300XI (1.4 mils dry)
  3. Gypsum Drywall (in wet areas)
    - a. Prime Coat: PPG Pure Performance Zero VOC Interior Latex Primer, 9-900 (1.4 mils dry)
    - b. Intermediate Coat: PPG Pitt Glaze Waterborne Acrylic Epoxy, 16-551 Series (2.0-3.0 mils dry)
    - c. Topcoat: PPG Pitt Glaze Waterborne Acrylic Epoxy, 16-551 Series (2.0-3.0 mils dry)
  4. Concrete Masonry Units (Enamel)
    - a. Prime Coat: PPG Speedhide Interior Exterior Latex Block Filler, 6-7 Series (7.4 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. 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)
  6. 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
  7. 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)
  8. Concrete Garage Floor (Stain & Sealer Solvent Based-Opaque Color)
    - a. Prime Coat: PPG Color Seal Solvent Based Acrylic Concrete Stain, PP3249.
    - b. Topcoat: PPG Color Seal Solvent Based Acrylic Concrete Stain, PP3249; Anti Slip Additive to the topcoat. Note- Etch floor prior to application.

9. 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-New concrete must be etched prior to application.
- D. Provide the following Rust-Oleum paint systems for the various substrates, as indicated:
1. Gypsum Drywall (Semi-Gloss)
    - 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 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)
  2. 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)
  3. 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)
  4. Concrete Masonry Units (Enamel)
    - a. Prime Coat: Rust-Oleum Zinsser Water Tite Flexible Primer & Finish (5.0-6.0 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. 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)
  6. 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
  7. 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)

8. 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.)
  9. 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.
- E. Provide the following Sherwin-Williams paint systems for the various substrates, as indicated:
1. Gypsum Drywall (Semi-Gloss)
    - 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 Semi-Gloss, B31-2600 (1.6 mils dry)
    - c. Topcoat: S-W Harmony Low Odor Interior Latex Semi-Gloss, B10 Series (1.6 mils dry)
  2. Gypsum Drywall( Egg Shell)
    - a. Prime Coat: S-W 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)
  3. 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)
  4. Concrete Masonry Units (Enamel)
    - a. Prime Coat: S-W PrepRite Block Filler, B25W25 (8.0 mils dry)
    - b. Intermediate Coat: S-W ProMar 200 Zero VOC Interior Latex Semi-Gloss, B31-2600 (1.6 mils dry)
    - c. Topcoat: S-W ProMar 200 Zero VOC Interior Latex Semi-Gloss, B31-2600 (1.6 mils dry)
  5. 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)
  6. 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

7. 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)
8. 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.)
9. 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-New concrete must be etched prior to application.

END OF SECTION

## SECTION 10 11 00 VISUAL DISPLAY UNITS

## PART 1 - GENERAL

## 1.01 SUMMARY

## A. Section Includes:

1. Markerboards.
2. Tackboards.

## B. Related Sections:

1. Section 09 05 15 – Color Design (for color selections).

## 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. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer's standard form in which manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.
    - 1. Failures include, but are not limited to, the following:
      - a. Surfaces lose original writing and erasing qualities.
      - b. Surfaces exhibit crazing, cracking, or flaking.
    - 2. Warranty Period: Life of the building.

## PART 2 - PRODUCTS

### 2.01 ACCEPTABLE MANUFACTURERS

- A. Drawings and Specifications are based on products manufactured by Claridge Products and Equipment, Inc., P.O. Box 910, Harrison, AR 72602. Tel. (870) 743-2200.
- B. Equivalent products by the following manufacturers are acceptable:
  - 1. Best-Rite Manufacturing, Temple, TX, Tel. (800) 749-2258.
  - 2. Marsh Industries, Inc., New Philadelphia, OH, Tel. (800) 426-4244.
  - 3. PolyVision Corporation, Suwanee, GA, Tel. (800) 620-7659.
- C. 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 MATERIALS

- A. Markerboard: Equal to Claridge Series #LCS-2000-R type "A" factory built marker board with map rail with tan cork insert, jamb trim, and chalk trough with end closures. LCS = porcelain enamel liquid chalk surface on Duracore with 0.002 aluminum foil back approx. 1/2 inch thick overall, color No. 32 white.
  - 1. Extruded aluminum trim to have anodized satin finish. Include standard eraser and assorted LCS markers.
  - 2. Size: 4 feet by 6 feet.
  - 3. One unit required unless additional units are indicated on the Drawings.

- B. Tackboard: Equal to Claridge Series # 1 type "CO" factory built tackboard.
  - 1. Tackboard is Claridge 1/4-inch Cork on 1/4 inch Hardboard, color as selected by Project Engineer / MDOT Architect from manufacturer's standards.
  - 2. Size: 4 feet by 6 feet.
  - 3. One unit required unless additional units are indicated on the Drawings.

### PART 3 - EXECUTION

#### 3.01 EXAMINATION

Installer shall examine areas and conditions under which units are to be installed and notify Contractor in writing of conditions detrimental to proper and timely completion of Work. Do not proceed with Work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

#### 3.02 INSTALLATION

- A. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display surfaces and wall surfaces.
- B. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation. Comply with Manufacturer's written installation instructions.
  - 1. If units are not shown on Drawings, install units in location(s) as directed by Project Engineer.

#### 3.03 ADJUSTING AND CLEANING

- A. Verify accessories required for units are properly installed and operating units are adjusted and properly functioning. .
- B. Clean visual display surfaces according to manufacturer's written instructions. Attach one cleaning label to visual display surface in each room. Cover and protect visual display surfaces.

END OF SECTION

SECTION 10 14 00 SIGNAGE

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
  - 1. Signage for room identification system.
  - 2. Wall mounted exterior sign.
  - 3. Truss emblem signage.
- B. Related Sections: Section 09 05 15 – Color Design (for color selection).

1.02 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical data and installation instructions for each type of signage required.
- B. Shop Drawings: For dimensional letter signs.
  - 1. Include fabrication and installation details and attachments to other work.
  - 2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
  - 3. Show message list, typestyles, graphic elements, and layout for each sign at least half size.
- C. Samples: Submit 3 samples of each color and finish of exposed materials and accessories required for specialty signs. Project Engineer / MDOT Architect's review of samples will be for color and texture only.
  - 1. When requested, furnish full-size samples of specialty sign materials.
- D. Sign Schedule: Use same designations (Room numbers) specified or indicated on Drawings or in a sign schedule.

1.03 INFORMATIONAL SUBMITTALS

- A. Sample warranty.

1.04 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.05 QUALITY ASSURANCE

- A. Provide each type of sign as a complete unit produced by a single manufacturer including necessary mounting accessories, fittings and fastenings.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components correctly packed to prevent damage. Store in secure area out of weather. Handle per manufacturer's instructions.



## 1.07 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: Five years from date of Completion.

## PART 2 - PRODUCTS

## 2.01 ACCEPTABLE MANUFACTURERS

- A. Drawings and Specifications for interior and exterior signage are based on products manufactured by ASI Sign Systems, Inc., 3890 W. NW Hwy, Suite 102, Dallas, TX. 75220. Tel. (800) 274-7732. Truss emblem signage (exterior) is based on products manufactured by Mohawk Sign Systems, Inc., Schenectady, NY. Tel. (518) 370-3433.
- B. Equivalent products by the following manufacturers are acceptable:
  - 1. 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. Exterior Signage: Wall mounted LC Series, Helvetica and Helvetica Medium styles, size and location(s) as shown on Drawings. Text shall be center justified unless shown otherwise.
- B. Interior Signage: Wall or desktop mounted WS Series with rounded corners. Design so that paper insert can be installed from each end. Comply with 2010 ADA requirements.
- C. Truss Emblem Signage (Exterior): Wall mounted, Helvetica Medium styles, size as shown on Drawings.

## 2.03 COMPONENTS - EXTERIOR SIGNAGE

- A. Materials: Cast aluminum, projected mount with sleeve and stud.
- B. Finish: Baked enamel in manufacturer's standard color.

## 2.04 COMPONENTS - TRUSS EMBLEM SIGNAGE (EXTERIOR)

- A. Material: Emblem shall be made of (0.063) aluminum with a bright reflective paint or applied vinyl surface.
- B. Shape: Emblem shall be in the shape of an isosceles triangle measuring six (6) inches horizontally and three (3) inches vertically.

- C. Lettering: Emblem shall have letters printed in the center of the triangle based on the type of truss construction used in the building being identified by the emblem:
1. "F" signifies floor with truss construction.
  2. "R" signifies roof with truss construction.
  3. "F/R" signifies both floor and roof with truss construction.
- D. Colors and Graphics:
1. Text Style: Helvetica Medium.
  2. Boarder: 3/8 inch wide white boarder on all sides.
  3. Center Background Triangle Color: Red.
  4. Lettering: 1-1/4 inch tall lettering (F/R) shall be white and centered on red background.
  5. Along base (6 inch length) of triangle centered on the white border include the following 1/4 inch tall all capital lettering in red:
    - a. Do Not Remove By Order Of the Local Fire Inspector.
- E. Accessories: Provide stainless steel mounting screws appropriate for surface to which sign will be mounted.
- F. See suggested layout at the end of this Section.

## 2.05 COMPONENTS – INTERIOR SIGNAGE

- A. Window Inserts: Laser printed paper insert with MDOT watermark will be furnished by Owner. Text will be left justified unless noted otherwise.
- B. Sign Face: Clear Acrylic, 0.080-inch thick, matte first surface.
- C. Adhesive: Pressure sensitive, adhesive film on second surface.
- D. Insert Guide Rails: 0.040-inch thick vinyl tape.
- E. Tactile Laminate: Polyamid Resin.
- F. Laminating Base: Acrylic, 0.080-inch thick.
- G. Fasteners: 0.030- inch thick, double-face tape.
- H. Stand: Clear Acrylic, 0.080-inch thick.
- I. Sizes as Follows:
1. Type No. 1: 12 inches wide by 3 inches high.
  2. Type No. 2: 6 inches wide by 9 inches high.
  3. Type No. 3: 12 inches wide by 3 inches high. .

## 2.06 BRAILLE AND TACTILE COPY

- A. Comply with requirements of the Americans with Disabilities Act 2010. Tactile copy to be raised 1/32-inch minimum from sign first surface by manufacturer's photomechanical stratification processes. Translation of copy into Braille shall be the responsibility of the manufacturer.

2.07 FINISHES – INTERIOR SIGNAGE

- A. Color: Selected by Project Engineer / MDOT Architect from manufacturer's standard.
- B. Surface Texture: Matte.

2.08 FONT

- A. Font Type: Helvetica Medium, unless noted otherwise.

PART 3 - EXECUTION

3.01 EXANIMATION

- A. Contractor, with Installer present, shall examine the substrates and conditions under which the specialty signs are to be installed and notify the Project Engineer / MDOT Architect in writing of conditions detrimental to the proper and timely completion of the Work.
  - 1. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.02 INSTALLATION – GENERAL

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions. Comply with ADA 2010 requirements.
  - 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
  - 2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
  - 3. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

3.03 INSTALLATION – INTERIOR SIGNAGE

- A. Install signs using mounting methods indicated and according to manufacturer's written instructions.
  - 1. Install sign units and components at the locations shown or scheduled, securely mounted with concealed theft-resistant fasteners, unless otherwise indicated. Attach signs to substrates in accordance with the manufacturer's instructions, unless otherwise shown.
  - 2. Install level, plumb, and at the proper height. Cooperate with other trades for installation of sign units to finish surfaces. Repair or replace damaged units as directed by the Project Engineer / MDOT Architect.
  - 3. Position sign on wall surface 2 inches from strike side of doorframe. Tactile characters on signs shall be located 48 inches minimum above the finish floor or ground surface, measured from the baseline of the lowest tactile character and 60 inches maximum above the finish floor or ground surface, measured from baseline of the highest tactile character (comply with 2010 ADA requirements).

- B. Mounting Method-Double Sided Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear strips of tape symmetrically to face of substrate. Place sign in position, and push to engage adhesive tape strips.
- C. Mounting Method-Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.

#### 3.04 INSTALLATION – EXTERIOR SIGNAGE

- A. Install signs using mounting methods indicated and according to manufacturer's written instructions.
  - 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
  - 2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
- B. Mounting Method - Projected Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
  - 1. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place spacers on studs, place sign in position, and push until spacers are pinched between sign and substrate, embedding the stud ends in holes. Temporarily support sign in position until adhesive fully sets.

#### 3.05 INSTALLATION – TRUSS EMBLEM SIGNAGE

- A. Install signs using mounting methods indicated and according to manufacturer's written instructions.
- B. Permanently affix emblem to the exterior of the building to the left of the main entrance door at a height of 5'-0" above the finish floor or grade.
- C. Mounting Method-Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.

#### 3.06 SCHEDULES – INTERIOR SIGNAGE

- A. Sign Type No. 1: Offices
  - Locker Room
  - Crew Room
  - Storage Room
- B. Sign Type No. 2: Toilet Rooms

3.07 SCHEDULES – EXTERIOR SIGNAGE

A. Building Letters: Flat – Letter style will be determined by Project Engineer / MDOT Architect from all styles available.

- 1. 15 inches high, 11 Letters:  
MAINTENANCE

B. Truss Emblem Signage: "F/R"



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. 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 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 by 42 inches high with 41 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, Mosaic or Designer color collections 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.

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 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.

- 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.

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. Towel Dispenser/Waste Receptacle
5. Clothes Hook
6. Mop Holder
7. Under Lavatory Guards (required where hot water line is exposed).

1.02 ACTION SUBMITTALS

- A. Product Data: Manufacturer's product and technical data indicating compliance with these specifications and shop drawings for the fabrication and installation of all toilet accessories. Show all anchorage and other necessary items including mounting heights.
- B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
1. Identify locations using room designations indicated.
  2. Identify products using designations indicated.

1.03 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.04 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.05 QUALITY ASSURANCE

- A. Provide products of the same manufacturer for each type of accessory unit and for units exposed in the same areas, unless otherwise acceptable to the MDOT Architect. Stamped names or labels on exposed faces of units will not be permitted, except where otherwise indicated.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Upon receipt of toilet accessories and other materials, examine the shipment for damage and completeness. Materials shall be stored in a clean, dry place. Stack all materials to prevent damage.

## 1.07 WARRANTY

- A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.
1. Warranty Period: 15 years from date of Completion.

## PART 2 - PRODUCTS

## 2.01 PUBLIC-USE WASHROOM ACCESSORIES

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings (Bradley Washroom Accessories Division, P.O. Box 309, Menomonee Falls, WI 53051. Tel. (414) 354-0100) or comparable product by one of the following:
1. A & J Washroom Accessories, Inc., New Windsor, NY. Tel. (845) 562-3332.
  2. Bobrick Washroom Equipment, Inc., Jackson, TN. Tel. (731) 424-7000.
  3. Plumberex Specialty Prod., Inc. Palm Springs, CA. Tel. (800) 475-8629.
  4. TCI Products. Hillsboro, OR. Tel. (866) 533-4273.
  5. Truebro, Inc., Ellington, CT. Tel. (800) 340-5969.
- B. Mirrors: Provide 1/4 inch tempered glass mirrors with 3/4 inch stainless steel channel frame with mitered corners. Mirrors shall be 24 inches by 36 inches equal to Bradley model 781-24362. Locate at each toilet lavatory mounted in locations shown.
- C. Toilet Paper Dispenser: Provide surface mounted stainless steel multi-roll toilet tissue dispenser equal to Bradley model 5402. Locate at each toilet mounted in locations shown.
- D. Grab Bars: Provide 1-1/2 inch diameter horizontal 2 wall stainless steel grab bars with safety-grip non-slip finish and concealed mounting equal to Bradley model 8122. Locate at toilets where indicated at heights shown. Contractor shall provide at each water closet one 36-inch horizontal grab bar one 42-inch horizontal grab bar and one 18-inch vertical grab bar; installation must meet all ADA 2010 requirements.
- E. Towel Dispenser/Waste Receptacle: Provide surface mounted stainless steel towel dispenser/waste receptacle equal to Bradley model 237. Locate at each area with lavatory/sink where shown and at height shown.
- F. Clothes Hook: Provide surface mounted stainless steel hook equal to Bradley model 9135 at each Toilet Room, unless coat hooks are provided with toilet partition doors.
- G. Mop Provide surfaced mounted stainless steel mop and broom holder equal to Bradley model 9933. One piece construction with welded gusset and hooks. Holder consists of spring activated rubber cams on plated steel retainers. Unit measures 14 inches high by 34 inches long, with 4 hooks and 3 holders. Shelf projects 8 inches. Locate at each service sink where shown and at height shown or if not shown then per the Project Engineer's instructions.

H. Under Lavatory Guard:

1. Description: Insulating pipe covering for supply and drain piping assemblies that prevent direct contact with and burns from piping, and allow service access without removing coverings.
2. Material and Finish: Antimicrobial, molded-plastic, white.

I. 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 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. 78<sup>th</sup> Street Circle, Bloomington, MN 55435. Tel. (612) 835-6850) or comparable product by one of the following:

1. Philips Healthcare, Andover, MA. Tel. (866) 333-4246.
2. Physio-Control, Inc., Redmond, WA. Tel. (800) 442-1142.

- B. 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 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 equal to J.L. Industries 1437F12 stainless steel semi-recessed type cabinet complying with ADA requirements. 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 2010 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 from damage until acceptance by Owner.

END OF SECTION



SECTION 10 44 16 FIRE EXTINGUISHERS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Portable multi-purpose, dry-chemical and class K wet chemical fire extinguishers including cabinets, accessories and mounting brackets.

1.02 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical data and installation instructions for all portable fire extinguishers required.

1.03 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.04 QUALITY ASSURANCE

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
- C. Coordinate type and capacity of fire extinguishers with fire protection cabinets to ensure fit and function.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Drawings and Specifications are based on products manufactured by J.L. Industries, Inc., 4450 W. 78<sup>th</sup> Street Circle, Bloomington, MN 55435. Tel. (612) 835-6850.
- B. Equivalent products by the following manufacturers are acceptable:
  - 1. Amerex Corp., Trussville, AL. Tel. (205) 655-3271.
  - 2. Larsen's Mfg. Co., Minneapolis, MN. Tel. (612) 571-1181.
  - 3. Potter-Roemer, Santa Ana, CA. Tel. (800) 366-3473.
- C. 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 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 and Wall 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 Crew Room.

#### 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 semi-recessed model 1032F17 with ADAC option. Cabinet shall accommodate the Cosmic 10E extinguisher. Provide black die-cut letters, vertical.

- 1. Cabinets are required at drywall partitions.

- B. Equal to J.L. Industries Cosmopolitan stainless steel cabinet with return trim, rolled edge semi-recessed model 2032F17 including ADAC option with flush pull handle. Cabinet shall accommodate the Saturn 15 extinguisher. Provide black die-cut letters, vertical.

### PART 3 - EXECUTION

#### 3.01 INSTALLATION

- A. Install items included in this section in locations and at mounting heights indicated, or if not indicated, at heights to comply with ADA 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.
  - 1. Provide one unit with cabinet in Admin. Corridor, 3 wall mounted in Shop Service Bay, one wall mounted in the Shop Storage Room, and one wall mounted in the Mezzanine Storage.
  - 2. Units shall be required within 20 feet of all Mechanical Rooms and exits.
  - 3. Type K unit shall be required in Crew Room - one unit with cabinet.

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. 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 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 LOCKER UNITS

- A. Vanguard Model 6175V Single Tier Locker with standard louvered doors. Size: 72 inches overall height by 15 inches width by 21 inches depth. Provide closed bases and finished end panels.

## 2.04 MATERIALS

- A. All parts shall be made from prime grade mild cold rolled sheet steel free from surface imperfection, and capable of taking a high grade enamel finish.

## 2.05 ACCESSORIES

- A. Each locker 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.
- B. Continuous slope top hood with slope top fillers fit on top of flat locker tops. All hoods are to be cut to length during installation, intermediate splices, ends, rear supports required to complete installation.
- C. Vertical fillers to fill gaps and provide continuous row appearance are required.

## 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 locker bodies and doors in contrasting colors 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 locker bases, end panels, filler panels and accessories.

3.02 ADJUSTING

- A. Adjust locker 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 locker 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: Furnish three (3 copies) for 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.
- B. Finish: Manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
  - 1. Color will be selected from standard color chart by Project Engineer / MDOT Architect. Refer to Section 09 05 15 – Color Design for color selected.

2.03 SAFETY CABINET

- A. Safety Cabinet: Equal to Eagle Manufacturing 90 Gallon Tower™ Safety Cabinet model 1992LEGS. Cabinets shall meet OSHA, NFPA Code 30 and FM approval.
  - 1. Shelves: 2 shelves 30 inches deep.
  - 2. Legs: 4 inches high.
  - 3. Finish Color: Yellow.
  - 4. Dimensions: 43 inches wide by 34 inches deep by 69 inches high.
  - 5. Door Style: 2 manual close.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install units plumb and level, in locations and with mountings as indicated.
- B. Securely attach all components together in accordance with manufacturer's installation instructions.
  - 1. Securely fasten units to adjacent units and to wall as required so that units will not move or fall.

3.02 CLEANING AND PROTECTION

- A. At completion of installation, clean surfaces in accordance with manufacturer's instructions.
- B. Protect units from damage until acceptance by Owner.

END OF SECTION

SECTION 10 73 16

CANOPIES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Extruded aluminum cantilever bracket support canopies as shown on the Drawings and specified herein.
- B. Related Sections:
  - 1. Section 07 92 00 – Joint Sealants.
  - 2. Section 09 05 15 – Color Design.
  - 3. Section 13 34 18 - Metal Building-Equipment Shed.
  - 4. Section 13 34 19 – Metal Building Systems-Shop.

1.02 ACTION SUBMITTALS

- A. Product Data: Furnish manufacturer's standard literature and specifications for canopies.
- B. Shop Drawings: Showing fabrication and installation of canopies including plans, elevations and details of components and attachments to other units of work. Indicate materials, profiles of each metalwork member and fitting, joinery, finishes, fasteners, anchorage and accessory items.
- C. Samples: Samples for initial selection purposes furnish three (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 2012 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 Canopies, LLC, 7748 North 56<sup>th</sup> Street Lincoln, NE 68514 Tel.(888) 273-1132
- B. Equivalent products by the following manufacturers are acceptable:
  - 1. Architectural Covers & Enclosures, LLC, Cordova, TN. Tel. (901) 355-2180.
  - 2. Dittmer Arch. Alum., Winter Springs, FL. Tel (800) 822-1755.
  - 3. Peachtree Protective Covers, Inc., Hiram, GA. Tel. (800) 341-3325.
- C. 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.

## 2.03 MATERIALS

- A. Canopy decking and fascia shall be extruded aluminum, alloy 6063-T6, in profile and thickness shown in current Mapes brochures. .
  - 1. Fasteners shall be stainless steel or cadmium plated as provided by the manufacturer.
- B. Roof deck shall be Flat Soffit Super Lumideck
  - 1. Deck sections shall be designed to the proper length to withstand the design load as determined by the local code.
- C. Cantilever supported brackets shall be standard finish.
- D. Water drainage shall be accomplished as a spill out on the front corners.

## 2.04 MANUFACTURED UNITS

- A. Equal to all weather aluminum cantilever bracket support canopy with 3 Inches extruded Flat Soffit Super Lumideck 0.078 decking members and style "J", 1/8 inch thick by 8 inches high heavy extruded aluminum, fascia.

## 2.05 FINISHES

- A. Standard Finish: Clear Anodized.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible, to ensure proper fitting of metalwork. Do not delay job progress; allow for adjustments and fitting where taking of field measurements before fabrication might delay work.
- B. Installation:
  - 1. Installation shall comply with manufacturer's instructions.
  - 2. Contractor: Coordinate with metal building manufacturer to provide secondary framing as required to support canopies.
  - 3. Installer: Erection shall be performed by the manufacturer or manufacturer's approved installer.
  - 4. Care: Extreme care shall be taken to prevent damage or scratching.
    - a. Workmanship must be of the very best with neat miters and fitted joints.

3.02 REPAIR AND PROTECTION

- A. Protect existing materials from damage during the installation process.
  - 1. When installation is complete, repair or replace damaged items.
  - 2. Replacement items are to match the original.

3.03 CLEAN-UP

- A. After work is complete, remove waste materials and dispose off the owner's property.

END OF SECTION

SECTION 10 80 15 OPEN TOP CONTAINMENT TANK

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Polyethylene resin rectangular open top secondary containment tank 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 by Snyder Industries, Inc., Lincoln, NE. Tel. (888) 422-8683) or comparable product by one of the following:

1. New Pig Corporation, Tipton, PA. Tel. (855) 493-4647.
2. Norwesco, Inc., St. Bonifacius, MN. Tel. (800) 328-3420.

- 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 RECTANGULAR OPEN TOP SECONDARY CONTAINMENT TANK

- A. Materials and Components:

1. Material: Polyethylene resin
2. Part Number: (SII) 1011500N
3. Capacity: 330 Gallons
4. Size: 69 inches W by 93 inches L by 18 inches H.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine the areas and conditions under which containment tank 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. Securely fasten mounting brackets to structure, square and plumb, to comply with manufacturer's instructions.

- C. Unit shall be mounted in exposed location as indicated on the Drawings, or if not indicated, as directed by the Project Engineer/ MDOT Architect. A minimum of one unit is required.

3.03 CLEANING AND PROTECTION:

- A. At completion of installation, clean surfaces in accordance with manufacturer's instructions.
- B. Protect unit from damage until acceptance by Owner.

END OF SECTION

SECTION 11 31 15

RESIDENTIAL APPLIANCES AND EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Electric Range.
2. Refrigerator.
3. Microwave.
4. Overhead Exhaust Hood
5. Ice Machine.

1.02 ACTION SUBMITTALS

- A. Product Data: Manufacturer's brochures, technical data, installation, maintenance and operating instructions for each item and component part specified, including data substantiating that materials comply with requirements.

1.03 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. General Electric Company (GE), Louisville, KY. Tel. (800) 626-2000.
2. Ice-O-Matic, Denver, CO. Tel. (303) 371-3737.
3. Magic Chef Co., Cleveland, TN. Tel. (423) 472-3371.
4. Manitowoc Ice, Inc., Manitowoc, WI. Tel. (800) 545-5720.
5. Scotsman Ice System, Vernon Hills, IL. Tel. (847) 215-4500
6. Sears Brands LLC (Kenmore). Hoffman Estates, IL. Tel. (847) 286-2994.
7. Whirlpool Corporation, Benton, MI, Tel. (800) 253-1301.

- B. Substitutions 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 APPLIANCES

- A. Electric Range: 30 inch drop-in electric range equal to GE® Model JD630SFSS, stainless steel, Cooktop Burner radiant smoothtop, cooktop surface gray patterned ceramic glass, self-clean oven, with Optional Backguard JXS32SS. Approx. Dimensions (HxWxD) 27 inches by 31-1/4 inches by 28-1/2 inches.

- B. Refrigerator: 23.2 cu. ft. capacity Side-By-Side with Dispenser equal to GE® Model GSE23GSKSS with factory-installed icemaker, Stainless steel. Approx. Dimensions (HxWxD) 69-1/2 inches by 32-3/4 inches by 33-1/4 inches.
- C. Microwave: 2.2 cu. ft. oven capacity, 1100 watts countertop type, equal to GE® Model PEB7226SFSS, 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" Under the Cabinet Hood equal to GE® Model J VX5300SJSS, stainless steel, complete with 120V, 2.5 amp power/rating, convertible venting type with rear exhaust and optional damper accessory JXDA22, cooktop lighting, removable grease filter, single mesh and carbon, with optional remote control. Fan and light controls shall be ADA compliant. Approx. Dimensions (HxWxD) 5-1/2 inches by 29-7/8 inches by 20 inches.
- E. Ice Machine: Equal to Model ICE0500T with IFQ1 water filter system by Ice-O-Matic. Power supply shall be 115/60/1. Ice Storage Bin Model B55 – 530 lbs. Bin storage capacity. Furnish seven year parts and labor warranty on evaporator

### 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 in accordance with 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 - METAL

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Horizontal louver blinds with aluminum slats at office area 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 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 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 1 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 180 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.

END OF SECTION

## SECTION 12 48 43 FLOOR MATS

## PART 1 - GENERAL

## 1.01 SUMMARY

- A. Section Includes: Metal-rails, tapered (3 sides) Aluminum-frame, surfaced mounted with square end vinyl adjacent to door opening, removable, exterior carpeted floor roll-up mats located at Exterior Building Entrances where indicated.
- B. Related Sections: Section 09 05 15 – Color Design (for color selection).

## 1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM)
- B. The Aluminum Association
- C. The Carpet and Rug Institute (CRI)
- D. The National Floor Safety Institute (NFSI)

## 1.03 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 and finishes for materials exposed to view.

## 1.04 CLOSEOUT SUBMITTALS

- A. Maintenance data.

## 1.05 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
- C. Slip Resistance: Comply with ASTM D-2047-96, Coefficient of Friction, minimum 0.60 for accessible routes.
- D. Utilize superior structural aluminum alloy 6063-T6 for rail components.

## PART 2 - PRODUCTS

## 2.01 ENTRANCE FLOOR MATS AND FRAMES, GENERAL

- A. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1.

## 2.02 ACCEPTACLE MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Arden Architectural Specialties, Inc., Saint Paul, MN. Tel. (651) 631-1607.
2. C/S Group, Muncy, PA. Tel. (888) 834-4455. (Basis-of-Design)
3. J. L. Industries, Inc. Bloomington, MN. Tel. (612) 835-6850.,
4. Musson Rubber Company, Akron, OH. Tel. (330) 773-7651.

- B. Substitutions 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.

## 2.03 ROLL-UP RAIL MATS

- A. Roll-up, Aluminum-Rail Hinged Mats: Equal to C/S Group Surface-Mounted Floor Mat, Model M2 Pedimat AA.

1. Carpet Tread Inserts: .EC-Exterior Carpet shall be solution dyed polypropylene fibers with 50/50 blend of 600/12-denier multi filament and 595/D1 monofilament, available in one of 4 standard colors as offered by manufacturer. Color selected by Project Engineer / MDOT Architect. The texturized fibers have ultraviolet blockers and color as an integral part of the filament. Each carpet fiber and monofilament shall be fusion-bonded to a rigid two-ply backing to prevent fraying and supplied in continuous splice-free lengths. (Waterproof fibers do not get soggy, rot, fade or stain.) Carpet weight shall be 32-oz./yd<sup>2</sup>.
2. Rails: Extruded aluminum 6063-T6 as selected by Project Engineer / MDOT Architect from full range of manufacturer's anodized colors.
3. Surface-Mounted Frames: Tapered Aluminum (3 sides) with mitered corners. Color as selected by Project Engineer / MDOT Architect from full range of manufacturer's anodized colors. Square end vinyl one side at entrance (notch in field as required to fit).
4. Mat Size: 6 feet wide by 5 feet deep (traffic direction)

## 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-SHOP

## PART 1 - GENERAL

## 1.01 SUMMARY

## A. Section Includes:

1. Building Type: The building is a single-story, single-span, rigid-frame-type pre-engineered metal building of the nominal length, width eave height, and roof pitch indicated on the Drawings.
2. Exterior Walls: Field assembled, un-insulated panels attached to Insulated Barrier Wall System.
3. Roof system: Standing-seam insulated panel roof with concealed clips and factory-applied sealant.
4. Components and Accessories: Manufacturer's standard building components and accessories may be used, provided components, accessories, and complete structure conform to design indicated and specified requirements.

## B. Related sections:

1. Plywood wainscot is specified in Section 06 10 00.
2. Cellulose thermal insulation is specified in Section 07 21 28.
3. Personnel doors and frames and finish hardware are specified in Sections 08 11 13 and 08 71 00.
4. Overhead service doors, including operators, are specified in Sections 08 33 23.
5. Colors are specified in Section 09 05 15 - Color Design.
6. Painting for ferrous metal exposed to view is specified in Section 09 90 00 - Painting and Coating.
7. Canopies are specified in Section 10 73 16.

## 1.02 STRUCTURAL FRAMING AND ROOF AND SIDING PANELS

- A. Design anchor bolts, structural members, and exterior covering for applicable loads and combinations of loads in accordance with the MBMA's "Design Practices Manual" and in accordance with structural loading indicated on Drawing Sheet S-001.
- B. Structural Steel: Comply with AISC's "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings" for design requirements and allowable stresses.
- C. Light Gage Steel: Comply with AISI's "Specification for the Design of Cold-Formed Steel Structural Members" and "Design of Light Gage Steel Diaphragms" for design requirements and allowable stresses.
- D. Welded Connections: Comply with AWS's "Standard Code for Arc and Gas Welding in Building Construction" for welding procedures.
- E. Metal Roofing: Comply with SMACNA Architectural Sheet Metal Manual.

## 1.03 ACTION SUBMITTALS

- A. Product Data: Submit manufacturer's sample warranty and product information for building components, accessories and color chart.
- B. Shop Drawings: Submit Shop Drawings for anchor bolts, structural framing system, roofing and siding panels, and components and accessories not fully detailed or dimensioned in manufacturer's product data.
  - 1. Structural Framing: Furnish erection drawings. Include fabrication and assembly details. Show anchor bolts' settings and sidewall, end-wall, and roof framing.
  - 2. Wall Panels: Provide panel layouts and details of edge conditions, joints, corners, custom profiles, supports, anchorage, trim, flashing, closures, and special details.
  - 3. Roof Panels and Sheet Metal Accessories: 1/4-inch-scale layouts and 1-1/2-inch-scale details of accessories; show profiles, methods of joining to system components and dissimilar building materials, flashing of each condition for roof penetrations, and anchorage.
- C. Certification prepared, signed, and sealed by a Professional Engineer registered in the State of Mississippi, verifying that anchor bolts, structural framing and covering panels meet structural loading requirements as indicated on Drawing Sheet S101 and codes (IBC 2012), including design calculations.
- D. Installer certificates signed by Contractor certifying that welders comply with requirements specified under "Quality Assurance" article.
- E. Submit sample copies of the Paint Finish Guarantee and Weather Tightness Warranty prior to fabrication and installation for MDOT Architect's approval. DO NOT start roofing installation without MDOT Architect's approval of Guarantee and Warranty. Refer to Division 00 Sections for State of Mississippi requirements.

## 1.04 CLOSEOUT SUBMITTALS

- A. Maintenance data.
- B. Executed copies of Paint Finish Guarantee and Weather Tightness Warranty.

## 1.05 EXTRA MATERIALS

- A. Furnish 5 percent excess over required amount of nuts, bolts, screws, washers, and other required fasteners for each building. Pack in cartons labeled to identify contents and store on site where directed.

## 1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Provide buildings manufactured by a firm with 10 years' experience in manufacturing buildings similar to those indicated.
  - 1. The manufacturer shall be IAS Accredited (Class MB).
  - 2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.



- B. Erector Qualifications: An experienced erector, with five (5) years minimum experience, who specializes in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.
- C. Welding Qualifications: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
  - 2. AWS D1.3, "Structural Welding Code - Sheet Steel."
- D. Structural Steel: Comply with AISC 360, "Specification for Structural Steel Buildings," for design requirements and allowable stresses.
- E. Cold-Formed Steel: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" for design requirements and allowable stresses.
- F. Preinstallation Conference: Conduct conference at Project site.

#### 1.07 WARRANTY

- A. Special Warranty on Metal Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
  - 1. Finish Warranty Period: Twenty-five (25) 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, penetrations, 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 Kirby Building Systems, Starkville, MS. Tel.: (662) 323-8021.
- B. Comparable product by one of the following manufacturers are acceptable:
  - 1. ACI Building Systems, Inc., Batesville, MS Tel. (662) 563-4574.
  - 2. Ceco Building Division, Columbus, MS. Tel. (662) 328-6722.
  - 3. MBCI, Hernando, MS. Tel. (800) 206-6224
  - 4. VP Buildings; a United Dominion Company. Memphis, TN. Tel. (901) 748-8000.

- C. 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 METAL BUILDING SYSTEM PERFORMANCE

- A. Delegated Design: Design metal building system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Metal building systems shall be designed according to procedures in MBMA's "Metal Building Systems Manual."
  - 1. Design Loads: As indicated on Structural Drawing Sheet S-001.
  - 2. Design Loads: As required by MBMA's "Metal Building Systems Manual" and ASCE/SEI 7.
  - 3. Deflection Limits: Design metal building system assemblies to withstand design loads.
  - 4. Drift Limits: Engineer building structure to withstand design loads with drift limits.
  - 5. Metal panel assemblies shall withstand the effects of gravity loads and loads and stresses within limits and under conditions indicated according to ASTM E 1592.
- C. Seismic Performance: Metal building systems shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- D. Thermal Movements: Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F material surfaces.
- E. Air Infiltration for Metal Roof and Wall Panels:
  - 1. Insulated Roof Panels: Air leakage through assembly of not more than 0.003 cfm/sq. ft. of roof area when tested according to ASTM E 1680 at negative test-pressure difference of 1.57 lbf/sq. ft.
  - 2. Insulated Barrier Wall System: Air leakage through assembly of not more than 0.001 cfm/sq. ft. at 20 psf air pressure differential when tested according to ASTM E E283.
- F. Water Penetration for Metal Roof and Wall Panels: There shall be no uncontrolled water leakage at pressures of up to 20 psf when tested in accordance with ASTM E331 and ASTM E1646. Tested assembly must include endlap and sidelap conditions.
- G. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for Class 90.
- H. Solar Reflectance Index: Not less than 78 when calculated according to ASTM E 1980 based on testing identical products by a qualified testing agency.

- I. Energy Performance: Provide roof panels that are listed on the DOE's ENERGY STAR Roof Products Qualified Product List for low-slope roof products. The panel shall provide a nominal R-value of 7.2 [hr·ft<sup>2</sup>· deg F/Btu] per inch thickness when tested in accordance with ASTM C 518 at 75 deg F mean temperature and 8.0 [hr·ft<sup>2</sup>· deg F/Btu] per inch thickness when tested in accordance with ASTM C 518 at 35 deg F mean temperature.

## 2.03 STRUCTURAL-STEEL FRAMING

- A. Primary Framing: Manufacturer's standard primary-framing system, designed to withstand required loads and specified requirements. Primary framing includes transverse frames; rafters, rake, and canopy beams; sidewall, intermediate, end-wall, and corner columns; and wind bracing.
  1. General: Provide frames with attachment plates, bearing plates, and splice members. Factory drill for field-bolted assembly.
  2. Frame Configuration: Single slope
  3. Exterior Column Type: Uniform depth 10 inches (straight).
  4. Rafter Type: Tapered.
- B. End-Wall Framing: Manufacturer's standard primary end-wall framing fabricated for field-bolted assembly.
- C. Secondary Framing: Manufacturer's standard secondary framing, including purlins, girts, eave struts, flange bracing, base members, gable angles, clips, headers, jambs, and other miscellaneous structural members. Unless otherwise indicated, fabricate framing from either cold-formed, structural-steel sheet or roll-formed, metallic-coated steel sheet, prepainted with coil coating.
- D. Bolts: Provide plain-finish bolts for structural-framing components that are primed or finish painted. Provide zinc-plated or hot-dip galvanized bolts for structural-framing components that are galvanized.
- E. Finish: Factory primed. Apply specified primer immediately after cleaning and pretreating.

## 2.04 METAL ROOF AND SIDING PANELS

- A. Standing-Seam Insulated Metal Roof Panels: Equal to Kingspan Insulated Panels's KingZip formed as an insulated panel system with the following properties:
  1. Panel Thickness: Three (3) inches.
  2. R-Values 7.2 [hr·ft<sup>2</sup>·deg F/Btu] per inch thickness when tested in accordance with ASTM C 518 at 75 deg F mean temperature.
  3. Panel Width: Forty-two (42) inches.
  4. Panel Lengths: As indicated on Drawings.
  5. Insulation Material: Non-CFC foamed-in-place closed cell Polyurethane foam cured to achieve a minimum density of 2.4 pcf as determined by ASTM D 1622
  6. Joint Configuration: Standing seam with thermally broken Concealed Clips.
  7. Panel Exterior Face: 22 gage Galvalume®
  8. Panel Interior Face: 22 gage Galvalume®
  9. Exterior Profile: 2 inches high standing seam, non-embossed (smooth) between seams.
  10. Coating: Galvalume® Plus.
  11. Accessories: Fasteners, Sealants, Standard and Custom Trim as required for a complete system.

## 2.05 INSULATED BARRIER WALL SYSTEM

- A. Insulated metal panel barrier system equal to Kingspan Insulated Panels Karrier Series with the following properties:
1. Panel Thickness: 2-1/2 inches
  2. R-Values: 7.2 [hr·ft<sup>2</sup>· deg F/Btu] per inch thickness when tested in accordance with ASTM C 518 at 75 deg F mean temperature.
  3. Panel Width: Forty-two (42) inches.
  4. Panel Lengths: As indicated on drawings
  5. Insulation Material: Non-CFC foamed-in-place closed cell Polyurethane foam cured to achieve a minimum density of 2.4 pcf as determined by ASTM D 1622
  6. Joint Configuration: Thermally broken tongue and groove joints oriented vertically
  7. Panel Exterior Face: 22 gage, Shadowline profile, smooth finish
  8. Panel Interior Face: 22 gage, Shadowline profile, smooth finish
  9. Coating: Fluoropolymer two-coat design series color system with 70 percent PVDF
  10. Color: Standard colors from manufacturer's full range of colors to be selected by Project Engineer / MDOT Architect
  11. Integral Furring: equal to Karrier Rail. Provide 16 gage flat rail integrated into the panel joint where exterior cladding is vertical. Provide 16 gage "hat channel" profile with 2 inches bearing surface integrated into the panel joint where exterior cladding is horizontal.
  12. Accessories: Fasteners, Sealants, Standard and Custom Trim as required for a complete system.

## 2.06 EXTERIOR CLADDING METAL PANELS

- A. Metal Panel Type 1 equal to Morin; a Kingspan Group Company, Exposed fastener panel:
1. Profile: C-37-7/8
  2. Thickness: 7/8 inch
  3. Panel width: 37- 5/16 inches
  4. Gage: 20 Ga minimum
  5. Panel Joint: Lap joint with staggered vertical locations
  6. Finish: Galvalume® Plus.
  7. Texture: Smooth
  8. Structural Performance: Maximum deflection of L/180 based on structural loads indicated on Structural Drawing S-001
  9. Water penetration: Wall panels when tested shall have no water leakage at 6 pounds per square foot when tested as per ASTM E331.
  10. Air infiltration: maximum air leakage of 0.01 cfm per square feet of fixed wall area at a minimum static air-pressure differential of 1.57 foot pounds per square foot when tested as per ASTM E283
  11. Accessories: Closed Cell Closure strips, Fasteners, Sealants, Standard and Custom Trim as required for a complete system. Note inside corner, outside corner and field trim locations on elevations.
- B. Metal Panel Type 2 equal to Morin; a Kingspan Group Company, Concealed fastener panel:
1. Profile: F-12
  2. Thickness: 1-1/2 inches
  3. Panel width: 12 inches
  4. Gage: 20 Ga minimum

5. Panel Joint: Tongue and groove interlock joint
6. Panel Length: Vertical panels to be continuous. Flush joints with backer plate where required at horizontal panels. Where joints are required, stagger location so no joints are in alignment across three panels.
7. Finish: 1.0 mil. Fluoropolymer (PVDF) Two Coat system: 0.2 mil primer with 0.8 mil Kynar 500 (70 percent PVDF) MICA color coat.
8. Color: Blue Gray
9. Texture: Smooth
10. Structural Performance: Maximum deflection of L/180 based on structural loads indicated on Structural Drawing S-001
11. Water penetration: Wall panels when tested shall have no water leakage at 6 pounds per square foot when tested as per ASTM E331.
12. Air infiltration: maximum air leakage of 0.01 cfm per square feet of fixed wall area at a minimum static air-pressure differential of 1.57 foot pounds per square foot when tested as per ASTM E283
13. Accessories: Closed Cell Closure strips, Fasteners, Sealants, Standard and Custom Trim as required for a complete system. Note inside corner, outside corner and field trim locations on elevations.

## 2.07 ACCESSORIES

- A. General: Provide accessories as standard with metal building system manufacturer and as specified. Fabricate and finish accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional and structural requirements.
  1. Form exposed sheet metal accessories that are without excessive oil-canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
- B. Roof Panel Accessories: Provide components required for a complete metal roof panel assembly including copings, fasciae, corner units, ridge closures, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.
- C. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including copings, fasciae, mullions, sills, corner units, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels unless otherwise indicated.
- D. Flashing and Trim: Formed from 24 gage nominal-thickness, zinc-coated steel sheet (galvanized G-90) or aluminum-zinc alloy-coated steel sheet pre-painted with coil coating (Kynar 500 with 70 percent PVDF); finished to match adjacent metal panels, unless indicated otherwise.
- E. Gutters: Formed from 24 gage nominal-thickness, zinc-coated (galvanized G-90) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating (Kynar 500 with 70 percent PVDF); finished to match roof fascia and rake trim. Box-shaped profile, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 20'-0" long sections, sized according to SMACNA's "Architectural Sheet Metal Manual."
  1. Gutter Supports: Fabricated from same material and finish as gutters
    - a. Provide supports spaced at maximum of 4'-0" on center.
  2. Strainers: Aluminum wire ball type at outlets.

- F. Downspouts: Formed from 24 gage nominal-thickness (smooth, not corrugated), zinc-coated (galvanized G90) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating (Kynar 500 with 70 percent PVDF). Fabricate in full-length long sections (rectangular-shaped), complete with formed elbows and offsets.
  - 1. Mounting Straps: Fabricated from same material and finish as gutters.
    - a. Straps shall be spaced 5'-0" on center maximum (minimum of 3 required per downspout).
    - b. Strap edges shall be rolled or smooth.
- G. Pipe Flashing: Premolded, EPDM pipe collar with flexible aluminum ring bonded to base.
- H. Fasteners: Exposed fasteners shall be color matched to the material being anchored.

## 2.08 FABRICATION

- A. General: Design components and field connections required for erection to permit easy assembly.
  - 1. Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.
  - 2. Fabricate structural framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Members shall be free of cracks, tears, and ruptures.
- B. Tolerances: Comply with MBMA's "Metal Building Systems Manual" for fabrication and erection tolerances.
- C. Primary Framing: Shop fabricate framing components to size and section, with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.
- D. Secondary Framing: Shop fabricate framing components to size and section by roll-forming or break-forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.
- E. Metal Panels: Fabricate and finish metal panels at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.

## PART 3 - EXECUTION

### 3.01 ERECTION OF STRUCTURAL FRAMING

- A. Erect metal building system according to manufacturer's written erection instructions and erection drawings.
- B. Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer.

- C. Set structural framing accurately in locations and to elevations indicated, according to AISC specifications referenced in this Section. Maintain structural stability of frame during erection.
- D. Base and Bearing Plates: Clean concrete-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
  - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
  - 2. Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
  - 3. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- E. Align and adjust structural framing before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
  - 1. Level and plumb individual members of structure.
  - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure will be completed and in service.
- F. Primary Framing and End Walls: Erect framing level, plumb, rigid, secure, and true to line. Level baseplates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use grout to obtain uniform bearing and to maintain a level base-line elevation. Moist-cure grout for not less than seven days after placement.
  - 1. Make field connections using high-strength bolts installed according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for bolt type and joint type specified.
    - a. Joint Type: Snug tightened or pre-tensioned.
- G. Secondary Framing: Erect framing level, plumb, rigid, secure, and true to line. Field bolt secondary framing to clips attached to primary framing.
  - 1. Provide rake or gable purlins with tight-fitting closure channels and fasciae.
  - 2. Locate and space wall girts to suit openings such as doors and windows.
  - 3. Locate canopy framing as indicated.
  - 4. Provide supplemental framing at entire perimeter of openings, including doors, windows, louvers, ventilators, and other penetrations of roof and walls.
- H. Bracing: Install bracing in roof and sidewalls where indicated on erection drawings.
  - 1. Tighten rod and cable bracing to avoid sag.
  - 2. Locate interior end-bay bracing only where indicated.
  - 3. Diagonal rod or cable bracing at roof.
  - 4. Portal Frame bracing at walls.
- I. Framing for Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to structural framing.

- J. Erection Tolerances: Maintain erection tolerances of structural framing within AISC 303.

### 3.02 METAL ROOF AND WALL PANEL INSTALLATION, GENERAL

- A. General: Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
1. Field cut metal panels as required for doors, windows, and other openings. Cut openings as small as possible, neatly to size required, and without damage to adjacent metal panel finishes.
    - a. Field cutting of metal panels by torch is not permitted.
  2. Refer to building elevations and details for exterior cladding wall panel orientation. Install Insulated barrier wall system panels vertically across metal building girts.
  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. Stagger lap joints so no two joints align across three panels.
- B. Lap-Seam Metal Panels: Install screw fasteners using power tools with controlled torque adjusted to compress EPDM washers tightly without damage to washers, screw threads, or metal panels. Install screws in predrilled holes.
1. Arrange and nest side-lap joints so prevailing winds blow over, not into, lapped joints. Lap ribbed or fluted sheets one full rib corrugation. Apply metal panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
- C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.
- D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal panel assemblies. Provide types of gaskets, fillers, and sealants recommended by metal panel manufacturer.
1. Seal metal panel end laps with double beads of tape or sealant the full width of panel. Seal side joints where recommended by metal panel manufacturer.
  2. Prepare joints and apply sealants to comply with requirements in Section 07 92 00 "Joint Sealants."

### 3.03 METAL ROOF PANEL INSTALLATION

- A. General: Provide metal roof panels of full length from eave to ridge unless otherwise indicated or restricted by shipping limitations.
1. Install ridge caps as metal roof panel work proceeds.
  2. Flash and seal metal roof panels with weather closures at eaves and rakes. Fasten with self-tapping screws.



- B. Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each standing-seam joint, at location and spacing and with fasteners recommended by manufacturer.
1. Remove protective film before installation, or immediately thereafter to prevent sunlight damage.
  2. Install clips to supports with self-drilling or self-tapping fasteners.
  3. Install pressure plates at locations indicated in manufacturer's written installation instructions.
  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. Pre-drill panels for fasteners.
  6. Provide metal closures at rake edges and each side of ridge caps.
  7. As each panel is installed, crimp hidden clip assembly prior to placement of next panel.
- C. Metal Fascia Panels: Align bottom of metal panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws. Flash and seal metal panels with weather closures where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.

### 3.04 INSULATED BARRIER WALL SYSTEM

- A. Installation shall be in accordance with manufacturer's installation guidelines and recommendations.
- B. Install panels plumb, level, and true-to-line to dimensions and layout indicated on approved shop drawings.
- C. Cut panels prior to installing, where indicated on shop drawings, using a power circular saw with fine tooth carbide tip blade per manufacturer's instructions. Personnel should wear respiratory and eye protection devices.
- D. Butyl Weather Barrier Sealant: Apply non-skinning butyl sealant as shown on shop drawings and manufacturer's installation instructions as necessary to establish the vapor barrier for the panels. Use non-skinning butyl tube sealant only for tight metal-to-metal contact. Do not use non-skinning butyl tube sealant to bridge gaps.
- E. Place panel fasteners through pre-punched holes in attachment clips, concealed within the joint of the panel. Secure units to the structural supports. Space clips as recommended by manufacturer or otherwise indicated on the approved shop drawings.

### 3.05 EXTERIOR CLADDING METAL WALL PANEL INSTALLATION

- A. General: Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts, extending full height of building, unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.
1. Unless otherwise indicated, begin metal panel installation at corners with center of rib lined up with line of framing.
  2. Shim or otherwise plumb substrates receiving metal wall panels.
  3. When two rows of metal panels are required, lap panels complying with manufacturer's recommendation with **4 inches** minimum.

4. Where joints occur at the ends of panels, stagger joints so that no two joints align within three panels.
5. Rigidly fasten base end of metal wall panels and allow eave end free movement due to thermal expansion and contraction. Pre-drill panels.
6. Flash and seal metal wall panels with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws.
7. Install screw fasteners in predrilled holes.
8. Install flashing and trim as metal wall panel work proceeds.
9. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated; or, if not indicated, as necessary for waterproofing.
10. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws.
11. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.

- B. Metal Wall Panels: Install metal wall panels on exterior side of girts. Attach metal wall panels to supports with fasteners as recommended by manufacturer.

### 3.06 DOOR AND FRAME INSTALLATION

- A. General: Install doors and frames plumb, rigid, properly aligned, and securely fastened in place according to manufacturers' written instructions. Coordinate installation with wall flashings and other components. Seal perimeter of each door frame with elastomeric sealant used for metal wall panels.
- B. Personnel Doors and Frames: Install doors and frames according to SDI A250.8.
- C. Field Glazing: Comply with installation requirements in Section 08 80 00 "Glazing."
- D. Door Hardware: Mount units at heights indicated in DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
1. Install surface-mounted items after finishes have been completed on substrates involved.
  2. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
  3. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
  4. Set thresholds for exterior doors in full bed of butyl-rubber sealant complying with requirements specified in Section 07 92 00 "Joint Sealants."

### 3.07 WINDOW INSTALLATION

- A. General: Install windows plumb, rigid, properly aligned, without warp or rack of frames or sash, and securely fasten in place according to manufacturer's written instructions. Coordinate installation with wall flashings and other components. Seal perimeter of each window frame with elastomeric sealant used for metal wall panels.
1. Separate dissimilar materials from sources of corrosion or electrolytic action at points of contact with other materials by complying with requirements specified in AAMA/WDMA/CSA 101/I.S.2/A440.
- B. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction.

- C. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.
  - D. Field Glazing: Comply with installation requirements in Section 08 80 00 "Glazing."
- 3.08 General: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
- 1. Install components required for a complete metal roof panel assembly, including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
  - 2. Install components for a complete metal wall panel assembly, including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
  - 3. Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by manufacturer.
- B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
- 1. Install exposed flashing and trim that is without excessive oil-canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
  - 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).
- C. Gutters: Join sections with riveted-and-soldered or lapped-and-sealed joints. Attach gutters to eave with gutter hangers spaced as required for gutter size, but not more than 36 inches on center using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.
- D. Downspouts: Join sections with 1-1/2-inch telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches on center in between.
- 1. Provide elbows at base of downspouts to direct water away from building.
- E. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to panel as recommended by manufacturer.

3.09 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Tests and Inspections:
  - 1. High-Strength, Field-Bolted Connections: Connections shall be tested and inspected during installation according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
  - 2. Welded Connections: In addition to visual inspection, field-welded connections shall be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at inspector's option:
    - a. Liquid Penetrant Inspection: ASTM E 165.
    - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
    - c. Ultrasonic Inspection: ASTM E 164.
    - d. Radiographic Inspection: ASTM E 94.
- C. Product will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

END OF SECTION

SECTION 14 45 00                      VEHICLE LIFTS

PART 1 - GENERAL

1.01        SUMMARY

- A.    Section includes: Vehicle lifts including safety equipment, controls and accessories.
- B.    Related Sections:
  - 1.    Division 22 Sections (for plumbing requirements)
  - 2.    Division 26 Sections (for electrical requirements)

1.02        REFERENCES

- A.    ALI: Automotive Lift Institute.
- B.    ANSI/ALI/ALCTV: Safety Requirements for the Construction, Testing, and Validation of Automotive Lifts.

1.03        ACTION SUBMITTALS

- A.    Product Data: Manufacturer's data sheets on each product to be used, including:
  - 1.    Preparation instructions and recommendations.
  - 2.    Storage and handling requirements and recommendations.
  - 3.    Installation manual.
  - 4.    Operations and maintenance manual.
  - 5.    Safety manual.
- B.    Shop Drawings: Template drawings and load reactions for lift application.

1.04        INFORMATIONAL SUBMITTALS

- A.    Sample warranty.

1.05        CLOSEOUT SUBMITTALS

- A.    Operation and maintenance data.
- B.    Executed warranty.

1.06        QUALITY ASSURANCE

- A.    Installer Qualifications:
  - 1.    Factory trained authorized company.
  - 2.    Company insured for completed operations of installing lifts.

- B. In addition to the other requirements outlined herein, lifts, shall comply with applicable requirements of ANSI standards. "Safety Requirements for the Construction, Care and Use of Automotive Lifts" as published by the American National Standards Institute. The lift company Quality Management System shall be ISO9001 certified.

#### 1.07 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

#### 1.08 WARRANTY

- A. Contractor/manufacturer/installer has responsibility for a one year Corrective Period for work of this Section from Date of Completion against deficiencies as stated in the manufacturer's standard warranty.
- B. Contractor/manufacturer/installer shall promptly and without inconvenience and cost to Owner correct said deficiencies: Failure due to defective materials and workmanship.
- C. Contractor/manufacturer/installer shall be notified immediately of defective products, and be given a reasonable opportunity to inspect the goods prior to return. Manufacturer will not assume responsibility, or compensation, for unauthorized repairs or labor.

### PART 2 - PRODUCTS

#### 2.01 ACCEPTABLE MANUFACTURERS

- A. Drawings and Specifications are based on products manufactured by Rotary Lift., a Dover Company, 2700 Lanier Drive, Madison, IN 47250. Tel. (800) 640-5438.
- B. Equivalent products by the following manufacturers are acceptable:
  1. Challenger Lifts, Inc., Louisville, KY. Tel: (800) 648-5438.
  2. Mohawk Lifts, Amsterdam, NY. Tel: (800) 833-2006.
- C. Substitutions: Products produced by other manufacturers that fully meet or exceed the specified requirements may be considered under provisions of Section 01 25 00-Product Procedures and Section 01 60 00-Product Requirements.

#### 2.02 VEHICLE SERVICE LIFT

- A. 30,000 Lb Four Post Surface Mounted Drive on General Service Lift SM30S.
  1. Capacity: 30,000 lbs.
  2. SM30S Series Single Point Manual Controls - Pneumatic (100 psi - 120 psi Air Required) Lock Release Electric Power Unit, UL201 Compliant, Over Hydraulic Cylinder Drive: (Models Bio-Fluid Compatible)
    - a. 4hp 208-230V 1 phase Motor
  3. Minimum Bay Requirements: SM30S; floor space 16 feet by 30 feet.
  4. Rise: 68 inches (from floor to top of runway).
  5. Overall Length: SM30S; 25'-8 1/2".

6. Overall Width: 12'-6".
7. Inside of Columns: 133 inches.
8. Between Columns: SM30S; 249 inches.
9. Height of Columns: 7'-3/4".
10. Width of Runways: 24 inches.
11. Height of Runways: 8 3/4 inches.
12. Width Between Runways: 42 to 48 inches.
13. Maximum Wheelbase: SM30S; 235 inches.
14. Finishes: Blue, Standard RAL5005.
15. Accessories:
  - a. RJ9000Y-2BK: Rolling Jacks 9000 lbs. capacity (ea.) (100 psi minimum - 120 psi maximum required). Two required.
  - b. Internal Air Line Kit (100 psi minimum - 120 psi maximum required).
16. Lift shall be 3rd party certified by ETL testing laboratory and labeled with the ETL/Automotive Lift Institute (ALI) label that affirms the lifts meet conformance to all applicable provisions of American National Standard ANSI/ALI ALCTV-2006 and in compliance with IBC 2012

### PART 3 - EXECUTION

#### 3.01 EXAMINATION

- A. Do not begin installation until supporting structures have been properly prepared. If supporting structure preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

#### 3.02 INSTALLATION

- A. Install in accordance with manufacturer instructions.

#### 3.03 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lifts. Include a review of emergency systems and emergency procedures to be followed at time of operational failure and other building emergencies.
- B. Check operation of lifts with Owner's personnel present and before date of Substantial Completion. Determine that operating systems and devices are functioning properly.
- C. Check operation of lifts with Owner's personnel present not more than one month before end of warranty period. Determine that operating systems and devices are functioning properly.

#### 3.04 PROTECTION

- A. Protect installed products until completion of project. Touch-up, repair or replace damaged products before Date of Completion.

END OF SECTION

SECTION 22 11 16

DOMESTIC WATER PIPING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Under-building-slab and aboveground domestic water pipes, tubes, and fittings inside buildings.
2. Encasement for piping.

1.02 ACTION SUBMITTALS

- A. Product Data: For pipe, encasement, transition fittings and dielectric fittings.

PART 2 - PRODUCTS

2.01 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.
- B. Potable-water piping and components shall comply with NSF 14 and NSF 61.

2.02 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.
- B. Soft Copper Tube: ASTM B 88, Type K water tube, annealed temper.
- C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
- D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
- E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
- F. Copper Unions:
1. MSS SP-123.
  2. Cast-copper-alloy, hexagonal-stock body.
  3. Ball-and-socket, metal-to-metal seating surfaces.
  4. Solder-joint or threaded ends.



- G. Copper Pressure-Seal-Joint Fittings:
  - 1. Fittings for NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
  - 2. Fittings for NPS 2-1/2 to NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
- H. Copper Push-on-Joint Fittings:
  - 1. Description:
    - a. Cast-copper fitting complying with ASME B16.18 or wrought-copper fitting complying with ASME B 16.22.
    - b. Stainless-steel teeth and EPDM-rubber, O-ring seal in each end instead of solder-joint ends.
- I. Appurtenances for Grooved-End Copper Tubing:
  - 1. Bronze Fittings for Grooved-End, Copper Tubing: ASTM B 75 copper tube or ASTM B 584 bronze castings.
  - 2. Mechanical Couplings for Grooved-End Copper Tubing:
    - a. Copper-tube dimensions and design similar to AWWA C606.
    - b. Ferrous housing sections.
    - c. EPDM-rubber gaskets suitable for hot and cold water.
    - d. Bolts and nuts.
    - e. Minimum Pressure Rating: 300 psig.

## 2.03 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials:
  - 1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
  - 2. Full-face or ring type unless otherwise indicated.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys.
- D. Flux: ASTM B 813, water flushable.

## 2.04 ENCASUREMENT FOR UNDERSLABPIPING

- A. Standard: ASTM A 674 or AWWA C105/A21.5.
- B. Form: tube.

## 2.05 TRANSITION FITTINGS

### A. General Requirements:

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

### B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

#### a.

## 2.06 DIELECTRIC FITTINGS

### A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

### B. Dielectric Unions:

1. Standard: ASSE 1079.
2. Pressure Rating: 150 psig.
3. End Connections: Solder-joint copper alloy and threaded ferrous.

### C. Dielectric Flanges:

1. Standard: ASSE 1079.
2. Factory-fabricated, bolted, companion-flange assembly.
3. Pressure Rating: 150 psig.
4. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

## PART 3 - EXECUTION

### 3.01 EARTHWORK

#### A. Comply with requirements in Division 31 for excavating, trenching, and backfilling.

### 3.02 PIPING INSTALLATION

#### A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

#### B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

#### C. Install underground copper tube in PE encasement according to ASTM A 674 or AWWA C105/A21.5.

- D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance.
- E. Install shutoff valve immediately upstream of each dielectric fitting.
- F. Install water-pressure-reducing valves downstream from shutoff valves where water pressure exceeds 75PSIG.
- G. Install domestic water piping level and plumb.
- H. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
- I. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- J. 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.
- K. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- L. Install piping to permit valve servicing.
- M. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
- N. Install piping free of sags and bends.
- O. Install fittings for changes in direction and branch connections.
- P. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- Q. Install thermostats in hot-water circulation piping.
- R. Install thermometers on inlet and outlet piping from each water heater.
- S. Install sleeves for piping penetrations of walls, ceilings, and floors.
- T. Install sleeve seals for piping penetrations of concrete walls and slabs.
- U. Install escutcheons for piping penetrations of walls, ceilings, and floors.

### 3.03 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- E. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.
- F. Push-on Joints for Copper Tubing: Clean end of tube. Measure insertion depth with manufacturer's depth gage. Join copper tube and push-on-joint fittings by inserting tube to measured depth.
- G. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.
- H. Joint Construction for Grooved-End Copper Tubing: Make joints according to AWWA C606. Roll groove ends of tubes. Lubricate and install gasket over ends of tubes or tube and fitting. Install coupling housing sections over gasket with keys seated in tubing grooves. Install and tighten housing bolts.
- I. Joint Construction for Grooved-End, Ductile-Iron Piping: Make joints according to AWWA C606. Cut round-bottom grooves in ends of pipe at gasket-seat dimension required for specified (flexible or rigid) joint. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.
- J. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
- K. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

#### 3.04 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:
  - 1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
  - 2. Fittings for NPS 2 and Larger: Sleeve-type coupling.
- C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

### 3.05 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings or nipples.
- C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.

### 3.06 HANGER AND SUPPORT INSTALLATION

- A. Install hangers and supports for domestic water piping.
  - 1. Vertical Piping: MSS Type 8 or 42, clamps.
  - 2. Individual, Straight, Horizontal Piping Runs:
    - a. MSS Type 1, adjustable, steel clevis hangers.
- B. Support vertical piping and tubing at base and at each floor.
- C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
- D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
  - 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
  - 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
  - 4. NPS 2-1/2: 108 inches with 1/2-inch rod.
  - 5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
  - 6. NPS 6: 10 feet with 5/8-inch rod.
  - 7. NPS 8: 10 feet with 3/4-inch rod.
- E. Install supports for vertical copper tubing every 10 feet.

### 3.07 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
  - 1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
  - 2. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code. Comply with requirements for connection sizes in Division 22 plumbing fixture Sections.

3. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

### 3.08 IDENTIFICATION

- A. Install permanent labels on domestic hot and cold water piping at 20 feet maximum intervals. Include flow direction.

### 3.09 INSULATION

- A. Install ½-inch thick preformed insulation with vapor barrier on all above slab domestic water piping (hot and cold). Install with appropriate adhesives and tapes in accordance with manufacturer's recommendations for 100% coverage of piping.
- B. Install "Lav-Guard" or equal insulation system on all exposed lavatory drains and hot/cold water supplies.

### 3.10 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  1. Piping Inspections:
    - a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
    - b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
      - 1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
      - 2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
    - c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
    - d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
  2. Piping Tests:
    - a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
    - b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.

- c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
  - d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
  - e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
  - f. Prepare reports for tests and for corrective action required.
- B. Domestic water piping will be considered defective if it does not pass tests and inspections.

### 3.11 CLEANING

- A. Clean and disinfect potable domestic water piping as follows:
- 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
  - 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
    - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    - b. Fill and isolate system according to either of the following:
      - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
      - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
    - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
    - d. Repeat procedures if biological examination shows contamination.
    - e. Submit water samples in sterile bottles to authorities having jurisdiction.
- B. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.
- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

### 3.12 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

- C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.
- D. Under-building-slab, domestic water, building-service piping, NPS 2 and smaller, shall be the following:
  - 1. Soft copper tube, ASTM B 88, Type K; no joints below slab.
- E. Under-building-slab, domestic water, building-service piping, NPS 3 and larger, shall be the following:
  - 1. Hard copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; keep joints to an absolute minimum.
- F. Aboveground domestic water piping, NPS 4 and smaller, shall be the following:
  - 1. Hard copper tube, ASTM B 88, Type L; cast- or wrought-copper, solder-joint fittings; and soldered joints.
  - 2. Hard copper tube, ASTM B 88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.
  - 3. Hard copper tube, ASTM B 88, Type L; copper push-on-joint fittings; and push-on joints.

### 3.13 VALVE SCHEDULE

- 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 gate valves.
  - 2. Use check valves to maintain correct direction of domestic water flow to and from equipment.

END OF SECTION



## SECTION 22 11 16.10 COMPRESSED AIR PIPING

## PART 1 - GENERAL

## 1.01 SUMMARY

- A. Section Includes: Shop compressed air piping and fittings inside buildings.

## 1.02 ACTION SUBMITTALS

- A. Product Data: For pipe, fittings and dielectric fittings.

## PART 2 - PRODUCTS

## 2.01 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

## 2.02 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L tube, drawn temper.
- B. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
- C. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
- D. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
- E. Copper Unions:
  - 1. MSS SP-123.
  - 2. Cast-copper-alloy, hexagonal-stock body.
  - 3. Ball-and-socket, metal-to-metal seating surfaces.
  - 4. Solder-joint or threaded ends.
- F. Copper Pressure-Seal-Joint Fittings:
  - 1. Fittings for NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
  - 2. Fittings for NPS 2-1/2 to NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber, O-ring seal in each end.

## 2.03 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials:
  - 1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
  - 2. Full-face or ring type unless otherwise indicated.

- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys.
- D. Flux: ASTM B 813, water flushable.

#### 2.04 TRANSITION FITTINGS

- A. General Requirements:
  - 1. Same size as pipes to be joined.
  - 2. Pressure rating at least equal to pipes to be joined.
  - 3. End connections compatible with pipes to be joined.

#### 2.05 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
  - 1. Standard: ASSE 1079.
  - 2. Pressure Rating: 150 psig.
  - 3. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Flanges:
  - 1. Standard: ASSE 1079.
  - 2. Factory-fabricated, bolted, companion-flange assembly.
  - 3. Pressure Rating: 150 psig.
  - 4. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

### PART 3 - EXECUTION

#### 3.01 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install piping level and plumb.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- E. Install piping to permit valve servicing.

- F. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- J. Install sleeves for piping penetrations of walls, ceilings, and floors.
- K. Install escutcheons for piping penetrations of walls, ceilings, and floors.

### 3.02 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- E. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.
- F. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for service. Join flanges with gasket and bolts according to ASME B31.9.
- G. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

### 3.03 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Aboveground Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

### 3.04 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

- B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings or nipples.
- C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.

### 3.05 HANGER AND SUPPORT INSTALLATION

- A. Install hangers and supports for piping.
  - 1. Vertical Piping: MSS Type 8 or 42, clamps.
  - 2. Individual, Straight, Horizontal Piping Runs:
    - a. MSS Type 1, adjustable, steel clevis hangers.
- B. Support vertical piping and tubing at base and at each floor.
- C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
- D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
  - 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
  - 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
  - 4. NPS 2-1/2: 108 inches with 1/2-inch rod.
  - 5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
  - 6. NPS 6: 10 feet with 5/8-inch rod.
  - 7. NPS 8: 10 feet with 3/4-inch rod.
- E. Install supports for vertical copper tubing every 10 feet.

### 3.06 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

### 3.07 IDENTIFICATION

- A. Install permanent labels on piping at 20 feet maximum intervals. Include flow direction.

### 3.08 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  - 1. Piping Tests:
    - a. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
    - b. Leave new, altered, extended, or replaced piping unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.

- c. Cap and subject piping to static pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
  - d. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
  - e. Prepare reports for tests and for corrective action required.
- B. Piping will be considered defective if it does not pass tests and inspections.

### 3.09 CLEANING

- A. Clean piping as follows:
- 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
- B. Clean interior of piping system. Remove dirt and debris as work progresses.

### 3.10 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.
- D. Aboveground piping, NPS 4 and smaller, shall be the following:
- 1. Hard copper tube, ASTM B 88, Type L; cast- or wrought-copper, solder-joint fittings; and soldered joints.
  - 2. Hard copper tube, ASTM B 88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.
  - 3. Hard copper tube, ASTM B 88, Type L; copper push-on-joint fittings; and push-on joints.

### 3.11 VALVE SCHEDULE

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
- 1. Shutoff Duty: Use ball valves.

END OF SECTION

## SECTION 22 11 19

## DOMESTIC WATER PIPING SPECIALTIES

## PART 1 - GENERAL

## 1.01 SUMMARY

## A. Section Includes:

1. Ball Valves.
2. Vacuum breakers.
3. Backflow preventers.
4. Water pressure-reducing valves.
5. Temperature-actuated, water mixing valves.
6. Strainers.
7. Outlet boxes.
8. Hose bibbs.
9. Wall hydrants.
10. Post hydrants.
11. Water-hammer arresters.
  - a. Trap-seal primer valves.
  - b. Flexible connectors.

## 1.02 SUBMITTALS

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

## PART 2 - PRODUCTS

## 2.01 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

- A. Potable-water piping and components shall comply with NSF 61.

## 2.02 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

## 2.03 BRONZE BALL VALVES

- A. Bronze Ball Valves, Two-Piece with Full Port, and Bronze or Brass Trim, Threaded or Soldered Ends:

1. Description:
  - a. Standard: MSS SP-110 or MSS-145.
  - b. CWP Rating: 600 psig.
  - c. Body Design: Two piece.
  - d. Body Material: Bronze.
  - e. Ends: Threaded and soldered.
  - f. Seats: PTFE.
  - g. Stem: Bronze or brass.
  - h. Ball: Chrome-plated brass.
  - i. Port: Full.

## B. Bronze Ball Valves, Two-Piece with Full Port, and Bronze or Brass Trim, Press Ends:

1. Description:
  - a. Standard: MSS SP-110 or MSS-145.
  - b. CWP Rating: Minimum 200 psig.
  - c. Body Design: Two piece.
  - d. Body Material: Bronze.
  - e. Ends: Press.
  - f. Press Ends Connections Rating: Minimum 200 psig.
  - g. Seats: PTFE or RTPFE.
  - h. Stem: Bronze or brass.
  - i. Ball: Chrome-plated brass.
  - j. Port: Full.
  - k. O-Ring Seal: EPDM or Buna-N.

## 2.04 VACUUM BREAKERS

## A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:

1. Standard: ASSE 1001.
2. Size: NPS 1/4 to NPS 3, as required to match connected piping.
3. Body: Bronze.
4. Inlet and Outlet Connections: Threaded.

## B. Hose-Connection Vacuum Breakers:

1. Standard: ASSE 1011.
2. Body: Bronze, nonremovable, with manual drain.
3. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.

## 2.05 BACKFLOW PREVENTERS

## A. Reduced-Pressure-Principle Backflow Preventers (RPZ):

1. Standard: ASSE 1013.
2. Operation: Continuous-pressure applications.
3. Pressure Loss: 12 psig maximum, through middle third of flow range.
4. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
5. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
6. Configuration: Designed for horizontal, straight-through or vertical flow.
7. Accessories:
  - a. Valves NPS 2 and Smaller: Ball type with threaded ends on inlet and outlet.
  - b. Valves NPS 2-1/2 and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.
  - c. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

## B. Hose-Connection Backflow Preventers:

1. Standard: ASSE 1052.
2. Operation: Up to 10-foot head of water back pressure.
3. Inlet Size: NPS 1/2 or NPS 3/4.

4. Outlet Size: Garden-hose thread complying with ASME B1.20.7.
5. Capacity: At least 3-gpm flow.

## 2.06 TEMPERATURE-ACTUATED, WATER MIXING VALVES

### A. Water-Temperature Limiting Devices:

1. Standard: ASSE 1017.
2. Pressure Rating: 125 psig.
3. Type: Thermostatically controlled, water mixing valve.
4. Material: Bronze body with corrosion-resistant interior components.
5. Connections: Threaded inlets and outlet.
6. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.

## 2.07 STRAINERS FOR DOMESTIC WATER PIPING

### A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller; cast iron for NPS 2-1/2 and larger.
3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
4. Screen: Stainless steel with round perforations unless otherwise indicated.
5. Perforation Size:
6. Drain: Pipe plug or Factory-installed, hose-end drain valve.

## 2.08 OUTLET BOXES

### A. Wide Mouthed Outlet Boxes:

1. Mounting: Recessed.
2. Material and Finish: Plastic box and faceplate.
3. Faucet: Combination valved fitting or separate hot- and cold-water valved fittings complying with ASME A112.18.1. Include garden-hose thread complying with ASME B1.20.7 on outlets.
4. Supply Shutoff Fittings: NPS 1/2 gate, globe, or ball valves and NPS 1/2 copper, water tubing.
5. Drain: NPS 2 standpipe and P-trap with wide mouthed outlet for direct waste connection to drainage piping.
6. Inlet Hoses: Two 60-inch-long, rubber household clothes washer inlet hoses with female, garden-hose-thread couplings. Include rubber washers.
7. Drain Hose: One 48-inch-long, rubber household clothes washer drain hose with hooked end.

### B. Icemaker Outlet Boxes:

1. Mounting: Recessed.
2. Material and Finish: Plastic box and faceplate.
3. Faucet: Valved fitting complying with ASME A112.18.1. Include NPS 1/2 or smaller copper tube outlet.
4. Supply Shutoff Fitting: NPS 1/2 gate, globe, or ball valve and NPS 1/2 copper, water tubing.



## 2.09 HOSE BIBBS

## A. Hose Bibbs:

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig.
7. Vacuum Breaker: Integral or field-installation, nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish: Rough bronze, or chrome or nickel plated.
9. Operation: Wheel handle.

## 2.10 WALL HYDRANTS

## A. Nonfreeze Wall Hydrants:

1. Standard: ASME A112.21.3M for self-draining wall hydrants.
2. Pressure Rating: 125 psig.
3. Operation: as indicated on drawing.
4. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
5. Inlet: NPS 3/4.
6. Outlet: with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.

## 2.11 WATER-HAMMER ARRESTERS

## A. Water-Hammer Arresters:

1. Standard: ASSE 1010 or PDI-WH 201.
2. Type: Metal bellows.
3. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

## 2.12 TRAP-SEAL PROTECTION DEVICE

- A. Trap-Seal Protection Device: Mechanical elastomeric device designed to limit trap evaporation.

## 2.13 FLEXIBLE CONNECTORS

- A. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig.
2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.
3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

## PART 3 - EXECUTION

## 3.01 INSTALLATION

- A. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
  - 1. Locate backflow preventers in same room as connected equipment or system.
  - 2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
  - 3. Do not install bypass piping around backflow preventers.
- B. Install water pressure regulators when water pressure exceeds 75 PSIG with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.
- C. Install temperature-actuated, water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.
  - 1. Install cabinet-type units recessed in or surface mounted on wall as specified.
- D. Install Y-pattern strainers for water on supply side of each backflow preventer and water pressure-reducing valve.
- E. Install outlet boxes recessed in wall.
- F. Install water-hammer arresters in water piping according to PDI-WH 201.

## 3.02 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  - 1. Test each backflow preventer according to authorities having jurisdiction and the device's reference standard.
- B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

## 3.03 ADJUSTING

- A. Set field-adjustable pressure set points of water pressure-reducing valves.
- B. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

END OF SECTION

## SECTION 22 13 16

## SANITARY WASTE AND VENT PIPING

## PART 1 - GENERAL

## 1.01 SUMMARY

- A. Section Includes: Pipe, tube, and fittings.

## 1.02 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

- 1. Soil, Waste, and Vent Piping: 10-foot head of water.

## 1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include under slab pipe elevations.

## 1.04 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

## PART 2 - PRODUCTS

## 2.01 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

## 2.02 PVC PIPE AND FITTINGS

- A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
- B. Cellular-Core PVC Pipe: ASTM F 891, Schedule 40.
- C. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
- D. Adhesive Primer: ASTM F 656.
  - 1. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

- E. Solvent Cement: ASTM D 2564.
  - 1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

### PART 3 - EXECUTION

#### 3.01 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 sizing and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- K. 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.
- L. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:
  - 1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.

2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
  3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- M. Install aboveground PVC piping according to ASTM D 2665.
- N. Install underground PVC piping according to ASTM D 2321.
- O. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- P. Install sleeves for piping penetrations of walls, ceilings, and floors.
- Q. Install sleeve seals for piping penetrations of concrete walls and slabs.
- R. Install escutcheons for piping penetrations of walls, ceilings, and floors.

### 3.02 JOINT CONSTRUCTION

- A. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  2. 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.
- B. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
  2. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

### 3.03 HANGER AND SUPPORT INSTALLATION

- A. Hangers:
1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
  2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
  3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
  4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
  5. Vertical Piping: MSS Type 8 or Type 42, clamps.
  6. Install individual, straight, horizontal piping runs:
    - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
  7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  8. Base of Vertical Piping: MSS Type 52, spring hangers.

- B. Support horizontal piping and tubing within 12 inches of each fitting and coupling.
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.
- E. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1-1/2 and 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 and NPS 8: 48 inches with 3/4-inch rod.
  - 5. NPS 10 and NPS 12: 48 inches with 7/8-inch rod.
- F. Install supports for vertical PVC piping every 48 inches.
- G. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

### 3.04 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect drainage and vent piping to the following:
  - 1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
  - 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
  - 3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
  - 4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
  - 5. 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.
- C. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

3.05 PIPING SCHEDULE

- A. Aboveground, soil and waste piping NPS 4 and smaller shall be any of the following:
  - 1. Solid-wall or Cellular-core PVC pipe, PVC socket fittings, and solvent-cemented joints.
  
- B. Aboveground, vent piping NPS 4 and smaller shall be any of the following:
  - 1. Solid-wall or Cellular-core PVC pipe, PVC socket fittings, and solvent-cemented joints.
  
- C. Underground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:
  - 1. Solid wall or Cellular-core PVC pipe, PVC socket fittings, and solvent-cemented joints.

END OF SECTION

## SECTION 22 33 00 ELECTRIC, DOMESTIC-WATER HEATERS

## PART 1 - GENERAL

## 1.01 SUMMARY

- A. Section Includes: Thermostat-control, electric, tankless, domestic-water heaters.

## 1.02 ACTION SUBMITTALS

- A. Product Data: For each type and size of domestic-water heater indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

## 1.03 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For electric, domestic-water heaters to include in emergency, operation, and maintenance manuals.

## 1.04 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.
- C. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 Annex G, "Drinking Water System Components - Health Effects."

## 1.05 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

## PART 2 - PRODUCTS

## 2.01 ELECTRIC, TANKLESS, DOMESTIC-WATER HEATERS

- A. Thermostat-Control, Electric, Tankless, Domestic-Water Heaters:
  - 1. Standard: UL 499 for electric, tankless, (domestic-water heater) heating appliance.
  - 2. Construction: Copper piping or tubing complying with NSF 61 Annex G barrier materials for potable water, without storage capacity.
    - a. Connections: ASME B1.20.1 pipe thread.
    - b. Pressure Rating: 150 psig.
    - c. Heating Element: Resistance heating system.



- d. Temperature Control: Thermostat.
  - e. Safety Control: High-temperature-limit cutoff device or system.
  - f. Jacket: Aluminum or steel with enameled finish or plastic.
3. Support: Bracket for wall mounting.

## 2.02 SOURCE QUALITY CONTROL

- A. Factory Tests: Test and inspect domestic-water heaters specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.
- B. Hydrostatically test domestic-water heaters to minimum of one and one-half times pressure rating before shipment.
- C. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

## PART 3 - EXECUTION

### 3.01 DOMESTIC-WATER HEATER INSTALLATION

- A. Electric, Tankless, Domestic-Water Heater Mounting: Install electric, tankless, domestic-water heaters at least 18 inches above floor on wall bracket.
  1. Maintain manufacturer's recommended clearances.
  2. Arrange units so controls and devices that require servicing are accessible.
  3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  4. Install anchor bolts to elevations required for proper attachment to supported equipment.
  5. Anchor domestic-water heaters to substrate.
- B. Install electric, domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
  1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping.
- C. Fill electric, domestic-water heaters with water.

### 3.02 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

### 3.03 IDENTIFICATION

- A. Identify water heaters with permanent labels.

3.04 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Prepare test and inspection reports.

3.05 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain, electric, domestic-water heaters.

END OF SECTION

## SECTION 22 34 00

## GAS-FIRED, DOMESTIC-WATER HEATERS

## PART 1 - GENERAL

## 1.01 SUMMARY

## A. Section Includes:

1. Gas-fired, tankless, domestic-water heaters.
2. Domestic-water heater accessories.

## 1.02 ACTION SUBMITTALS

- A. Product Data: For each type and size of domestic-water heater indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

## 1.03 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fuel-fired, domestic-water heaters to include in emergency, operation, and maintenance manuals.

## 1.04 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE/IESNA Compliance: Fabricate and label fuel-fired, domestic-water heaters to comply with ASHRAE/IESNA 90.1.
- C. ASME Compliance:
  1. Where ASME-code construction is indicated, fabricate and label commercial, domestic-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, domestic-water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.
- D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 Annex G, "Drinking Water System Components - Health Effects."

## 1.05 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

## 1.06 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired, domestic-water heaters that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
    - a. Structural failures including storage tank and supports.
    - b. Faulty operation of controls.
    - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
  2. Warranty Periods: From date of Substantial Completion.
    - a. Gas-Fired, Tankless, Domestic-Water Heaters:
      - 1) Heat Exchanger: Five years.
      - 2) Controls and Other Components: Three years.
    - b. Compression Tanks: Five years.

## PART 2 - PRODUCTS

## 2.01 GAS-FIRED, TANKLESS, DOMESTIC-WATER HEATERS

- A. Standard: ANSI Z21.10.3/CSA 4.3 for gas-fired, instantaneous, domestic-water heaters for indoor application.
- B. Construction: Copper piping or tubing complying with NSF 61 Annex G barrier materials for potable water, without storage capacity.
1. Tappings: ASME B1.20.1 pipe thread.
  2. Pressure Rating: 150 psig.
  3. Heat Exchanger: Copper tubing.
  4. Insulation: Comply with ASHRAE/IESNA 90.1.
  5. Jacket: Metal, with enameled finish, or plastic.
  6. Burner: For use with tankless, domestic-water heaters and natural-gas fuel.
  7. Automatic Ignition: Manufacturer's proprietary system for automatic, gas ignition.
  8. Temperature Control: Adjustable thermostat.
- C. Support: Bracket for wall mounting.

## 2.02 DOMESTIC-WATER HEATER ACCESSORIES

- A. Domestic-Water Compression Tanks:
1. Description: Steel, pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
  2. Construction:
    - a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
    - b. Interior Finish: Comply with NSF 61 Annex G barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
    - c. Air-Charging Valve: Factory installed.
  3. Characteristics:
    - a. Working-Pressure Rating: 150 psig.

- B. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.
- C. Gas Shutoff Valves: ANSI Z21.15/CSA 9.1-M, manually operated. Furnish for installation in piping.
- D. Gas Pressure Regulators: ANSI Z21.18/CSA 6.3, appliance type. Include 1/2-psig pressure rating as required to match gas supply.
- E. Automatic Gas Valves: ANSI Z21.21/CSA 6.5, appliance, electrically operated, on-off automatic valve.
- F. Combination Temperature-and-Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating..
  - 1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4-M.
- G. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4-M.
- H. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.

## 2.03 SOURCE QUALITY CONTROL

- A. Factory Tests: Test and inspect assembled domestic-water heaters and storage tanks specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.
- B. Hydrostatically test domestic-water heaters and storage tanks to minimum of one and one-half times pressure rating before shipment.
- C. Domestic-water heaters will be considered defective if they do not pass tests and inspections. Prepare test and inspection reports.

## PART 3 - EXECUTION

### 3.01 DOMESTIC-WATER HEATER INSTALLATION

- A. Tankless, Domestic-Water Heater Mounting: Install tankless, domestic-water heaters at least 18 inches above floor on wall bracket.
  - 1. Maintain manufacturer's recommended clearances.
  - 2. Arrange units so controls and devices that require servicing are accessible.
  - 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
  - 5. Anchor domestic-water heaters to substrate.

- B. Install domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
  - 1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping.
- C. Install gas-fired, domestic-water heaters according to NFPA 54.
  - 1. Install gas shutoff valves on gas supply piping to gas-fired, domestic-water heaters without shutoff valves.
  - 2. Install gas pressure regulators on gas supplies to gas-fired, domestic-water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
  - 3. Install automatic gas valves on gas supplies to gas-fired, domestic-water heaters if required for operation of safety control.
  - 4. Comply with requirements for gas shutoff valves, gas pressure regulators, and automatic gas valves specified in Section 231123 "Facility Natural-Gas Piping."
- D. Install combination temperature-and-pressure relief valves in water piping for domestic-water heaters without storage. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- E. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for domestic-water heaters that do not have tank drains.
- F. Install thermometer on outlet piping of domestic-water heaters.
- G. Assemble and install inlet and outlet piping manifold kits for multiple domestic-water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each domestic-water heater. Include shutoff valve and thermometer in each domestic-water heater inlet and outlet, and throttling valve in each domestic-water heater outlet.
- H. Fill domestic-water heaters with water.
- I. Charge domestic-water compression tanks with air.

### 3.02 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to fuel-fired, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

### 3.03 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Prepare test and inspection reports.

3.04 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain domestic-water heaters.

END OF SECTION

SECTION 22 41 00 PLUMBING FIXTURES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Kitchen sinks and faucets.
2. Water Closets, flush valves, and toilet seats
3. Urinals and flush valves
4. Wall hung lavatories
5. Lavatory faucets
6. Mop Sinks
7. Service Sinks
8. Supply fittings.
9. Waste fittings.
10. One-piece transfer shower.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for lavatories.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.03 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For plumbing fixtures and faucets to include in emergency, operation, and operation and maintenance manuals.

PART 2 - PRODUCTS

2.01 KITCHEN SINKS

A. Kitchen Sinks: Two bowl, counter mounted, stainless steel, ADA compliant.

1. Stainless-Steel Kitchen Sinks:
2. Fixture:
  - a. Standard: ASME A112.19.3/CSA B45.4 for stainless-steel kitchen sinks.
  - b. Metal Thickness: 18 gauge type 304.

2.02 KITCHEN SINK FAUCETS

A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.



- B. Sink Faucets: Solid brass, kitchen sink.
1. General-Duty, Solid-Brass Faucets:
  2. Standard: ASME A112.18.1/CSA B125.1.
  3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
  4. Kitchen Sink Option: Separate hand spray complying with ASSE 1025.
  5. Finish: Polished chrome plate.
  6. Maximum Flow Rate: 2.0 gpm unless otherwise indicated.
  7. Mixing Valve: Single control.
  8. Centers: 8 inches.
  9. Mounting: Deck.
  10. Handle(s): Lever.
  11. Spout Type: Swing, solid brass.
  12. Spout Outlet: Aerator.
  13. Drain: Grid.

### 2.03 FLOOR-MOUNTED, BOTTOM-OUTLET WATER CLOSETS

- A. Water Closets: Floor mounted, bottom outlet, top spud.
1. Bowl:
    - a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
    - b. Material: Vitreous china.
    - c. Type: Siphon jet.
    - d. Style: Flushometer valve.
    - e. Rim Contour: Elongated.
    - f. Spud Size and Location: NPS 1-1/2; top.
    - g. Color: White.

### 2.04 WATER CLOSET FLUSHOMETER VALVES

- A. Lever-Handle, Diaphragm Flushometer Valves:
1. Standard: ASSE 1037.
  2. Minimum Pressure Rating: 125 psig.
  3. Features: Include integral check stop and backflow-prevention device.
  4. Material: Brass body with corrosion-resistant components.
  5. Exposed Flushometer-Valve Finish: Chrome plated.
  6. Panel Finish: Chrome plated or stainless steel.
  7. Style: Exposed.
  8. Consumption: 1.28 gal. per flush.
  9. Minimum Inlet: NPS 1.
  10. Minimum Outlet: NPS 1-1/4.

### 2.05 TOILET SEATS

- A. Toilet Seats:
1. Standard: IAPMO/ANSI Z124.5.
  2. Material: Plastic.
  3. Type: Commercial (Standard).
  4. Shape: Elongated rim, open front.
  5. Color: White.

## 2.06 SUPPORTS

## A. Type II Urinal Carrier:

1. Standard: ASME A112.6.1M.

## 2.07 WALL-HUNG URINALS

## A. Urinals: Wall hung, back outlet, washout.

1. Fixture:
  - a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
  - b. Material: Vitreous china.
  - c. Drain: Separate removable chrome-plated dome strainer with chrome-plated, NPS 1-1/2 tailpiece.
  - d. Strainer or Trapway: Manufacturer's standard strainer and NPS 1-1/2 tailpiece.
  - e. Design Consumption: 0.2125 gal. per flush.
  - f. Inlet Spud Size and Location: NPS 3/4; top.
  - g. Outlet Size and Location: NPS 1-1/2; bottom.
  - h. Color: White.
2. Waste Fitting:
  - a. Standard: ASME A112.18.2/CSA B125.2.
  - b. Trap:
    - 1) Size: NPS 1-1/2, integral.
3. Support: Type II Urinal Carrier with hanger and bearing plates. Include rectangular, steel uprights.
4. Urinal Mounting Height: Standard and Handicapped/elderly according to ICC A117.1.

## 2.08 URINAL FLUSHOMETER VALVES

## A. Lever-Handle, Diaphragm Flushometer Valves:

1. Standard: ASSE 1037.
2. Minimum Pressure Rating: 125 psig.
3. Features: Include integral check stop and backflow-prevention device.
4. Material: Brass body with corrosion-resistant components.
5. Exposed Flushometer-Valve Finish: Chrome plated.
6. Panel Finish: Chrome plated or stainless steel.
7. Style: Exposed.
8. Consumption: 0.125 gal. per flush.
9. Minimum Inlet: NPS 3/4.
10. Minimum Outlet: NPS 3/4.

## 2.09 VITREOUS-CHINA, WALL-MOUNTED LAVATORIES

## A. Lavatory: Vitreous china, wall mounted, with back.

1. Fixture:
  - a. Standard: ASME A112.19.2/CSA B45.1.
  - b. Type: For wall hanging.
  - c. Nominal Size: Rectangular, 20by 22 inches.
  - d. Faucet-Hole Punching: Three holes, 4-inch centers.
  - e. Faucet-Hole Location: Top.

- f. Color: White.
- g. Mounting Material: Chair carrier.
- 2. Support: Type II, concealed-arm lavatory carrier. Include rectangular, steel uprights.
- 3. Lavatory Mounting Height: Standard and Handicapped/elderly according to ICC A117.1.

#### 2.10 SOLID-BRASS, MANUALLY OPERATED LAVATORY FAUCETS

- A. NSF Standard: Comply with NSF 372 for faucet materials that will be in contact with potable water.
- B. Lavatory Faucets: Manual-type, single-control mixing or two-handle (metering) mixing, commercial, solid-brass valve.
  - 1. Standard: ASME A112.18.1/CSA B125.1.
  - 2. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
  - 3. Body Type: Centerset.
  - 4. Body Material: Commercial, solid brass.
  - 5. Finish: Polished chrome plate.
  - 6. Maximum Flow Rate: 0.5 gpm.
  - 7. Maximum Flow: 0.5 gpm. per metering cycle.
  - 8. Mounting Type: Deck, exposed.
  - 9. Valve Handle(s): Single lever or push paddle.
  - 10. Spout: Rigid type.
  - 11. Spout Outlet: Aerator.
  - 12. Drain: Not part of faucet.

#### 2.11 MOP SINKS

- A. Service Basins: Terrazzo, floor mounted.
  - 1. Fixture:
    - a. Standard: IAPMO PS 99.
    - b. Shape: Five sided.
    - c. Color: Not applicable.
    - d. Drain: Grid with NPS 3 outlet.
  - 2. Mounting: On floor and flush to wall.

#### 2.12 SERVICE SINKS

- A. Utility Sinks: White enameled cast iron, wall hung.
  - 1. Fixture:
    - a. Number of Compartments: One.

#### 2.13 SERVICE/MOP SINK FAUCETS

- A. NSF Standard: Comply with NSF 372 for faucet-spout materials that will be in contact with potable water.

- B. Sink Faucets: Manual type, two lever handle.
1. Commercial, Solid-Brass Faucets:
  2. Standard: ASME A112.18.1/CSA B125.1.
  3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and sink receptor.
  4. Body Type: Widespread.
  5. Body Material: Commercial, solid brass.
  6. Finish: Chrome plated.
  7. Maximum Flow Rate: 2.2 gpm maximum.
  8. Handle(s): Lever.
  9. Mounting Type: Back/wall, exposed.
  10. Spout Type: Rigid, solid brass with wall brace and swing, solid brass.
  11. Vacuum Breaker: Required at service basin for hose outlet.
  12. Spout Outlet: Aerator at utility sink and hose thread according to ASME B1.20.7 at service basin.

#### 2.14 KITCHEN SINK SUPPLY FITTINGS

- A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.
- B. Standard: ASME A112.18.1/CSA B125.1.
- C. Kitchen Sink Supply Fittings:
1. Supply Piping: Chrome-plated-brass pipe or chrome-plated-copper tube matching water-supply piping size. Include chrome-plated wall flange.
  2. Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression stop with inlet connection matching water-supply piping type and size.
    - a. Operation: Wheel handle.
  3. Risers:
    - a. Size: NPS 3/8 kitchen sinks.
    - b. Material: Chrome-plated, soft-copper flexible tube riser.

#### 2.15 LAVATORY SUPPLY FITTINGS

- A. NSF Standard: Comply with NSF 372 for supply-fitting materials that will be in contact with potable water.
- B. Standard: ASME A112.18.1/CSA B125.1.
- C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless-steel wall flange.
- D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.
- E. Operation: Wheel handle.

- F. Risers:
  - 1. NPS 3/8.
  - 2. Chrome-plated, soft-copper flexible tube riser.

#### 2.16 ONE PIECE TRANSFER SHOWER

- A. White one piece acrylic, ADA compliant with ADA required accessories.
- B. Pressure balancing mixing valve and hand shower with slide bar.
- C. ANSI A117.1.

### PART 3 - EXECUTION

#### 3.01 EXAMINATION

- A. Examine roughing-in of water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing-fixture installation.
- B. Examine walls, floors, cabinets, and counters for suitable conditions where fixtures will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.02 INSTALLATION

- A. Install plumbing fixtures level and plumb according to roughing-in drawings.
- B. Install floor-mounted water closets on closet flange attachments to drainage piping.
- C. Install counter-mounting fixtures in and attached to casework.
- D. 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.
- E. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.
- F. Install toilet seats on water closets.
- G. Install traps on fixture outlets.
  - 1. Exception: Omit trap on fixtures with integral traps.
  - 2. Exception: Omit trap on indirect wastes unless otherwise indicated.
- H. Install disposer in outlet of each sink indicated to have a disposer. Install switch where indicated or in wall adjacent to sink if location is not indicated.
- I. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings.

- J. Seal joints between plumbing fixtures, counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color."
- K. Urinal Installation:
  - 1. Install urinals level and plumb according to roughing-in drawings.
  - 2. Install wall-hung, back-outlet urinals onto waste fitting seals and attached to supports.
  - 3. Install wall-hung, bottom-outlet urinals with tubular waste piping attached to supports.
  - 4. Install accessible, wall-mounted urinals at mounting height for the handicapped/elderly, according to ICC/ANSI A117.1.
  - 5. Install trap-seal liquid in waterless urinals.
- L. Assemble shower components according to manufacturers' written instructions.
- M. Install showers level and plumb according to roughing-in drawings.
- N. Install water-supply piping with stop on each supply to each shower faucet.
  - 1. Exception: Use ball or gate valves if supply stops are not specified with shower.
  - 2. Install stops in locations where they can be easily reached for operation.
- O. Install shower flow-control fittings with specified maximum flow rates in shower arms.
- P. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings.
- Q. Install shutoff valves in water-supply piping to fixtures.
- R. Install mounting frames, affixed to building construction, and attach recessed, electric water coolers to mounting frames.

### 3.03 CONNECTIONS

- A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks.

### 3.04 ADJUSTING

- A. Operate and adjust plumbing fixtures and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Adjust water pressure at faucets to produce proper flow.

3.05 CLEANING AND PROTECTION

- A. After completing installation of plumbing fixtures, inspect and repair damaged finishes.
- B. Clean plumbing fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed plumbing fixtures and fittings.
- D. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 22 45 00 EMERGENCY PLUMBING FIXTURES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
  - 1. Eyewash equipment.
  - 2. Combination units.
  - 3. Supplemental equipment.
  - 4. Water-tempering equipment.

1.02 DEFINITIONS

- A. Accessible Fixture: Emergency plumbing fixture that can be approached, entered, and used by people with disabilities.
- B. Plumbed Emergency Plumbing Fixture: Fixture with fixed, potable-water supply.
- C. Self-Contained Emergency Plumbing Fixture: Fixture with flushing-fluid-solution supply.
- D. Tepid: Moderately warm.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include flow rates and capacities, furnished specialties, and accessories.
- B. Shop Drawings: Diagram power, signal, and control wiring.

1.04 INFORMATIONAL SUBMITTALS

- A. Product Certificates: Submit certificates of performance testing specified in "Source Quality Control" Article.
- B. Field quality-control test reports.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For emergency plumbing fixtures to include in operation and maintenance manuals.

1.06 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Flushing-Fluid Solution: Separate lot and equal to at least 200 percent of amount of solution installed for each self-contained unit.



## 1.07 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ANSI Standard: Comply with ANSI Z358.1, "Emergency Eyewash and Shower Equipment."
- C. NSF Standard: Comply with NSF 61 Annex G, "Drinking Water System Components - Health Effects," for fixture materials that will be in contact with potable water.
- D. Regulatory Requirements: Comply with requirements in ICC/ANSI A117.1, "Accessible and Usable Buildings and Facilities for plumbing fixtures for people with disabilities."

## PART 2 - PRODUCTS

## 2.01 EYEWASH EQUIPMENT

- A. Standard, Freestanding, Plumbed Eyewash Units:
  - 1. Capacity: Not less than 0.4 gpm for at least 15 minutes.
  - 2. Supply Piping: NPS 1/2 chrome-plated brass or stainless steel with flow regulator and stay-open control valve.
  - 3. Control-Valve Actuator: Paddle.
  - 4. Spray-Head Assembly: Two receptor-mounted spray heads.
  - 5. Receptor: Plastic bowl.
  - 6. Drain Piping: NPS 1-1/4 minimum, chrome-plated brass, receptor drain, route to floor drain.
  - 7. Mounting: Pedestal.

## 2.02 COMBINATION UNITS

- A. Standard, Plumbed Emergency Shower with Eyewash Combination Units:
  - 1. Piping:
    - a. Material: Galvanized steel.
    - b. Unit Supply: NPS 1-1/4 minimum.
    - c. Unit Drain: Outlet at back or side near bottom.
  - 2. Shower:
    - a. Capacity: Not less than 20 gpm for at least 15 minutes.
    - b. Supply Piping: NPS 1 with flow regulator and stay-open control valve.
    - c. Control-Valve Actuator: Pull rod.
    - d. Shower Head: 8-inch-minimum diameter, plastic.
    - e. Mounting: Pedestal.
  - 3. Eyewash Unit:
    - a. Capacity: Not less than 0.4 gpm for at least 15 minutes.
    - b. Supply Piping: NPS 1/2 with flow regulator and stay-open control valve.
    - c. Control-Valve Actuator: Paddle.
    - d. Spray-Head Assembly: Two receptor-mounted spray heads.
    - e. Receptor: Plastic bowl.

- f. Mounting: Attached shower pedestal.
- g. Drench-Hose Option: May be provided instead of eyewash unit.
  - 1) Capacity: Not less than 0.4 gpm for at least 15 minutes.
  - 2) Drench Hose: Hand-held spray head with squeeze-handle actuator and hose.
  - 3) Mounting: Bracket on shower pedestal.

## 2.03 WATER-TEMPERING EQUIPMENT

### A. Hot- and Cold-Water, Water-Tempering Equipment:

- 1. Description: Factory-fabricated equipment with thermostatic mixing valve.
  - a. Thermostatic Mixing Valve: Designed to provide 85 deg F tepid, potable water at emergency plumbing fixtures, to maintain temperature at plus or minus 5 deg F throughout required 15-minute test period, and in case of unit failure to continue cold-water flow, with union connections, controls, metal piping, and corrosion-resistant enclosure.
  - b. Supply Connections: For hot and cold water.

### B. Electric Water-Tempering Equipment:

- 1. Description: Factory-fabricated equipment with electric heating.
  - a. Heating System: Electric, designed to provide 85 deg F tepid, potable water at emergency plumbing fixtures, to maintain temperature at plus or minus 5 deg F throughout required 15-minute test period, and in case of unit failure to continue cold-water flow, with union connections, controls, heating coils, high-temperature-limit device, metal piping, and corrosion-resistant enclosure.
    - 1) Electrical Characteristics: 208 V, single phase, 60 Hz.

## 2.04 SOURCE QUALITY CONTROL

- A. Certify performance of emergency plumbing fixtures by independent testing organization acceptable to authorities having jurisdiction.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine roughing-in for water and waste piping systems to verify actual locations of piping connections before plumbed emergency plumbing fixture installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 EMERGENCY PLUMBING FIXTURE INSTALLATION

- A. Assemble emergency plumbing fixture piping, fittings, control valves, and other components.
- B. Install fixtures level and plumb.
- C. Fasten fixtures to substrate.

- D. Install shutoff valves in water-supply piping to fixtures. Use ball valve if specific type valve is not indicated. Install valves chained or locked in open position if permitted. Install valves in locations where they can easily be reached for operation. Comply with requirements for valves specified in Section 220523.12 "Ball Valves for Plumbing Piping."
- E. Install dielectric fitting in supply piping to emergency equipment if piping and equipment connections are made of different metals.
- F. Install indirect waste piping on drain outlet of emergency equipment receptors that are indicated to be indirectly connected to drainage system.
- G. Install escutcheons on piping wall and ceiling penetrations in exposed, finished locations.

### 3.03 CONNECTIONS

- A. Connect cold-water-supply piping to plumbed emergency plumbing fixtures not having water-tempering equipment.
- B. Connect hot- and cold-water-supply piping to hot- and cold-water, water-tempering equipment. Connect output from water-tempering equipment to emergency plumbing fixtures.
- C. Connect cold water and electrical power to electric heating water-tempering equipment.
- D. Indirectly connect emergency plumbing fixture receptors without trapped drain outlet to sanitary waste or storm drainage piping.
- E. Where installing piping adjacent to emergency plumbing fixtures, allow space for service and maintenance of fixtures.

### 3.04 IDENTIFICATION

- A. Install all associated supplied emergency marking on each unit.

### 3.05 FIELD QUALITY CONTROL

- A. Mechanical-Component Testing: After plumbing connections have been made, test for compliance with requirements. Verify ability to achieve indicated capacities.
- B. Tests and Inspections:
  - 1. Perform each visual and mechanical inspection.
  - 2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation.
  - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Emergency plumbing fixtures and water-tempering equipment will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

3.06 ADJUSTING

- A. Adjust or replace fixture flow regulators for proper flow.
- B. Adjust equipment temperature settings.

END OF SECTION

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Balancing Air Systems:
  - a. Constant-volume air systems.
2. Testing, Adjusting, and Balancing Equipment:
  - a. Energy Recovery Heat Exchangers
  - b. Motors.
  - c. Condensing units.
3. Control system verification.

1.02 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. BAS: Building automation systems.
- C. NEBB: National Environmental Balancing Bureau.
- D. TAB: Testing, adjusting, and balancing.
- E. TABB: Testing, Adjusting, and Balancing Bureau.
- F. TAB Specialist: An independent entity meeting qualifications to perform TAB work.
- G. TDH: Total dynamic head.

1.03 PREINSTALLATION MEETINGS

- A. TAB Conference: If requested by the Owner, conduct a TAB conference at Project site after approval of the TAB strategies and procedures plan to develop a mutual understanding of the details.
  1. Minimum Agenda Items:
    - a. The Contract Documents examination report.
    - b. The TAB plan.
    - c. Needs for coordination and cooperation of trades and subcontractors.
    - d. Proposed procedures for documentation and communication flow.

1.04 ACTION SUBMITTALS

- A. TAB Report: Documentation indicating that Work complies with ASHRAE/IES 90.1, Section 6.7.2.3 - "System Balancing."

## 1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Contract Documents Examination Report: Submit the Contract Documents review report as specified in Part 3.
- C. Strategies and Procedures Plan: Submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.
- D. System Readiness Checklists: Submit system readiness checklists as specified in "Preparation" Article.
- E. Examination Report: Submit a summary report of the examination review required in "Examination" Article.
- F. Certified TAB reports.
- G. Sample report forms.
- H. Instrument calibration reports, to include the following:
  - 1. Instrument type and make.
  - 2. Serial number.
  - 3. Application.
  - 4. Dates of use.
  - 5. Dates of calibration.

## 1.06 QUALITY ASSURANCE

- A. TAB Specialists Qualifications: Certified by AABC , NEBB, or TABB.
  - 1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC.
  - 2. TAB Technician: Employee of the TAB specialist and certified by AABC as a TAB technician.
- B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."
- C. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.7.2.3 - "System Balancing."

## 1.07 FIELD CONDITIONS

- A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.
- B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

## 3.01 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.
- B. Examine installed systems for balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.
- F. Examine equipment performance data including fan and pump curves.
  - 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
  - 2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.
- G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- H. Examine test reports specified in individual system and equipment Sections.
- I. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.
- J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.
- K. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

- L. Examine operating safety interlocks and controls on HVAC equipment.
- M. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

### 3.02 PREPARATION

- A. Prepare a TAB plan that includes the following:
  - 1. Equipment and systems to be tested.
  - 2. Strategies and step-by-step procedures for balancing the systems.
  - 3. Instrumentation to be used.
  - 4. Sample forms with specific identification for all equipment.
- B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:
  - 1. Airside:
    - a. Duct systems are complete with terminals installed.
    - b. Volume, smoke, and fire dampers are open and functional.
    - c. Clean filters are installed.
    - d. Fans are operating, free of vibration, and rotating in correct direction.
    - e. Variable-frequency controllers' startup is complete and safeties are verified.
    - f. Automatic temperature-control systems are operational.
    - g. Ceilings are installed.
    - h. Windows and doors are installed.
    - i. Suitable access to balancing devices and equipment is provided.

### 3.03 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
  - 1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
  - 2. Install and join new insulation that matches removed materials.
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

### 3.04 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.



- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- D. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- E. Verify that motor starters are equipped with properly sized thermal protection.
- F. Check dampers for proper position to achieve desired airflow path.
- G. Check for airflow blockages.
- H. Check condensate drains for proper connections and functioning.
- I. Check for proper sealing of air-handling-unit components.
- J. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

### 3.05 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
  - 1. Measure total airflow.
    - a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
    - b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
    - c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
    - d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.
  - 2. Measure fan static pressures as follows:
    - a. Measure static pressure directly at the fan outlet or through the flexible connection.
    - b. Measure static pressure directly at the fan inlet or through the flexible connection.
    - c. Measure static pressure across each component that makes up the air-handling system.
    - d. Report artificial loading of filters at the time static pressures are measured.
  - 3. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
  - 4. Obtain approval from engineer for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
  - 5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.
  - 1. Measure airflow of submain and branch ducts.
  - 2. Adjust submain and branch duct volume dampers for specified airflow.
  - 3. Re-measure each submain and branch duct after all have been adjusted.
- C. Adjust air inlets and outlets for each space to indicated airflows.
  - 1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
  - 2. Measure inlets and outlets airflow.
  - 3. Adjust each inlet and outlet for specified airflow.
  - 4. Re-measure each inlet and outlet after they have been adjusted.
- D. Verify final system conditions.
  - 1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to design if necessary.
  - 2. Re-measure and confirm that total airflow is within design.
  - 3. Re-measure all final fan operating data, rpms, volts, amps, and static profile.
  - 4. Mark all final settings.
  - 5. Test system in economizer mode. Verify proper operation and adjust if necessary.
  - 6. Measure and record all operating data.
  - 7. Record final fan-performance data.

### 3.06 PROCEDURES FOR ENERGY RECOVERY HEAT EXCHANGERS

- A. Adjust flows to within specified tolerances.
- B. Measure inlet and outlet temperatures.
- C. Check settings and operation. Record settings.

### 3.07 PROCEDURES FOR MOTORS

- A. Motors 1/2 HP and Larger: Test at final balanced conditions and record the following data:
  - 1. Manufacturer's name, model number, and serial number.
  - 2. Motor horsepower rating.
  - 3. Motor rpm.
  - 4. Phase and hertz.
  - 5. Nameplate and measured voltage, each phase.
  - 6. Nameplate and measured amperage, each phase.
  - 7. Starter size and thermal-protection-element rating.
  - 8. Service factor and frame size.

### 3.08 PROCEDURES FOR CONDENSING UNITS

- A. Verify proper rotation of fans.
- B. Measure entering- and leaving-air temperatures.

- C. Record fan and motor operating data.

### 3.09 CONTROLS VERIFICATION

- A. In conjunction with system balancing, perform the following:
  1. Verify temperature control system is operating within the design limitations.
  2. Confirm that the sequences of operation are in compliance with Contract Documents.
  3. Verify that controllers are calibrated and function as intended.
  4. Verify that controller set points are as indicated.
  5. Verify the operation of lockout or interlock systems.
  6. Verify the operation of valve and damper actuators.
  7. Verify that controlled devices are properly installed and connected to correct controller.
  8. Verify that controlled devices travel freely and are in position indicated by controller: open, closed, or modulating.
  9. Verify location and installation of sensors to ensure that they sense only intended temperature, humidity, or pressure.
- B. Reporting: Include a summary of verifications performed, remaining deficiencies, and variations from indicated conditions.

### 3.10 TOLERANCES

- A. Set HVAC system's airflow rates and water flow rates within the following tolerances:
  1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
  2. Air Outlets and Inlets: Plus or minus 10 percent.
  3. Heating-Water Flow Rate: Plus or minus 10 percent.
  4. Cooling-Water Flow Rate: Plus or minus 10 percent.
- B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above. Toilet, shower, locker rooms shall be negative pressure relative to adjacent spaces, regardless of tolerances allowed above.

### 3.11 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
  1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
  2. Include a list of instruments used for procedures, along with proof of calibration.
  3. Certify validity and accuracy of field data.
- B. Final Report Contents: In addition to certified field-report data, include the following:
  1. Fan curves.
  2. Manufacturers' test data.
  3. Field test reports prepared by system and equipment installers.
  4. Other information relative to equipment performance; do not include Shop Drawings and Product Data.

- C. General Report Data: In addition to form titles and entries, include the following data:
1. Title page.
  2. Name and address of the TAB specialist.
  3. Project name.
  4. Project location.
  5. Architect's name and address.
  6. Engineer's name and address.
  7. Contractor's name and address.
  8. Report date.
  9. Signature of TAB supervisor who certifies the report.
  10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
  11. Summary of contents including the following:
    - a. Indicated versus final performance.
    - b. Notable characteristics of systems.
    - c. Description of system operation sequence if it varies from the Contract Documents.
  12. Nomenclature sheets for each item of equipment.
  13. Data for terminal units, including manufacturer's name, type, size, and fittings.
  14. Notes to explain why certain final data in the body of reports vary from indicated values.
  15. Test conditions for fans and pump performance forms including the following:
    - a. Settings for outdoor-, return-, and exhaust-air dampers.
    - b. Conditions of filters.
    - c. Cooling coil, wet- and dry-bulb conditions.
    - d. Face and bypass damper settings at coils.
    - e. Fan drive settings including settings and percentage of maximum pitch diameter.
    - f. Inlet vane settings for variable-air-volume systems.
    - g. Settings for supply-air, static-pressure controller.
    - h. Other system operating conditions that affect performance.
- D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outdoor, supply, return, and exhaust airflows.
  2. Water and steam flow rates.
  3. Duct, outlet, and inlet sizes.
  4. Pipe and valve sizes and locations.
  5. Terminal units.
  6. Balancing stations.
  7. Position of balancing devices.
- E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:
1. Unit Data:
    - a. Unit identification.
    - b. Location.
    - c. Make and type.
    - d. Model number and unit size.
    - e. Manufacturer's serial number.
    - f. Unit arrangement and class.
    - g. Discharge arrangement.
    - h. Sheave make, size in inches, and bore.

- i. Center-to-center dimensions of sheave and amount of adjustments in inches.
- j. Number, make, and size of belts.
- k. Number, type, and size of filters.
- 2. Motor Data:
  - a. Motor make, and frame type and size.
  - b. Horsepower and rpm.
  - c. Volts, phase, and hertz.
  - d. Full-load amperage and service factor.
  - e. Sheave make, size in inches, and bore.
  - f. Center-to-center dimensions of sheave and amount of adjustments in inches.
- 3. Test Data (Indicated and Actual Values):
  - a. Total airflow rate in cfm.
  - b. Total system static pressure in inches wg.
  - c. Fan rpm.
  - d. Discharge static pressure in inches wg.
  - e. Filter static-pressure differential in inches wg.
  - f. Preheat-coil static-pressure differential in inches wg.
  - g. Cooling-coil static-pressure differential in inches wg.
  - h. Heating-coil static-pressure differential in inches wg.
  - i. Outdoor airflow in cfm.
  - j. Return airflow in cfm.
  - k. Outdoor-air damper position.
  - l. Return-air damper position.
  - m. Vortex damper position.

F. 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. Airflow 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. Water flow rate in gpm.
  - i. Water pressure differential in feet of head or psig.
  - j. Entering-water temperature in deg F.
  - k. Leaving-water temperature in deg F.
  - l. Refrigerant expansion valve and refrigerant types.
  - m. Refrigerant suction pressure in psig.

- n. Refrigerant suction temperature in deg F.
  - o. Inlet steam pressure in psig.
- G. Gas- and Oil-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:
- 1. Unit Data:
    - a. System identification.
    - b. Location.
    - c. Make and type.
    - d. Model number and unit size.
    - e. Manufacturer's serial number.
    - f. Fuel type in input data.
    - g. Output capacity in Btu/h.
    - h. Ignition type.
    - i. Burner-control types.
    - j. Motor horsepower and rpm.
    - k. Motor volts, phase, and hertz.
    - l. Motor full-load amperage and service factor.
    - m. Sheave make, size in inches, and bore.
    - n. Center-to-center dimensions of sheave and amount of adjustments in inches.
  - 2. Test Data (Indicated and Actual Values):
    - a. Total airflow rate in cfm.
    - b. Entering-air temperature in deg F.
    - c. Leaving-air temperature in deg F.
    - d. Air temperature differential in deg F.
    - e. Entering-air static pressure in inches wg.
    - f. Leaving-air static pressure in inches wg.
    - g. Air static-pressure differential in inches wg.
    - h. Low-fire fuel input in Btu/h.
    - i. High-fire fuel input in Btu/h.
    - j. Manifold pressure in psig.
    - k. High-temperature-limit setting in deg F.
    - l. Operating set point in Btu/h.
    - m. Motor voltage at each connection.
    - n. Motor amperage for each phase.
    - o. Heating value of fuel in Btu/h.
- H. Fan Test Reports: For supply, return, and exhaust fans, include the following:
- 1. Fan Data:
    - a. System identification.
    - b. Location.
    - c. Make and type.
    - d. Model number and size.
    - e. Manufacturer's serial number.
    - f. Arrangement and class.
    - g. Sheave make, size in inches, and bore.
    - h. Center-to-center dimensions of sheave and amount of adjustments in inches.
  - 2. Motor Data:
    - a. Motor make, and frame type and size.
    - b. Horsepower and rpm.
    - c. Volts, phase, and hertz.

- d. Full-load amperage and service factor.
- e. Sheave make, size in inches, and bore.
- f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
- g. Number, make, and size of belts.
- 3. Test Data (Indicated and Actual Values):
  - a. Total airflow rate in cfm.
  - b. Total system static pressure in inches wg.
  - c. Fan rpm.
  - d. Discharge static pressure in inches wg.
  - e. Suction static pressure in inches wg.
- I. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
  - 1. Report Data:
    - a. System and air-handling-unit number.
    - b. Location and zone.
    - c. Traverse air temperature in deg F.
    - d. Duct static pressure in inches wg.
    - e. Duct size in inches.
    - f. Duct area in sq. ft..
    - g. Indicated airflow rate in cfm.
    - h. Indicated velocity in fpm.
    - i. Actual airflow rate in cfm.
    - j. Actual average velocity in fpm.
    - k. Barometric pressure in psig.
- J. Air-Terminal-Device Reports:
  - 1. Unit Data:
    - a. System and air-handling unit identification.
    - b. Location and zone.
    - c. Apparatus used for test.
    - d. Area served.
    - e. Make.
    - f. Number from system diagram.
    - g. Type and model number.
    - h. Size.
    - i. Effective area in sq. ft..
  - 2. Test Data (Indicated and Actual Values):
    - a. Airflow rate in cfm.
    - b. Air velocity in fpm.
    - c. Preliminary airflow rate as needed in cfm.
    - d. Preliminary velocity as needed in fpm.
    - e. Final airflow rate in cfm.
    - f. Final velocity in fpm.
    - g. Space temperature in deg F.
- K. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:
  - 1. Unit Data:
    - a. System and air-handling-unit identification.
    - b. Location and zone.

- c. Room or riser served.
    - d. Coil make and size.
    - e. Flowmeter type.
  2. Test Data (Indicated and Actual Values):
    - a. Airflow rate in cfm.
    - b. Entering-water temperature in deg F.
    - c. Leaving-water temperature in deg F.
    - d. Water pressure drop in feet of head or psig.
    - e. Entering-air temperature in deg F.
    - f. Leaving-air temperature in deg F.
  
- L. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:
  1. Unit Data:
    - a. Unit identification.
    - b. Location.
    - c. Service.
    - d. Make and size.
    - e. Model number and serial number.
    - f. Water flow rate in gpm.
    - g. Water pressure differential in feet of head or psig.
    - h. Required net positive suction head in feet of head or psig.
    - i. Pump rpm.
    - j. Impeller diameter in inches.
    - k. Motor make and frame size.
    - l. Motor horsepower and rpm.
    - m. Voltage at each connection.
    - n. Amperage for each phase.
    - o. Full-load amperage and service factor.
    - p. Seal type.
  2. Test Data (Indicated and Actual Values):
    - a. Static head in feet of head or psig.
    - b. Pump shutoff pressure in feet of head or psig.
    - c. Actual impeller size in inches.
    - d. Full-open flow rate in gpm.
    - e. Full-open pressure in feet of head or psig.
    - f. Final discharge pressure in feet of head or psig.
    - g. Final suction pressure in feet of head or psig.
    - h. Final total pressure in feet of head or psig.
    - i. Final water flow rate in gpm.
    - j. Voltage at each connection.
    - k. Amperage for each phase.
  
- M. Instrument Calibration Reports:
  1. Report Data:
    - a. Instrument type and make.
    - b. Serial number.
    - c. Application.
    - d. Dates of use.
    - e. Dates of calibration.



3.12 VERIFICATION OF TAB REPORT

- A. Owner may randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
- B. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
- C. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
- D. If TAB work fails, proceed as follows:
  - 1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
  - 2. If the second final inspection also fails, Owner may contract the services of another TAB specialist to complete TAB work according to the Contract Documents and deduct the cost of the services from the original TAB specialist's final payment.
  - 3. If the second verification also fails, Owner may contact AABC Headquarters regarding the AABC National Performance Guaranty.
- E. Prepare test and inspection reports.

END OF SECTION

## SECTION 23 07 13 DUCT INSULATION

## PART 1 - GENERAL

## 1.01 SUMMARY

- A. Section includes insulating the following duct services:

1. Indoor supply, return, exhaust and outdoor air.

## 1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).

## 1.03 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
  2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

## 1.04 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

## 1.05 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields.
- B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

## 1.06 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

## PART 2 - PRODUCTS

## 2.01 INSULATION MATERIALS

- A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- F. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- G. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied ASJ complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

## 2.02 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
- C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

## 2.03 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
  2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
  3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
  4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
  5. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested according to ASTM E 96/E 96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

## 2.04 TAPES

- A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
1. Width: 3 inches.
  2. Thickness: 6.5 mils.
  3. Adhesion: 90 ounces force/inch in width.
  4. Elongation: 2 percent.
  5. Tensile Strength: 40 lbf/inch in width.
  6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

## 2.05 SECUREMENTS

- A. Insulation Pins and Hangers:
1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, length to suit depth of insulation indicated.
  2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
  3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
    - a. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
    - b. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
  4. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
    - a. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

## PART 3 - EXECUTION

## 3.01 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
  - 1. Verify that systems to be insulated have been tested and are free of defects.
  - 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.02 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

## 3.03 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.
- B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Keep insulation materials dry during application and finishing.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

- K. Install insulation with factory-applied jackets as follows:
1. Draw jacket tight and smooth.
  2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches on center.
  3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches on center.
    - a. For below ambient services, apply vapor-barrier mastic over staples.
  4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
  5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

#### 3.04 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, of duct and plenum surfaces.
  2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
  3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
    - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    - b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    - d. Do not overcompress insulation during installation.
    - e. Impale insulation over pins and attach speed washers.
    - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
    - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
  5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches on center.
  6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
  7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches on center.
- B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area of duct and plenum surfaces.
  2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
  3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
    - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    - b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    - d. Do not overcompress insulation during installation.
    - e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
  - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
  - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches on center.

### 3.05 DUCT INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation: Refer to General Notes on drawings.
- B. Items Not Insulated:
  1. Fibrous-glass ducts.
  2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
  3. Factory-insulated flexible ducts.
  4. Factory-insulated plenums and casings.
  5. Flexible connectors.
  6. Vibration-control devices.
  7. Factory-insulated access panels and doors.

END OF SECTION



## SECTION 23 11 23

## FACILITY NATURAL-GAS PIPING

## PART 1 - GENERAL

## 1.01 SUMMARY

## A. Section Includes:

1. Pipes, tubes, and fittings.
2. Piping specialties.
3. Piping and tubing joining materials.
4. Manual gas shutoff valves.
5. Pressure regulators.
6. Service meters.

## 1.02 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

## 1.03 ACTION SUBMITTALS

## A. Product Data: For each type of the following:

1. Piping specialties.
2. Valves. Include pressure rating, capacity, settings, and connection data of selected models.
3. Pressure regulators. Indicate pressure ratings and capacities.
4. Service meters. Indicate pressure ratings and capacities. Include bypass fittings.

## 1.04 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: to include in emergency, operation, and maintenance manuals.

## 1.05 QUALITY ASSURANCE

- A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

## 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.
- B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.
- D. Protect stored HDPE pipes and valves from direct sunlight.

## 1.07 PROJECT CONDITIONS

- A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.

## 1.08 COORDINATION

- A. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces.

## PART 2 - PRODUCTS

## 2.01 PERFORMANCE REQUIREMENTS

- A. Minimum Operating-Pressure Ratings:
  - 1. Piping and Valves: 100 psig minimum unless otherwise indicated.
  - 2. Service Regulators: 65 psig minimum unless otherwise indicated.
- B. Natural-Gas System Pressure within Buildings: 1.0 psig or less.
- C. Natural-Gas System Pressures outside Buildings: 2.0 psig or less.

## 2.02 PIPES, TUBES, AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
  - 1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
  - 2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
  - 3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.

4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
    - a. Material Group: 1.1.
    - b. End Connections: Threaded or butt welding to match pipe.
    - c. Lapped Face: Not permitted underground.
    - d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
    - e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.
  5. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and HDPE.
    - a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink HDPE sleeves.
  6. Mechanical Couplings:
    - a. Steel flanges and tube with epoxy finish.
    - b. Buna-nitrile seals.
    - c. Steel bolts, washers, and nuts.
    - d. Coupling shall be capable of joining HDPE pipe to HDPE pipe, steel pipe to HDPE pipe, or steel pipe to steel pipe.
    - e. Steel body couplings installed underground on plastic pipe shall be factory equipped with anode.
- B. HDPE Pipe: ASTM D 2513, SDR 11.
1. HDPE Fittings: ASTM D 2683, socket-fusion type or ASTM D 3261, butt-fusion type with dimensions matching HDPE pipe.
  2. HDPE Transition Fittings: Factory-fabricated fittings with HDPE pipe complying with ASTM D 2513, SDR 11; and steel pipe complying with ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
  3. Anodeless Service-Line Risers: Factory fabricated and leak tested.
    - a. Underground Portion: HDPE pipe complying with ASTM D 2513, SDR 11 inlet.
    - b. Casing: Steel pipe complying with ASTM A 53/A 53M, Schedule 40, black steel, Type E or S, Grade B, with corrosion-protective coating covering. Vent casing aboveground.
    - c. Aboveground Portion: HDPE transition fitting.
    - d. Outlet shall be threaded or flanged or suitable for welded connection.
    - e. Tracer wire connection.
    - f. Ultraviolet shield.
    - g. Stake supports with factory finish to match steel pipe casing or carrier pipe.
  4. Transition Service-Line Risers: Factory fabricated and leak tested.
    - a. Underground Portion: HDPE pipe complying with ASTM D 2513, SDR 11 inlet connected to steel pipe complying with ASTM A 53/A 53M, Schedule 40, Type E or S, Grade B, with corrosion-protective coating for aboveground outlet.
    - b. Outlet shall be threaded or flanged or suitable for welded connection.
    - c. Bridging sleeve over mechanical coupling.
    - d. Factory-connected anode.
    - e. Tracer wire connection.
    - f. Ultraviolet shield.
    - g. Stake supports with factory finish to match steel pipe casing or carrier pipe.

## 2.03 PIPING SPECIALTIES

## A. Appliance Flexible Connectors:

1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
4. Corrugated stainless-steel tubing with polymer coating.
5. Operating-Pressure Rating: 0.5 psig.
6. End Fittings: Zinc-coated steel.
7. Threaded Ends: Comply with ASME B1.20.1.
8. Maximum Length: 72 inches

- B. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

## 2.04 JOINING MATERIALS

- A. Joint Compound and Tape: Suitable for natural gas.

- B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

## 2.05 MANUAL GAS SHUTOFF VALVES

- A. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.

- B. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.

1. CWP Rating: 125 psig.
2. Threaded Ends: Comply with ASME B1.20.1.
3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
6. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.

- C. General Requirements for Metallic Valves, NPS 2-1/2 and Larger: Comply with ASME B16.38.

1. CWP Rating: 125 psig.
2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
3. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
4. Service Mark: Initials "WOG" shall be permanently marked on valve body.

- D. One-Piece, Bronze Ball Valve with Bronze Trim: MSS SP-110.
1. Body: Bronze, complying with ASTM B 584.
  2. Ball: Chrome-plated brass.
  3. Stem: Bronze; blowout proof.
  4. Seats: Reinforced TFE; blowout proof.
  5. Packing: Separate packnut with adjustable-stem packing threaded ends.
  6. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
  7. CWP Rating: 600 psig.
  8. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
  9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- E. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.
1. Body: Bronze, complying with ASTM B 584.
  2. Ball: Chrome-plated bronze.
  3. Stem: Bronze; blowout proof.
  4. Seats: Reinforced TFE; blowout proof.
  5. Packing: Threaded-body packnut design with adjustable-stem packing.
  6. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
  7. CWP Rating: 600 psig.
  8. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
  9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- F. Two-Piece, Regular-Port Bronze Ball Valves with Bronze Trim: MSS SP-110.
1. Body: Bronze, complying with ASTM B 584.
  2. Ball: Chrome-plated bronze.
  3. Stem: Bronze; blowout proof.
  4. Seats: Reinforced TFE.
  5. Packing: Threaded-body packnut design with adjustable-stem packing.
  6. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
  7. CWP Rating: 600 psig.
  8. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
  9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- G. Bronze Plug Valves: MSS SP-78.
1. Body: Bronze, complying with ASTM B 584.
  2. Plug: Bronze.
  3. Ends: Threaded, socket, or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
  4. Operator: Square head or lug type with tamperproof feature where indicated.
  5. Pressure Class: 125 psig.

6. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
  7. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- H. Cast-Iron, Nonlubricated Plug Valves: MSS SP-78.
1. Body: Cast iron, complying with ASTM A 126, Class B.
  2. Plug: Bronze or nickel-plated cast iron.
  3. Seat: Coated with thermoplastic.
  4. Stem Seal: Compatible with natural gas.
  5. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
  6. Operator: Square head or lug type with tamperproof feature where indicated.
  7. Pressure Class: 125 psig.
  8. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
  9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- I. Cast-Iron, Lubricated Plug Valves: MSS SP-78.
1. Body: Cast iron, complying with ASTM A 126, Class B.
  2. Plug: Bronze or nickel-plated cast iron.
  3. Seat: Coated with thermoplastic.
  4. Stem Seal: Compatible with natural gas.
  5. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
  6. Operator: Square head or lug type with tamperproof feature where indicated.
  7. Pressure Class: 125 psig.
  8. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
  9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- J. HDPE Ball Valves: Comply with ASME B16.40.
1. Body: HDPE.
  2. Ball: HDPE.
  3. Stem: Acetal.
  4. Seats and Seals: Nitrile.
  5. Ends: Plain or fusible to match piping.
  6. CWP Rating: 80 psig.
  7. Operating Temperature: Minus 20 to plus 140 deg F.
  8. Operator: Nut or flat head for key operation.
  9. Include plastic valve extension.
  10. Include tamperproof locking feature for valves where indicated on Drawings.
- K. Valve Boxes:
1. Cast-iron, two-section box.
  2. Top section with cover with "GAS" lettering.
  3. Bottom section with base to fit over valve and barrel a minimum of 5 inches in diameter.
  4. Adjustable cast-iron extensions of length required for depth of bury.
  5. Include tee-handle, steel operating wrench with socket end fitting valve nut or flat head, and with stem of length required to operate valve.

## 2.06 PRESSURE REGULATORS

## A. General Requirements:

1. Single stage and suitable for natural gas.
2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 and smaller; flanged for regulators NPS 2-1/2 and larger.

## B. Service Pressure Regulators: Comply with ANSI Z21.80.

1. Body and Diaphragm Case: Cast iron or die-cast aluminum.
2. Springs: Zinc-plated steel; interchangeable.
3. Diaphragm Plate: Zinc-plated steel.
4. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
5. Orifice: Aluminum; interchangeable.
6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
7. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
8. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
9. Overpressure Protection Device: Factory mounted on pressure regulator.
10. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
11. Maximum Inlet Pressure: 100 psig.

## C. Line Pressure Regulators: Comply with ANSI Z21.80.

1. Body and Diaphragm Case: Cast iron or die-cast aluminum.
2. Springs: Zinc-plated steel; interchangeable.
3. Diaphragm Plate: Zinc-plated steel.
4. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
5. Orifice: Aluminum; interchangeable.
6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
7. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
8. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
9. Overpressure Protection Device: Factory mounted on pressure regulator.
10. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.

## D. Appliance Pressure Regulators: Comply with ANSI Z21.18.

1. Body and Diaphragm Case: Die-cast aluminum.
2. Springs: Zinc-plated steel; interchangeable.
3. Diaphragm Plate: Zinc-plated steel.
4. Seat Disc: Nitrile rubber.
5. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.

6. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
7. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.

## 2.07 SERVICE METERS

A. Furnish meter type as required by gas utility company; verify requirements with utility.

B. Diaphragm Type Service Meters: Comply with ANSI B109.1 or ANSI B109.2.

1. Case: Die-cast aluminum.
2. Connections: Steel threads.
3. Diaphragm: Synthetic fabric.
4. Diaphragm Support Bearings: Self-lubricating.
5. Compensation: Continuous temperature and pressure.
6. Meter Index: Cubic feet.
7. Meter Case and Index: Tamper resistant.
8. Remote meter reader compatible.
9. Maximum Inlet Pressure: 100 psig.
10. Accuracy: Maximum plus or minus 1.0 percent.

C. Rotary-Type Service Meters: Comply with ANSI B109.3.

1. Case: Extruded aluminum.
2. Connection: Flange.
3. Impellers: Polished aluminum.
4. Rotor Bearings: Self-lubricating.
5. Compensation: Continuous temperature and pressure.
6. Meter Index: Cubic feet.
7. Tamper resistant.
8. Remote meter reader compatible.
9. Maximum Inlet Pressure: 100 psig.
10. Accuracy: Maximum plus or minus 2.0 percent.

D. Turbine Meters: Comply with ASME MFC-4M.

1. Housing: Cast iron or welded steel.
2. Connection Threads or Flanges: Steel.
3. Turbine: Aluminum or plastic.
4. Turbine Bearings: Self-lubricating.
5. Compensation: Continuous temperature and pressure.
6. Meter Index: Cubic feet.
7. Tamper resistant.
8. Remote meter reader compatible.
9. Maximum Inlet Pressure: 100 psig.
10. Accuracy: Maximum plus or minus 2.0 percent.

E. Service-Meter Bypass Fittings:

1. Ferrous, tee, pipe fitting with capped side inlet for temporary natural-gas supply.
2. Integral ball-check bypass valve.



## 2.08 LABELING AND IDENTIFYING

- A. Detectable Warning Tape: Acid- and alkali-resistant, HDPE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 PREPARATION

- A. Close equipment shutoff valves before turning off natural gas to premises or piping section.
- B. Inspect natural-gas piping according to the International Fuel Gas Code to determine that natural-gas utilization devices are turned off in piping section affected.
- C. Comply with the International Fuel Gas Code requirements for prevention of accidental ignition.

### 3.03 OUTDOOR PIPING INSTALLATION

- A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.
- B. Install underground, natural-gas piping buried at least 36 inches below finished grade. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.
  - 1. If natural-gas piping is installed less than 36 inches below finished grade, install it in containment conduit.
- C. Install underground, HDPE, natural-gas piping according to ASTM D 2774.
- D. Install fittings for changes in direction and branch connections.

### 3.04 INDOOR PIPING INSTALLATION

- A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

- C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.
- D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- G. Locate valves for easy access.
- H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.
- I. Install piping free of sags and bends.
- J. Install fittings for changes in direction and branch connections.
- K. Verify final equipment locations for roughing-in.
- L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.
- M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
  - 1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.
- N. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.
- O. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.
- P. Concealed Location Installations: Except as specified below, install concealed natural-gas piping and piping installed under the building in containment conduit constructed of steel pipe with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.
  - 1. Above Accessible Ceilings: Natural-gas piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.
  - 2. In Floors: Install natural-gas piping with welded or brazed joints and protective coating in cast-in-place concrete floors. Cover piping to be cast in concrete slabs with minimum of 1-1/2 inches of concrete. Piping may not be in physical contact with other metallic structures such as reinforcing rods or electrically neutral conductors. Do not embed piping in concrete slabs containing quick-set additives or cinder aggregate.

- 3. In Floor Channels: Install natural-gas piping in floor channels. Channels must have cover and be open to space above cover for ventilation.
  - 4. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.
    - a. Exception: Tubing passing through partitions or walls does not require striker barriers.
  - 5. Prohibited Locations:
    - a. Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
    - b. Do not install natural-gas piping in solid walls or partitions.
  - Q. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
  - R. Connect branch piping from top or side of horizontal piping.
  - S. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.
  - T. Do not use natural-gas piping as grounding electrode.
  - U. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.
  - V. Install sleeves for piping penetrations of walls, ceilings, and floors.
  - W. Install sleeve seals for piping penetrations of concrete walls and slabs.
  - X. Install escutcheons for piping penetrations of walls, ceilings, and floors.
- 3.05 SERVICE-METER ASSEMBLY INSTALLATION
- A. Install service-meter assemblies aboveground and in accordance with the gas utility company's requirements.
  - B. Install metal shutoff valves upstream from service regulators. Shutoff valves are not required at second regulators if two regulators are installed in series.
  - C. Install strainer on inlet of service-pressure regulator and meter set.
  - D. Install service regulators mounted outside with vent outlet horizontal or facing down. Install screen in vent outlet if not integral with service regulator.
  - E. Install metal shutoff valves upstream from service meters.
  - F. Install service meters downstream from pressure regulators.
  - G. Install metal bollards to protect meter assemblies.
- 3.06 VALVE INSTALLATION
- A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.

- B. Install underground valves with valve boxes.
- C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.
- D. Install anode for metallic valves in underground HDPE piping.

### 3.07 PIPING JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints:
  - 1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
  - 2. Cut threads full and clean using sharp dies.
  - 3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
  - 4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
  - 5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- D. Welded Joints:
  - 1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
  - 2. Bevel plain ends of steel pipe.
  - 3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.
- E. HDPE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
  - 1. Plain-End Pipe and Fittings: Use butt fusion.
  - 2. Plain-End Pipe and Socket Fittings: Use socket fusion.

### 3.08 HANGER AND SUPPORT INSTALLATION

- A. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
  - 1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
  - 2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
  - 3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
  - 4. NPS 2-1/2 to NPS 3-1/2: Maximum span, 10 feet; minimum rod size, 1/2 inch.
  - 5. NPS 4 and Larger: Maximum span, 10 feet; minimum rod size, 5/8 inch.

### 3.09 CONNECTIONS

- A. Connect to utility's gas main according to utility's procedures and requirements.

- B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.
  - C. Install piping adjacent to appliances to allow service and maintenance of appliances.
  - D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.
  - E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.
- 3.10 LABELING AND IDENTIFYING
- A. Above ground piping: install permanent "NATURAL GAS" labels with flow arrows at 20 foot intervals.
  - B. Install detectable warning tape directly above underground gas piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.
- 3.11 PAINTING
- A. Clean, prime, and paint exposed, exterior metal piping, valves, service regulators, service meters and meter bars, and piping specialties, except components, with factory-applied paint or protective coating.
  - B. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.
- 3.12 FIELD QUALITY CONTROL
- A. Perform tests and inspections.
  - B. Tests and Inspections:
    - 1. Test, inspect, and purge natural gas according to the International Fuel Gas Code and authorities having jurisdiction.
  - C. Natural-gas piping will be considered defective if it does not pass tests and inspections.
  - D. Prepare test and inspection reports.
- 3.13 OUTDOOR PIPING SCHEDULE
- A. Underground natural-gas piping shall be the following:
    - 1. HDPE pipe and fittings joined by heat fusion, or mechanical couplings; service-line risers with tracer wire terminated in an accessible location.
  - B. Aboveground natural-gas piping shall be one of the following:
    - 1. Steel pipe with malleable-iron fittings and threaded joints.
    - 2. Steel pipe with wrought-steel fittings and welded joints.

- C. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.
- 3.14 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 5 PSIG
- A. Aboveground, distribution piping shall be one of the following:
1. Steel pipe with malleable-iron fittings and threaded joints.
  2. Steel pipe with wrought-steel fittings and welded joints.
- B. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.
- C. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.
- 3.15 UNDERGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE
- A. Connections to Existing Gas Piping: Use valve and fitting assemblies made for tapping utility's gas mains and listed by an NRTL.
- B. Underground:
1. HDPE valves.
  2. NPS 2 and Smaller: Bronze plug valves.
  3. NPS 2-1/2 and Larger: Cast-iron, lubricated plug valves.
- 3.16 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE
- A. Valves for pipe sizes NPS 2 and smaller at service meter shall be one of the following:
1. One-piece, bronze ball valve with bronze trim.
  2. Two-piece, full-port, bronze ball valves with bronze trim.
  3. Bronze plug valve.
- B. Valves for pipe sizes NPS 2-1/2 and larger at service meter shall be one of the following:
1. Two-piece, full-port, bronze ball valves with bronze trim.
  2. Bronze plug valve.
  3. Cast-iron, nonlubricated plug valve.
- C. Distribution piping valves for pipe sizes NPS 2 and smaller shall be one of the following:
1. One-piece, bronze ball valve with bronze trim.
  2. Two-piece, full-port, bronze ball valves with bronze trim.
  3. Bronze plug valve.
- D. Distribution piping valves for pipe sizes NPS 2-1/2 and larger shall be one of the following:
1. Two-piece, full-port, bronze ball valves with bronze trim.
  2. Bronze plug valve.
  3. Cast-iron, lubricated plug valve.

- E. Valves in branch piping for single appliance shall be one of the following:
1. One-piece, bronze ball valve with bronze trim.
  2. Two-piece, full-port, bronze ball valves with bronze trim.
  3. Bronze plug valve.

END OF SECTION

## SECTION 23 31 13

## METAL DUCTS

## PART 1 - GENERAL

## 1.1 SUMMARY

## A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Single-wall round ducts and fittings.
3. Sheet metal materials.
4. Sealants and gaskets.
5. Hangers and supports.

## 1.2 PERFORMANCE REQUIREMENTS

- A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

## 1.3 ACTION SUBMITTALS

## A. Product Data: For each type of the following products:

1. Ductwork
2. Sealants and gaskets.

## B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment and vibration isolation.

## 1.4 QUALITY ASSURANCE

- A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."



- B. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

## PART 2 - PRODUCTS

### 2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

### 2.2 SINGLE-WALL ROUND DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
- B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).
- C. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
  - 1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

- D. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
  2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.
- E. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

### 2.3 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
1. Galvanized Coating Designation: G60.
  2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

### 2.4 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. Two-Part Tape Sealing System:
1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
  2. Sealant: Modified styrene acrylic.
  3. Water resistant.
  4. Mold and mildew resistant.
  5. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
  6. Service: Indoor and outdoor.
  7. Service Temperature: Minus 40 to plus 200 deg F.
  8. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.

- C. Water-Based Joint and Seam Sealant:
1. Application Method: Brush on.
  2. Solids Content: Minimum 65 percent.
  3. Shore A Hardness: Minimum 20.
  4. Water resistant.
  5. Mold and mildew resistant.
  6. VOC: Maximum 75 g/L (less water).
  7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
  8. Service: Indoor or outdoor.
  9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- D. Flanged Joint Sealant: Comply with ASTM C 920.
1. General: Single-component, acid-curing, silicone, elastomeric.
  2. Type: S.
  3. Grade: NS.
  4. Class: 25.
  5. Use: O.
- E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

## 2.5 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
- D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
- F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- H. Trapeze and Riser Supports:
1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

## PART 3 - EXECUTION

## 3.1 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install ducts in maximum practical lengths.
- D. Install ducts with fewest possible joints.
- E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.
- K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

## 3.2 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

- D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

### 3.3 DUCT SEALING

- A. Seal ducts "Seal Class A" according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

### 3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
  - 1. Where practical, install concrete inserts before placing concrete.
  - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
  - 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
  - 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

### 3.5 CONNECTIONS

- A. Make connections to equipment with flexible connectors.
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

### 3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Duct system will be considered defective if it does not pass tests and inspections.

- C. Prepare test and inspection reports.
- 3.7 START UP
- A. Air Balance: Comply with requirements in Section 23 05 93 "Testing, Adjusting, and Balancing for HVAC."
- 3.8 DUCT SCHEDULE
- A. Fabricate ducts with galvanized sheet steel.
  - B. Elbow Configuration:
    - 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
      - a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
      - b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
      - c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
    - 2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
      - a. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
      - b. Round Elbows, 14 Inches and Larger in Diameter: Standing seam or Welded.

END OF SECTION

SECTION 23 34 23

HVAC PROPELLER WALL FANS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Propeller wall fans.

1.02 PERFORMANCE REQUIREMENTS

- A. Operating Limits: Classify according to AMCA 99.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories.

1.04 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.05 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Belts: One set(s) for each belt-driven unit.

1.06 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.
- C. UL Standards: Power ventilators shall comply with UL 705. Power ventilators for use for restaurant kitchen exhaust shall also comply with UL 762.

1.07 COORDINATION

- A. Coordinate size and location of structural-steel support members.

## PART 2 - PRODUCTS

## 2.01 PROPELLER WALL FANS

- A. Housing: Galvanized-steel sheet with flanged edges and integral orifice ring with baked-enamel finish coat applied after assembly.
- B. Steel Fan Wheels: Formed-steel blades riveted to heavy-gage steel spider bolted to cast-iron hub.
- C. Fan Wheel: Replaceable, cast or extruded-aluminum, airfoil blades fastened to cast-aluminum hub; factory set pitch angle of blades.
- D. Fan Drive: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing.
- E. Fan Drive:
  - 1. Resiliently mounted to housing.
  - 2. Statically and dynamically balanced.
  - 3. Selected for continuous operation at maximum rated fan speed and motor horsepower, with final alignment and belt adjustment made after installation.
  - 4. Extend grease fitting to accessible location outside of unit.
  - 5. Service Factor Based on Fan Motor Size: 1.4.
  - 6. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
  - 7. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings. Pulleys: Cast iron with split, tapered bushing; dynamically balanced at factory.
  - 8. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
  - 9. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
  - 10. Belt Guards: Fabricate of steel for motors mounted on outside of fan cabinet.
- F. Accessories: Refer to drawings.
- G. Capacities and Characteristics: Refer to drawings.

## 2.02 MOTORS

- A. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
- B. Enclosure Type: Totally enclosed, fan cooled.

## 2.03 SOURCE QUALITY CONTROL

- A. Certify sound-power level ratings according to AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.



- B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

### PART 3 - EXECUTION

#### 3.01 INSTALLATION

- A. Install power ventilators level and plumb.
- B. Install units with clearances for service and maintenance.
- C. Install in accordance with manufacturer's installation instructions.

#### 3.02 CONNECTIONS

- A. Ground and wire equipment according to Division 26.

#### 3.03 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. Verify that shipping, blocking, and bracing are removed.
  - 2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
  - 3. Verify that cleaning and adjusting are complete.
  - 4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
  - 5. Adjust belt tension.
  - 6. Adjust damper linkages for proper damper operation.
  - 7. Verify lubrication for bearings and other moving parts.
  - 8. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
  - 9. Shut unit down and reconnect automatic temperature-control operators.
  - 10. Remove and replace malfunctioning units and retest as specified above.
- C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Prepare test and inspection reports.

3.04 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Adjust belt tension.
- C. Replace fan and motor pulleys as required to achieve design airflow.
- D. Lubricate bearings.

END OF SECTION

SECTION 23 34 39 HIGH-VOLUME, LOW-SPEED FANS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes high-volume, low-speed fans.

1.02 DEFINITIONS

- A. HVLS - High volume, low speed.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  1. Include plans, elevations, sections, and mounting details.
  2. Include details of equipment assemblies. Show dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection. Include diagrams for power, signal, and control wiring.
  3. Include rated capacities, furnished specialties, and accessories for each fan.
  4. Certified fan performance curves with system operating conditions indicated.
  5. Certified fan sound-power ratings.
  6. Motor ratings and electrical characteristics, plus motor and electrical accessories.
  7. Material thickness and finishes, including color charts.
  8. Fan speed controllers.

1.04 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For HVLS fans to include in emergency, operation, and maintenance manuals.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by HVLS fan manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store products in a clean and dry place.
- B. Comply with manufacturer's written rigging and installation instructions for unloading and moving to final installed location.
- C. Handle products carefully to prevent damage, breaking, denting, and scoring. Do not install damaged products.

- D. Protect products from weather, dirt, dust, water, construction debris, and physical damage.
  - 1. Retain factory-applied coverings on equipment to protect finishes during construction and remove just prior to operating unit.
  - 2. Cover unit openings before installation to prevent dirt and dust from entering inside of units. If required to remove coverings during unit installation, reapply coverings over openings after unit installation and remove just prior to operating unit.
- E. Replace installed products damaged during construction.

## PART 2 - PRODUCTS

### 2.01 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. UL Compliance: Listed and labeled to UL 507.
- C. CSA Compliance: Listed and labeled to CSA C22.2, No. 113.
- D. Comply with NFPA 13 requirements for HVLS fans.
- E. AMCA Compliance:
  - 1. Test HVLS fans according to AMCA 230.
  - 2. Certify HVLS fan performance according to AMCA 211.

### 2.02 HIGH-VOLUME, LOW-SPEED FANS

- A. Description: Factory-assembled and -tested horizontal, non-ducted fan unit, consisting of large-diameter blade set, direct-drive electric motor, with variable-speed motor controller.
  - 1. Provide fan designed to circulate large air volume, vertically, at low velocity.
  - 2. Maximum Operating Temperature: 140 deg F.
  - 3. Blades: Airfoil type.
  - 4. Wiring and Controls Enclosure:
    - a. NEMA 250, Class 1.
    - b. Grounded.
  - 5. Controls: Provide wall-mounted keypad.
    - a. Provide variable speed motor controller speed control.
  - 6. Accessories:
    - a. Mounting extension tube.

## PART 3 - EXECUTION

## 3.01 EXAMINATION

- A. Examine conditions for compliance with requirements for installation tolerances and other conditions affecting HVLS fan performance, maintenance, and operations.
  - 1. Fan locations indicated on Drawings are approximate. Determine exact locations before roughing-in for mounting, control, and electrical connections.
- B. Examine roughing-in for mounting location, anchor-bolt sizes, and locations, to verify actual locations for mounting connections before installation of fan.
- C. Examine areas for suitable conditions where fan will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.02 INSTALLATION OF HIGH-VOLUME LOW-SPEED FANS

- A. Install fan according to manufacturer's published instructions.
- B. Comply with NECA 1 and NFPA 70.
- C. Comply with NFPA 13 for installation of HVLS fans and maximum allowable fan diameter. Center HVLS fans between four adjacent sprinklers. Minimum vertical clearance from HVLS fan to sprinkler deflector is 3 feet.
- D. Comply with NFPA 72 and interlock HVLS fans to shut down upon receiving an alarm from fire alarm system.
- E. Equipment Mounting:
  - 1. Anchor fan to building structure with manufacturer's recommended mounting bracket for installed condition.
- F. Install unit to permit access for maintenance.
- G. Install parts and accessories shipped loose.

## 3.03 ELECTRICAL CONNECTIONS

- A. Connect wiring according to Division 26.
- B. Ground equipment according to Division 26.
- C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.
- D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
- E. Install power wiring to field-mounted electrical devices, furnished by fan manufacturer, but not factory mounted.

### 3.04 CONTROL CONNECTIONS

- A. Connect control wiring to field-mounted control devices.
- B. Connect control interlock wiring between HVLS fan and other equipment to provide a complete and functioning system.
- C. Connect control wiring between fan unit control interface and control system to provide remote control and monitoring.
- D. Install control devices furnished by manufacturer, but not factory mounted.
- E. Install control wiring to field-mounted control devices, furnished by fan manufacturer, but not factory mounted.
- F. Protect installed units from damage caused by other work.

### 3.05 FIELD QUALITY CONTROL

- A. Testing Agency, Owner Engaged: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Testing Agency, Contractor Engaged: Engage a qualified testing agency to perform tests and inspections.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- D. Perform the following tests and inspections:
  - 1. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Fan or components will be considered defective if fan or components do not pass tests and inspections.
- F. Prepare and submit test and inspection reports.

### 3.06 STARTUP SERVICE

- A. Perform startup service.
  - 1. Complete installation and startup checks according to manufacturer's written instructions.
  - 2. Verify that fan is secure on mountings and supporting devices and that connections to electrical systems are complete. Verify that proper thermal-overload protection is installed in motors, controllers and switches.
  - 3. Verify proper motor rotation direction and free fan rotation.
  - 4. Check bearing lubrication.
  - 5. Verify proper fan rotation.

3.07 CLEANING

- A. Clean equipment externally; remove coatings applied for protection during shipping and storage, foreign material, and oily residue according to manufacturer's written instructions. Following manufacturer's cleaning procedures, and clean with manufacturer-recommended cleaning products.

3.08 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain HVLS fans.

END OF SECTION

## SECTION 23 55 23.13 LOW-INTENSITY, GAS-FIRED, RADIANT HEATERS

## PART 1 - GENERAL

## 1.01 SUMMARY

- A. Section includes low-intensity, gas-fired, forced-draft radiant heaters.

## 1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include rated capacities, dimensions, operating characteristics, electrical characteristics, and furnished specialties and accessories.

## 1.03 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For gas-fired, radiant heaters to include in emergency, operation, and maintenance manuals.

## PART 2 - PRODUCTS

## 2.01 PERFORMANCE REQUIREMENTS

- A. CSA certified, with CSA Seal and certification number clearly visible on units indicating compliance with ANSI Z83.20/CSA 2.34.
- B. UL listed and labeled, with UL label clearly visible on units indicating compliance with ANSI Z83.20/CSA 2.34.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

## 2.02 FORCED-DRAFT HEATERS

- A. Description: Factory-assembled, indoor, overhead-mounted, electrically controlled, low-intensity, infrared radiant heating units using gas combustion. Heater to have all necessary factory-installed wiring and piping required prior to field installation and startup.
- B. Fuel Type: Design burner for natural gas having characteristics same as those of gas available at Project site.
- C. Burner Assembly:
  - 1. Combustion-Air Inlet: Non-ducted, unvented.
  - 2. Combustion-Air Inlet: Ducted horizontal to outdoors through sidewall with vent caps.
  - 3. Combustion-Air Inlet: Ducted vertical to outdoors through roof with vent caps.



4. Burner Control Housing: Corrosion-resistant, aluminized steel.
    - a. Totally enclosed with access cover.
    - b. Sight glass for visual inspection of burner.
  5. Burner: Stainless steel or One-piece cast iron.
  6. Ignition System: with flame rod sensing capabilities.
  7. Combustion Blower Fan: Dynamically balanced, direct-driven, forward-curved fan with impeller and steel housing, with a minimum temperature rating of 450 deg F.
    - a. Motor: Resilient-mounted, capacitor-start-capacitor-run type with sealed ball bearings; totally enclosed, nonventilated type with internal thermal protection.
    - b. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
- D. Combustion Chamber: 4-inch- diameter, aluminized-steel tubing with high-emissivity, high-temperature, corrosion-resistant external finish. Chambers shall be equipped with sight glass for burner and pilot flame observation.
- E. Emitter Tube: aluminized-steel tubing with high-emissivity, high-temperature, corrosion-resistant external finish.
- F. Reflector: with end caps. Shape to control radiation from tubing for uniform intensity at floor level with 100 percent cutoff above centerline of tubing. Reflectors or entire heater shall accommodate rotational adjustment from horizontal to a minimum 30-degree tilt from vertical.
- G. Accessories:
1. Stainless-steel flexible connector with manual valve for gas supply.
  2. Hanger chain with "S" hooks.

### 2.03 CONTROLS AND SAFETIES

- A. Gas Control Valve: regulated redundant 24-V ac gas valve that contains pilot solenoid valve, electric gas valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff all in one body.
- B. Failure Safeguards: 100 percent shutoff of gas flow in the event of flame or power failure.
- C. Prepurge of air control system prior to burner ignition.
- D. Blocked Vent Safety: Differential pressure switch in burner safety circuit to stop burner operation with high discharge or suction pressure.
- E. Control Panel Interlock: Stops burner if panel is open.
- F. Thermostat: wall-mounted type with 50 to 90 deg F operating range
  1. Control Transformer: Integrally mounted.

## PART 3 - EXECUTION

## 3.01 EXAMINATION

- A. Examine structures, substrates, areas and conditions, with Installer present, for compliance with requirements for installation tolerances, required clearances, and other conditions affecting performance of the Work.
- B. Examine roughing-in for fuel-gas piping to verify actual locations of piping connections before equipment installation.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.02 INSTALLATION

- A. Equipment Installation: Install gas-fired, radiant heaters and associated gas features and systems according to NFPA 54.
- B. Suspended Units: Suspend from substrate using chain hanger kits and building attachments.
- C. Maintain manufacturers' recommended clearances for combustibles.

## 3.03 CONNECTIONS

- A. Gas Piping: Comply with Section 23 11 23 "Facility Natural-Gas Piping." Connect gas piping to gas train inlet; provide union with enough clearance for burner removal and service.
  - 1. Gas Connections: Connect gas piping to radiant heaters according to NFPA 54.
- B. Where installing piping adjacent to gas-fired, radiant heaters, allow space for service and maintenance.
- C. Electrical Connections: Comply with applicable requirements in Division 26.
  - 1. Install electrical devices furnished with heaters but not specified to be factory mounted.

## 3.04 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Perform the following tests and inspections:
  - 1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
  - 2. Verify bearing lubrication.

- 3. Verify proper motor rotation.
  - 4. 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.
  
  - C. Gas-fired, radiant heaters will be considered defective if they do not pass tests and inspections.
  
  - D. Prepare test and inspection reports.
- 3.05 ADJUSTING
- A. Adjust initial-temperature set points.
  
  - B. Adjust burner and other unit components for optimum heating performance and efficiency.
- 3.06 DEMONSTRATION
- A. Train Owner's maintenance personnel to adjust, operate, and maintain gas-fired, radiant heaters.

END OF SECTION

## SECTION 23 81 29

## VARIABLE-REFRIGERANT-FLOW HVAC SYSTEMS

## PART 1 - GENERAL

## 1.01 SUMMARY

- A. Section includes complete VRF HVAC system(s) including, but not limited to, delegated design and the following components to make a complete operating system(s) according to requirements indicated:
1. Indoor, recessed, ceiling-mounted units.
  2. Indoor, energy recovery ventilator.
  3. Outdoor, air-source heat recovery units.
  4. Heat recovery control units.
  5. System controls.
  6. System refrigerant and oil.
  7. System condensate drain piping.
  8. System refrigerant piping.
  9. Metal hangers and supports.
  10. Metal framing systems.
  11. Fastener systems.
  12. Miscellaneous support materials.
  13. Piping and tubing insulation.
  14. System control cable and raceways.

## 1.02 DEFINITIONS

- A. Air-Conditioning System Operation: System capable of operation with all zones in cooling only.
- B. Heat-Pump System Operation: System capable of operation with all zones in either heating or cooling, but not with simultaneous heating and cooling zones that transfer heat between zones.
- C. Heat Recovery System Operation: System capable of operation with simultaneous heating and cooling zones that transfer heat between zones.
- D. HRCU: Heat Recovery Control Unit. HRCUs are used in heat recovery VRF HVAC systems to manage and control refrigerant between indoor units to provide simultaneous heating and cooling zones. "Heat Recovery Control Unit" is the term used by ASHRAE for what different manufacturers term as branch circuit controller, branch selector box, changeover box, flow selector unit, mode change unit, and other such terms.
- E. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.
- F. Plenum: A space forming part of the air distribution system to which one or more air ducts are connected. An air duct is a passageway, other than a plenum, for transporting air to or from heating, ventilating, or air-conditioning equipment.

- G. Three-Pipe System Design: One high pressure refrigerant vapor line, one low pressure refrigerant vapor line, and one refrigerant liquid line connect a single outdoor unit or multiple manifold outdoor units in a single system to associated system HRCUs. One liquid line and refrigerant vapor line connect HRCUs to associated indoor units.
  - H. Two-Pipe System Design: One refrigerant vapor line and one refrigerant liquid line connect a single outdoor unit or multiple manifold outdoor units in a single system to associated system HRCUs. One refrigerant liquid line and refrigerant vapor line connect HRCUs to associated indoor units. HRCUs used in two pipe systems act as an intermediate heat exchanger and include diverting valves and gas/liquid separators to move high and low pressure refrigerant between indoor units.
  - I. VRF: Variable refrigerant flow.
- 1.03 PREINSTALLATION MEETINGS
- A. Preinstallation Conference: Conduct conference at Project site.
- 1.04 ACTION SUBMITTALS
- A. Product Data: For each type of product.
    1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for indoor and outdoor units and for HRCUs.
    2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
    3. Include operating performance at design conditions and at extreme maximum and minimum outdoor ambient conditions.
    4. Include description of system controllers, dimensions, features, control interfaces and connections, power requirements, and connections.
    5. Include system operating sequence of operation in narrative form for each unique indoor- and outdoor-unit and HRCU control.
    6. Include description of control software features.
    7. Include total refrigerant required and a comprehensive breakdown of refrigerant required by each system installed.
    8. Include refrigerant type and data sheets showing compliance with requirements indicated.
    9. For system design software.
    10. Indicate location and type of service access.
  - B. Shop Drawings: For VRF HVAC systems.
    1. Include plans, elevations, sections, and mounting details.
    2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
    3. Include diagrams and details of refrigerant piping and tubing showing installation requirements for manufacturer-furnished divided flow fittings.
    4. Include diagrams for power, signal, and control wiring.

## C. Delegated-Design Submittals:

1. Include design calculations with corresponding diagram of refrigerant piping and tubing sizing for each system installed.
2. Include design calculations with corresponding floor plans indicating that refrigerant concentration limits are within allowable limits of ASHRAE 15 and governing codes.
3. Include calculations showing that system travel distance for refrigerant piping and controls cabling are within horizontal and vertical travel distances set by manufacturer. Provide a comparison table for each system installed.

## 1.05 INFORMATIONAL SUBMITTALS

## A. Qualification Data:

1. For Installer: Certificate from VRF HVAC system manufacturer certifying that Installer has successfully completed prerequisite training administered by manufacturer for proper installation of systems, including but not limited to, equipment, piping, controls, and accessories indicated and furnished for installation.
  - a. Retain copies of Installer certificates on-site and make available on request.
2. For VRF HVAC system manufacturer.
3. For VRF HVAC system provider.

## B. Source quality-control reports.

## C. Field quality-control reports.

## D. Sample Warranties: For manufacturer's warranties.

## 1.06 CLOSEOUT SUBMITTALS

## A. Operation and Maintenance Data: For VRF HVAC systems to include in emergency, operation, and maintenance manuals.

## B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On CD or DVD, USB media, or approved cloud storage platform, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

## 1.07 MAINTENANCE MATERIAL SUBMITTALS

## A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters:
  - a. One set(s) for each unit with replaceable filters.

## 1.08 QUALITY ASSURANCE

## A. Manufacturer Qualifications:

1. Nationally recognized manufacturer of VRF HVAC systems and products.
2. Shipped VRF HVAC systems with similar requirements to those indicated for a continuous period of five years within time of bid.
3. VRF HVAC systems and products that have been successfully tested and in use on at least five completed projects.
4. Having complete published catalog literature, installation, and operation and maintenance manuals for all products intended for use.
5. Having full-time in-house employees for the following:
  - a. Product research and development.
  - b. Product and application engineering.
  - c. Product manufacturing, testing, and quality control.
  - d. Technical support for system installation training, startup, commissioning, and troubleshooting of installations.
  - e. Owner training.

## B. Factory-Authorized Service Representative Qualifications:

1. Authorized representative of, and trained by, VRF HVAC system manufacturer.
2. Demonstrated past experience with products being installed for period within three consecutive years before time of bid.
3. Demonstrated past experience on five projects of similar complexity, scope, and value.
  - a. Each person assigned to Project shall have demonstrated past experience.
4. Staffing resources of competent and experienced full-time employees that are assigned to execute work according to schedule.
5. Service and maintenance staff assigned to support Project during warranty period.
6. Product parts inventory to support ongoing system operation for a period of not less than five years after Substantial Completion.
7. VRF HVAC system manufacturer's backing to take over execution of Work if necessary to comply with requirements indicated. Include Project-specific written letter, signed by manufacturer's corporate officer, if requested.

## C. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by VRF HVAC system manufacturer.

1. Each employee shall be certified by manufacturer for proper installation of systems, including, but not limited to, equipment, piping, controls, and accessories indicated and furnished for installation.
2. Installer certification shall be valid and current for duration of Project.
3. Retain copies of Installer certificates on-site and make available on request.
4. Each person assigned to Project shall have demonstrated past experience.
  - a. Demonstrated past experience with products being installed for period within three consecutive years before time of bid.
  - b. Demonstrated past experience on five projects of similar complexity, scope, and value.
5. Installers shall have staffing resources of competent, trained, and experienced full-time employees that are assigned to execute work according to schedule.

## 1.09 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store products in a clean and dry place.
- B. Comply with manufacturer's written rigging and installation instructions for unloading and moving to final installed location.
- C. Handle products carefully to prevent damage, breaking, denting, and scoring. Do not install damaged products.
- D. Protect products from weather, dirt, dust, water, construction debris, and physical damage.
  - 1. Retain factory-applied coverings on equipment to protect finishes during construction and remove just prior to operating unit.
  - 2. Cover unit openings before installation to prevent dirt and dust from entering inside of units. If required to remove coverings during unit installation, reapply coverings over openings after unit installation and remove just prior to operating unit.
- E. Replace installed products damaged during construction.

## 1.10 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace equipment and components that fail(s) in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures.
    - b. Faulty operation.
    - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
  - 2. Warranty Period:
    - a. For Compressor: Five year(s) from date of Substantial Completion.
    - b. For Parts, Including Controls: Five year(s) from date of Substantial Completion.
    - c. For Labor: Five year(s) from date of Substantial Completion.

## PART 2 - PRODUCTS

## 2.01 MANUFACTURERS

- A. Source Limitations: Obtain products from single source from single manufacturer including, but not limited to, the following:
  - 1. Indoor and outdoor units, including accessories.
  - 2. Controls and software.
  - 3. HRCUs.
  - 4. Refrigerant isolation valves.
  - 5. Specialty refrigerant pipe fittings.



## 2.02 SYSTEM DESCRIPTION

- A. Direct-expansion (DX) VRF HVAC system(s) with variable capacity in response to varying cooling and heating loads. System shall consist of multiple indoor units, HRCUs, outdoor unit(s), piping, controls, and electrical power to make complete operating system(s) complying with requirements indicated.
  - 1. Three-pipe system design.
  - 2. Each system with one refrigerant circuit shared by all indoor units connected to system.
- 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. AHRI Compliance: System and equipment performance certified according to AHRI 1230.
- D. ASHRAE Compliance:
  - 1. ASHRAE 15: For safety code for mechanical refrigeration.
  - 2. ASHRAE 62.1: For indoor air quality.
  - 3. ASHRAE 135: For control network protocol with remote communication.
  - 4. ASHRAE/IES 90.1 Compliance: For system and component energy efficiency.
- E. UL Compliance: Comply with UL 1995.

## 2.03 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified specialist to design complete and operational VRF HVAC system(s) complying with requirements indicated.
  - 1. Provide system refrigerant calculations.
    - a. Refrigerant concentration limits shall be within allowable limits of ASHRAE 15 and governing codes.
    - b. Indicate compliance with manufacturer's maximum vertical and horizontal travel distances. Prepare a comparison table for each system showing calculated distances compared to manufacturer's maximum allowed distances.
  - 2. System Refrigerant Piping and Tubing:
    - a. Arrangement: Arrange piping to interconnect indoor units, HRCUs, and outdoor unit(s) in compliance with manufacturer requirements and requirements indicated.
    - b. Routing: Conceal piping above ceilings and behind walls to maximum extent possible.
    - c. Sizing: Size piping system, using a software program acceptable to manufacturer, to provide performance requirements indicated. Consider requirements to accommodate future change requirements.
  - 3. System Controls:
    - a. Network arrangement.
    - b. Network interface with other building systems.
    - c. Product selection.
    - d. Sizing.

- B. Service Access:
1. Provide and document service access requirements.
  2. Locate equipment, system isolation valves, and other system components that require service and inspection in easily accessible locations. Avoid locations that are difficult to access if possible.
  3. Where serviceable components are installed behind walls and above inaccessible ceilings, provide finished assembly with access doors or panels to gain access. Properly size the openings to allow for service, removal, and replacement.
  4. If less than full and unrestricted access is provided, locate components within an 18-inch reach of the finished assembly.
  5. Where ladder access is required to service elevated components, provide an installation that provides for sufficient access within ladder manufacturer's written instructions for use.
  6. Comply with OSHA regulations.
- C. System Design and Installation Requirements:
1. Design and install systems indicated according to manufacturer's recommendations and written instructions.
  2. Where manufacturer's requirements differ from requirements indicated, contact Architect for direction. The most stringent requirements should apply unless otherwise directed in writing by Architect.
- D. System Adaptability to Future Changes: Arrange and size system refrigerant piping to accommodate future changes to system without having to resize and replace existing refrigerant piping.
1. Future changes to system(s) indicated on Drawings.
- E. Isolation of Equipment: Provide isolation valves to isolate each HRCU, indoor unit and outdoor unit for service, removal, and replacement without interrupting system operation.
- F. System Capacity Ratio: The sum of connected capacity of all indoor units shall be within the following range of outdoor-unit rated capacity:
1. Not less than 50 percent.
  2. Not more than 130 percent.
  3. Range acceptable to manufacturer.
- G. System Turndown: Stable operation down to 20 percent of outdoor-unit capacity.
- H. System Auto Refrigerant Charge: Each system shall have an automatic refrigerant charge function to ensure the proper amount of refrigerant is installed in system.

- I. Outdoor Conditions:
    - 1. Suitable for outdoor ambient conditions encountered.
      - a. Design equipment and supports to withstand wind loads of governing code.
      - b. Design equipment and supports to withstand snow and ice loads of governing code.
      - c. Provide corrosion-resistant coating for components and supports where located in coastal or industrial climates that are known to be harmful to materials and finishes.
    - 2. Maximum System Operating Outdoor Temperature: See Drawings.
    - 3. Minimum System Operating Outdoor Temperature: See Drawings.
  - J. Thermal Movements: Allow for controlled thermal movements from ambient, surface, and system temperature changes.
  - K. Capacities and Characteristics: As indicated on Drawings.
- 2.04 INDOOR, RECESSED, CEILING-MOUNTED UNITS
- A. Description: Factory-assembled and -tested complete unit with components, piping, wiring, and controls required for mating to ductwork, piping, power, and controls field connections.
  - B. Cabinet:
    - 1. Material: Painted steel, or coated steel frame covered by a plastic cabinet, with an architectural acceptable finish suitable for tenant occupancy on exposed surfaces.
    - 2. Insulation: Manufacturer's standard internal insulation, complying with ASHRAE 62.1, to provide thermal resistance and prevent condensation.
    - 3. Mounting: Manufacturer-designed provisions for field installation.
    - 4. Internal Access: Removable panels of adequate size for field access to internal components for inspection, cleaning, service, and replacement.
  - C. DX Coil Assembly:
    - 1. Coil Casing: Aluminum, galvanized, or stainless steel.
    - 2. Coil Fins: Aluminum, mechanically bonded to tubes, with arrangement required by performance.
    - 3. Coil Tubes: Copper, of diameter and thickness required by performance.
    - 4. Expansion Valve: Electronic modulating type with linear or proportional characteristics.
    - 5. Internal Tubing: Copper tubing with brazed joints.
    - 6. Internal Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
    - 7. Field Piping Connections: Manufacturer's standard.
    - 8. Factory Charge: Dehydrated air or nitrogen.
    - 9. Testing: Factory pressure tested and verified to be without leaks.

- D. Drain Assembly:
1. Pan: Non-ferrous material, with bottom sloped to low point drain connection.
  2. Condensate Removal: Unit-mounted pump or other integral lifting mechanism, capable of lifting drain water to an elevation above top of cabinet.
  3. Field Piping Connection: Non-ferrous material.
- E. Fan and Motor Assembly:
1. Fan(s):
    - a. Direct-drive arrangement.
    - b. Single or multiple fans connected to a common motor shaft and driven by a single motor.
    - c. Fabricated from non-ferrous components or ferrous components with corrosion protection finish.
    - d. Wheels statically and dynamically balanced.
  2. Motor: Brushless dc or electronically commutated with permanently lubricated bearings.
  3. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.
  4. Speed Settings and Control: Two (low, high), three (low, medium, high), or more than three speed settings or variable speed with a speed range of least 50 percent.
  5. Vibration Control: Integral isolation to dampen vibration transmission.
- F. Filter Assembly:
1. Access: Bottom, to accommodate filter replacement without the need for tools.
  2. Efficiency: ASHRAE 52.2, MERV 7.
  3. Media: If more than one filter type is indicated, Contractor has option to choose.
    - a. Replaceable: Extended surface, panel, or cartridge with antimicrobial treatment fiber media.
    - b. Washable: Manufacturer's standard filter with antimicrobial treatment.
- G. Discharge-Air Grille Assembly: Mounted in bottom of unit cabinet.
1. Discharge Pattern: One-, two-, three-, or four-way throw as indicated on Drawings.
    - a. Discharge Pattern Adjustment: Field-adjustable limits for up and down range of motion.
    - b. Discharge Pattern Closure: Ability to close individual discharges of units with multiple patterns.
  2. Motorized Vanes: Modulating up and down flow pattern for uniform room air distribution.
  3. Additional Branch Supply Duct Connection: Sheet metal knockout for optional connection to one additional supply branch duct.
- H. Return-Air Grille Assembly: Manufacturer's standard grille mounted in bottom of unit cabinet.
- I. Outdoor Air Ventilation Connection: Sheet metal knockout for optional connection to outdoor air ventilation duct.

## J. Unit Accessories:

1. Outdoor Air Ventilation Kit: Connection, motorized damper, and control to satisfy unit control sequence of operation indicated on Drawings.
2. Remote Room Temperature Sensor Kit: Wall-mounted, hardwired room temperature sensor kit for use in rooms that do not have room temperature measurement.

## K. Unit Controls:

1. Enclosure: Manufacturer's standard, and suitable for indoor locations.
2. Factory-Installed Controller: Configurable digital control.
3. Communication: Network communication with other indoor units and outdoor unit(s).
4. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
5. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

## L. Unit Electrical:

1. Enclosure: Manufacturer's standard, and suitable for indoor locations.
2. Field Connection: Single point connection to power entire unit and integral controls.
3. Disconnecting Means: Factory-mounted circuit breaker or switch, complying with NFPA 70.
4. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.
5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Raceways: Enclose line voltage wiring in metal raceways to comply with NFPA 70.

## 2.05 INDOOR, ENERGY RECOVERY VENTILATOR

A. Description: Factory-assembled and -tested complete unit with components, wiring, and controls required for mating to ductwork, power, and controls field connections.

## B. Cabinet:

1. Material: Galvanized steel.
2. Insulation: Manufacturer's standard internal insulation, complying with ASHRAE 62.1.
3. Duct Connections: Extended collar or flange, or designated exterior cabinet surface, designed for attaching field-installed ductwork.
4. Mounting: Manufacturer-designed provisions for field installation.
5. Internal Access: Removable panels or hinged doors of adequate size for field access to internal components for inspection, cleaning, service, and replacement.

- C. Fan and Motor Assemblies: Separate fan and motor assemblies for supply and exhaust airstreams with control for equal airflow.
1. Fan(s):
    - a. Direct-drive arrangement.
    - b. Fabricated from non-ferrous components or ferrous components with corrosion protection finish.
    - c. Wheels statically and dynamically balanced.
  2. Motor: Brushless dc or electronically commutated with permanently lubricated bearings.
  3. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.
  4. Speed Settings and Control: Two (low, high), three (low, medium, high), or more than three speed settings or variable speed with a speed range of least 50 percent.
  5. Vibration Control: Integral isolation to dampen vibration transmission.
- D. Filter Assemblies: Separate filter assemblies for outdoor air and exhaust airstreams entering energy recovery heat exchanger.
1. Access: To accommodate filter replacement without the need for tools.
  2. Efficiency: ASHRAE 52.2, MERV 7.
  3. Replaceable Media: Extended surface, panel, or cartridge with antimicrobial treatment fiber media.
- E. Energy Recovery Heat Exchanger:
1. Total (sensible and latent) energy exchange between outdoor air and exhaust airstreams with performance indicated on Drawings.
  2. Fixed element with no moving parts.
  3. AHRI 1060 certified and bearing the AHRI label.
- F. Unit Controls:
1. Enclosure: Metal, similar to enclosure, and suitable for indoor locations.
  2. Factory-Installed Controller: Configurable digital control.
  3. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
  4. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
- G. Unit Electrical:
1. Enclosure: Metal, similar to enclosure, and suitable for indoor locations.
  2. Field Connection: Single point connection to power entire unit and integral controls.
  3. Disconnecting Means: Factory-mounted circuit breaker or switch, complying with NFPA 70.
  4. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.
  5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
  6. Raceways: Enclose line voltage wiring in metal raceways to comply with NFPA 70.

## 2.06 OUTDOOR, AIR-SOURCE HEAT RECOVERY UNITS

- A. Description: Factory-assembled and -tested complete unit with components, piping, wiring, and controls required for mating to piping, power, and controls field connections.
1. Specially designed for use in systems with simultaneous heating and cooling.
  2. Systems shall consist of one unit, or multiple unit modules that are designed by variable refrigerant system manufacturer for field interconnection to make a single refrigeration circuit that connects multiple indoor units.
  3. All units installed shall be from the same product development generation.
- B. Cabinet:
1. Galvanized steel and coated with a corrosion-resistant finish.
  2. Mounting: Manufacturer-designed provisions for field installation on concrete base.
  3. Internal Access: Removable panels or hinged doors of adequate size for field access to internal components for inspection, cleaning, service, and replacement.
- C. Compressor and Motor Assembly:
1. One or more positive-displacement, direct-drive and hermetically sealed scroll compressor(s) with inverter drive and turndown to 15 percent of rated capacity.
  2. Protection: Integral protection against the following:
    - a. High refrigerant pressure.
    - b. Low oil level.
    - c. High oil temperature.
    - d. Thermal and overload.
    - e. Voltage fluctuations.
    - f. Phase failure and phase reversal.
    - g. Short cycling.
  3. Speed Control: Variable to automatically maintain refrigerant suction and condensing pressures while varying refrigerant flow to satisfy system cooling and heating loads.
  4. Vibration Control: Integral isolation to dampen vibration transmission.
  5. Oil management system to ensure safe and proper lubrication over entire operating range.
  6. Crankcase heaters with integral control to maintain safe operating temperature.
  7. Fusible plug.
- D. Condenser Coil Assembly:
1. Plate Fin Coils:
    - a. Casing: Aluminum, galvanized, or stainless steel.
    - b. Fins: Aluminum or copper, mechanically bonded to tubes, with arrangement required by performance.
    - c. Tubes: Copper, of diameter and thickness required by performance.

2. Aluminum Microchannel Coils:
    - a. Series of flat tubes containing a series of multiple, parallel-flow microchannels layered between refrigerant header manifolds.
    - b. Single- or multiple-pass arrangement.
    - c. Construct fins, tubes, and header manifolds of aluminum alloy.
  3. Hail Protection: Provide condenser coils with louvers, baffles, or hoods to protect against hail damage.
- E. Condenser Fan and Motor Assembly:
1. Fan(s): Propeller type.
    - a. Direct-drive arrangement.
    - b. Fabricated from non-ferrous components or ferrous components with corrosion protection finish to match performance indicated for condenser coil.
    - c. Statically and dynamically balanced.
  2. Fan Guards: Removable safety guards complying with OSHA regulations. If using metal materials, coat with corrosion-resistant coating to match performance indicated for condenser coil.
  3. Motor(s): Brushless dc or electronically commutated with permanently lubricated bearings and rated for outdoor duty.
  4. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.
  5. Speed Settings and Control: Variable speed with a speed range of least 75 percent.
  6. Vibration Control: Integral isolation to dampen vibration transmission.
- F. Drain Pan: If required by manufacturer's design, provide unit with non-ferrous drain pan with bottom sloped to a low point drain connection.
- G. Unit Controls:
1. Enclosure: Manufacturer's standard, and suitable for unprotected outdoor locations.
  2. Factory-Installed Controller: Configurable digital control.
  3. Factory-Installed Sensors:
    - a. Refrigerant suction temperature.
    - b. Refrigerant discharge temperature.
    - c. Outdoor air temperature.
    - d. Refrigerant high pressure.
    - e. Refrigerant low pressure.
    - f. Oil level.
  4. Communication: Network communication with indoor units and other outdoor unit(s).
  5. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
  6. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
- H. Unit Electrical:
1. Enclosure: Metal, similar to enclosure, and suitable for unprotected outdoor locations.
  2. Field Connection: Single point connection to power entire unit and integral controls.



3. Disconnecting Means: Factory-mounted circuit breaker or switch, complying with NFPA 70.
4. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.
5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Raceways: Enclose line voltage wiring in metal raceways to comply with NFPA 70.

I. Unit Piping:

1. Unit Tubing: Copper tubing with brazed joints.
2. Unit Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
3. Field Piping Connections: Manufacturer's standard.
4. Factory Charge: Dehydrated air or nitrogen.
5. Testing: Factory pressure tested and verified to be without leaks.

2.07 HEAT RECOVERY CONTROL UNITS (HRCUs)

A. Description: Factory-assembled and -tested complete unit with components, piping, wiring, and controls required for mating to piping, power, and controls field connections.

1. Specially designed for use in systems with simultaneous heating and cooling.
2. Systems shall consist of one unit, or multiple unit that are designed by variable refrigerant system manufacturer for field interconnection to make a single refrigeration circuit that connects multiple indoor units.

B. Cabinet:

1. Galvanized-steel construction.
2. Insulation: Manufacturer's standard internal insulation to provide thermal resistance and prevent condensation.
3. Mounting: Manufacturer-designed provisions for field installation.
4. Internal Access: Removable panels or hinged doors of adequate size for field access to internal components for inspection, cleaning, service, and replacement.

C. Drain Pan: If required by manufacturer's design, provide unit with non-ferrous drain pan with bottom sloped to a low point drain connection.

D. Refrigeration Assemblies and Specialties:

1. Specially designed by manufacturer for type of VRF HVAC system being installed, either - three pipe.
2. Each refrigerant branch circuit shall have refrigerant control valve(s) to control refrigerant flow.

3. Each system piping connection upstream of heat recovery unit shall be fitted with an isolation valve to allow for service to any heat recovery control unit in the system without interrupting operation of the system.
4. Each branch circuit connection shall be fitted with an isolation valve and capped service port to allow for service to any individual branch circuit without interrupting operation of the system.
  - a. If not available as an integral part of the heat recovery control unit, isolation valves shall be field installed adjacent to the unit pipe connection.

E. Unit Controls:

1. Enclosure: Manufacturer's standard, and suitable for indoor locations.
2. Factory-Installed Controller: Configurable digital control.
3. Features and Functions: Self-diagnostics, fuse protection,.
4. Communication: Network communication with indoor units and outdoor unit(s).
5. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

F. Unit Electrical:

1. Enclosure: Metal, similar to enclosure, and suitable for indoor locations.
2. Field Connection: Single point connection to power entire unit and integral controls.
3. Disconnecting Means: Factory-mounted circuit breaker or switch, complying with NFPA 70.
4. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.
5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Raceways: Enclose line voltage wiring in metal raceways to comply with NFPA 70.

G. Unit Piping:

1. Unit Tubing: Copper tubing with brazed joints.
2. Unit Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
3. Field Piping Connections: Manufacturer's standard.
4. Factory Charge: Dehydrated air or nitrogen.
5. Testing: Factory pressure tested and verified to be without leaks.

## 2.08 SYSTEM CONTROLS

A. General Requirements:

1. Network: Indoor units, HRCUs, and outdoor units shall include integral controls and connect through a TIA-485A or manufacturer-selected control network.
2. Network Communication Protocol: Manufacturer proprietary or open control communication between interconnected units.

3. Integration with Building Automation System: ASHRAE 135, BACnet IP and certified by BACnet Testing Lab (BTL), including the following:
  - a. Ethernet connection via RJ-45 connectors and port with transmission at 100 Mbps or higher.
  - b. Integration devices shall be connected to local uninterruptible power supply unit(s) to provide at least 5 minutes of battery backup operation after a power loss.
4. Operator Interface:
  - a. Operators shall interface with system and unit controls through the following:
    - 1) Operator interfaces integral to controllers.
    - 2) Owner-furnished PC connected to central controller(s).
    - 3) Web interface through web browser software.
    - 4) Integration with Building Automation System.
  - b. Users shall be capable of interface with controllers for indoor units control to extent privileges are enabled. Control features available to users shall include the following:
    - 1) On/off control.
    - 2) Temperature set-point adjustment.

B. Central Controllers:

1. Centralized control for all indoor and outdoor units from a single central controller location.
  - a. Include multiple interconnected controllers as required.
2. Controls operation mode of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units. Operation modes available through central controller shall match those operation modes of controllers for indoor units.
3. Schedule operation of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units.
  - a. Sets schedule for daily, weekly, and annual events.
  - b. Schedule options available through central controller shall at least include the schedule options of controllers for indoor units.
4. Changes operating set points of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units.
5. Optimized start feature to start indoor units before scheduled time to reach temperature set-point at scheduled time based on operating history.
6. Night setback feature to operate indoor units at energy-conserving heating and cooling temperature set-points during unoccupied periods.
7. Service diagnostics tool.
8. Able to disable and enable operation of individual controllers for indoor units.
9. Information displayed on individual controllers shall also be available for display through central controller.
10. Information displayed for outdoor units, including refrigerant high and low pressures.
11. Multiple RJ-45 ports for direct connection to a local PC and an Ethernet network switch.
12. Operator interface through a backlit, high-resolution color display touch panel.

C. Wired Controllers for Indoor Units:

1. Single controller capable of controlling multiple indoor units as group.
2. Auto Timeout Touch Screen LCD: Timeout duration shall be adjustable.
3. Multiple Language: English.

4. Temperature Units: Fahrenheit.
5. On/Off: Turns indoor unit on or off.
6. Hold: Hold operation settings until hold is released.
7. Operation Mode: Cool, Heat, Auto, Dehumidification, Fan Only, and Setback.
8. Temperature Display: 1-degree increments.
9. Temperature Set-Point: Separate set points for Cooling, Heating, and Setback. Adjustable in 1-degree increments between.
10. Relative Humidity Display: 1 percent increments.
11. Relative Humidity Set-Point: Adjustable in 1 percent increments between.
12. Fan Speed Setting: Select between available options furnished with the unit.
13. Airflow Direction Setting: If applicable to unit, select between available options furnished with the unit.
14. Seven-day programmable operating schedule.
15. Auto Off Timer: Operates unit for an adjustable time duration and then turns unit off.
16. Occupancy detection.
17. Service Notification Display: "Filter".
18. Service Run Tests: Limit use by service personnel to troubleshoot operation.
19. Error Code Notification Display: Used by service personnel to troubleshoot abnormal operation and equipment failure.
20. User and Service Passwords: Capable of preventing adjustments by unauthorized users.
21. Setting stored in nonvolatile memory to ensure that settings are not lost if power is lost. Battery backup for date and time only.
22. Low-voltage power required for controller shall be powered through non-polar connections to indoor unit.

## 2.09 SYSTEM REFRIGERANT AND OIL

### A. Refrigerant:

1. As required by VRF HVAC system manufacturer for system to comply with performance requirements indicated.
2. R-410a.

### B. Oil:

1. As required by VRF HVAC system manufacturer and to comply with performance requirements indicated.

## 2.10 SYSTEM CONDENSATE DRAIN PIPING

### A. If more than one material is listed, material selection is Contractor's option.

### B. Copper Tubing:

1. Drawn-Temper Tubing: According to ASTM B 88, Type L or Type DWV according to ASTM B 306.
2. Wrought-Copper Fittings: ASME B16.22.
3. Wrought-Copper Unions: ASME B16.22.
4. Solder Filler Metals: ASTM B 32, lead-free alloys, and water-flushable flux according to ASTM B 813.

- C. CPVC plastic pipe according to ASTM F 441/F 441M, Schedule 40, with socket-type pipe fittings according to ASTM F 438 and solvent cement according to ASTM F 493.
- D. PVC plastic pipe according to ASTM D 1785, Schedule 40, with socket-type pipe fittings according to ASTM D 2466 and solvent cement according to ASTM D 2564, primer according to ASTM F 656.
- E. As indicated on drawing.

## 2.11 SYSTEM REFRIGERANT PIPING

- A. Comply with equipment manufacturer's requirements.
- B. Refrigerant Piping:
  - 1. Copper Tube: ASTM B 280, Type ACR.
  - 2. Wrought-Copper Fittings: ASME B16.22.
  - 3. Brazing Filler Metals: AWS A5.8/A5.8M.
- C. Refrigerant Tubing Kits:
  - 1. Furnished by VRF HVAC system manufacturer.
  - 2. Factory-rolled and -bundled, soft-copper tubing with tubing termination fittings at each end.
  - 3. Standard one-piece length for connecting to indoor units.
  - 4. Pre-insulated with flexible elastomeric insulation of thickness to comply with governing energy code and sufficient to eliminate condensation.
  - 5. Factory Charge: Dehydrated air or nitrogen.
- D. Divided-Flow Specialty Fittings: Where required by VRF HVAC system manufacturer for proper system operation, VRF HVAC system manufacturer shall furnish specialty fittings with identification and instructions for proper installation by Installer.
- E. Refrigerant Isolation Ball Valves:
  - 1. Description: Uni-body full port design, rated for maximum system temperature and pressure, and factory tested under pressure to ensure tight shutoff. Designed for valve operation without removing seal cap.
  - 2. Seals: Compatible with system refrigerant and oil. Seal service life of at least 20 years.
  - 3. Valve Connections: Flare or sweat depending on size.

## 2.12 METAL HANGERS AND SUPPORTS

- A. Copper Tube Hangers:
  - 1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
  - 2. Hanger Rods: Continuous-thread rod, nuts, and washer made of galvanized or copper-coated steel.

## B. Plastic Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, galvanized-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of galvanized steel.

## 2.13 METAL FRAMING SYSTEMS

## A. MFMA Manufacturer Metal Framing Systems:

1. Description: Shop- or field-fabricated, pipe-support assembly for supporting multiple parallel pipes.
2. Standard: MFMA-4.
3. Channels: Continuous slotted steel channel with inturred lips.
4. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of galvanized steel for use indoors and of stainless steel for use outdoors.
6. Metallic Coating for Use Indoors: hot-dip galvanized.
7. Plastic Coating for Use Outdoors: PVC polyurethane epoxy or polyester.

## 2.14 FASTENER SYSTEMS

## A. Mechanical-Expansion Anchors: Insert-wedge-type anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Indoor Applications: Zinc-coated or stainless steel.
2. Outdoor Applications: Stainless steel.

## 2.15 MISCELLANEOUS SUPPORT MATERIALS

## A. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

## B. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; galvanized.

## C. Threaded Rods: Continuously threaded. Zinc-plated steel or galvanized steel for indoor applications and stainless steel for outdoor applications. Mating nuts and washers of similar material as rods.

## 2.16 PIPING AND TUBING INSULATION

- A. Condensate Drain Piping and Tubing Insulation and Jacket Requirements:
1. Flexible Elastomeric Insulation:
    - a. Closed-cell, sponge- or expanded-rubber materials, complying with ASTM C 534, Type I for tubular materials.
    - b. Indoors: 1/2 inch thick.
- B. Refrigerant Tubing Insulation and Jacket Requirements:
1. Flexible Elastomeric Insulation:
    - a. Closed-cell, sponge- or expanded-rubber materials, complying with ASTM C 534, Type I for tubular materials.
    - b. Indoors: 1/2 inch thick.
    - c. Outdoors: 1 inch thick.
  2. Field-Applied Jacket:
    - a. Indoors, Exposed to View: None required.
    - b. Outdoors, Exposed to View: Aluminum, smooth, 0.020 inch thick.
- C. Flexible Elastomeric Insulation Adhesive: Comply with MIL-A-24179A, Type II, Class I.
- D. Metal Jacket Flashing Sealants:
1. Materials shall be compatible with insulation materials, jackets, and substrates.
  2. Fire- and water-resistant, flexible, elastomeric sealant.
  3. Service Temperature Range: Minus 40 to plus 250 deg F.
  4. Color: Aluminum.

## 2.17 SYSTEM CONTROL CABLE

- A. Cable Rating: Listed and labeled for application according to NFPA 70.
1. Flame Travel and Smoke Density in Plenums: As determined by testing identical products according to NFPA 262, by a qualified testing agency. Identify products for installation in plenums with appropriate markings of applicable testing agency.
    - a. Flame Travel Distance: 60 inches or less.
    - b. Peak Optical Smoke Density: 0.5 or less.
    - c. Average Optical Smoke Density: 0.15 or less.
  2. Flame Travel and Smoke Density for Riser Cables in Non-Plenum Building Spaces: As determined by testing identical products according to UL 1666.
  3. Flame Travel and Smoke Density for Cables in Non-Riser Applications and Non-Plenum Building Spaces: As determined by testing identical products according to UL 1685.
- B. Low-Voltage Control Cabling:
1. Paired Cable: NFPA 70, Type CMG.
    - a. One pair, twisted, No. 16 AWG, stranded (19x29) or No. 18 AWG, stranded (19x30) tinned-copper conductors as required by VRF HVAC system manufacturer.
    - b. PVC insulation.
    - c. Braided or foil shielded.
    - d. PVC jacket.
    - e. Flame Resistance: Comply with UL 1685.

2. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.
    - a. One pair, twisted, No. 16 AWG, stranded (19x29) or No. 18 AWG, stranded (19x30) tinned-copper conductors as required by VRF HVAC system manufacturer.
    - b. PVC insulation.
    - c. Braided or foil shielded.
    - d. PVC jacket.
    - e. NFPA 262 includes the standard flame-resistance test criteria in common use for cables and conductors.
    - f. Flame Resistance: Comply with NFPA 262.
- C. TIA-485A Network Cabling:
1. Standard Cable: NFPA 70, Type CMG.
    - a. Paired, one pair two pairs, twisted, No. 22 AWG, stranded (7x30) tinned-copper conductors.
    - b. PVC insulation.
    - c. Unshielded.
    - d. PVC jacket.
    - e. Flame Resistance: Comply with UL 1685.
  2. Plenum-Rated Cable: NFPA 70, Type CMP.
    - a. Paired,, No. 22 AWG, stranded (7x30) tinned-copper conductors.
    - b. Fluorinated ethylene propylene insulation.
    - c. Unshielded.
    - d. Fluorinated ethylene propylene jacket.
    - e. NFPA 262 includes the standard flame-resistance test criteria in common use for cables and conductors.
    - f. Flame Resistance: NFPA 262.
- D. Ethernet Network Cabling: TIA-568-C.2 Category 6 cable with RJ-45 connectors.
1. Description: Four-pair, balanced-twisted pair cable, certified to meet transmission characteristics of category cable indicated.
  2. Conductors: 100-ohm, 23 AWG solid copper.
  3. Cable Rating: By application.
  4. Jacket: thermoplastic.

## 2.18 SOURCE QUALITY CONTROL

- A. Factory Tests: Test and inspect factory-assembled equipment.
- B. Equipment will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports for historical record. Submit reports only if requested.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.



- B. Examine products before installation. Reject products that are wet, moisture damaged, or mold damaged.
- C. Examine roughing-in for piping and tubing to verify actual locations of connections before equipment installation.
- D. Examine roughing-in for ductwork to verify actual locations of connections before equipment installation.
- E. Examine roughing-in for wiring and conduit to verify actual locations of connections before equipment installation.
- F. Examine walls, floors, roofs, and outdoor pads for suitable conditions where equipment will be installed.
- G. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- H. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 EQUIPMENT INSTALLATION, GENERAL

- A. Clearance:
  - 1. Maintain manufacturer's recommended clearances for service and maintenance.
  - 2. Maintain clearances required by governing code.
- B. Loose Components: Install components, devices, and accessories furnished by manufacturer, with equipment, that are not factory mounted.

### 3.03 INSTALLATION OF INDOOR UNITS

- A. Install units to be level and plumb while providing a neat and finished appearance.
- B. Unless otherwise required by VRF HVAC system manufacturer, support ceiling-mounted units from structure above using threaded rods; minimum rod size of 3/8 inch.
- C. Adjust supports of exposed and recessed units to draw units tight to adjoining surfaces.
- D. Protect finished surfaces of ceilings, floors, and walls that come in direct contact with units. Refinish or replaced damaged areas after units are installed.
- E. In rooms with ceilings, conceal piping and tubing, controls, and electrical power serving units above ceilings.
- F. In rooms without ceiling, arrange piping and tubing, controls, and electrical power serving units to provide a neat and finished appearance.
- G. For floor- and wall-mounted units that are exposed, conceal piping and tubing, controls, and electrical power serving units within walls.
- H. Install floor-mounted units on support structure indicated on Drawings.
- I. Attachment: Install hardware for proper attachment to supported equipment.

- J. Grouting: Place grout under equipment supports and make bearing surface smooth.

### 3.04 INSTALLATION OF OUTDOOR UNITS

- A. Install units to be level and plumb while providing a neat and finished appearance.
- B. Install outdoor units on support structures indicated on Drawings.
- C. Pad-Mounted Installations: Install outdoor units on cast-in-place concrete equipment bases.
  - 1. Attachment: Install anchor bolts to elevations required for proper attachment to supported equipment.
  - 2. Grouting: Place grout under equipment supports and make bearing surface smooth.

### 3.05 GENERAL REQUIREMENTS FOR PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping and tubing systems. Install piping and tubing as indicated unless deviations to layout are approved on coordination drawings.
- B. Install piping and tubing in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping and tubing at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping and tubing above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping and tubing to permit valve servicing.
- F. Install piping and tubing at indicated slopes.
- G. Install piping and tubing free of sags.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping and tubing to allow application of insulation.
- J. Install groups of pipes and tubing parallel to each other, spaced to permit applying insulation with service access between insulated piping and tubing.
- K. Install sleeves for piping and tubing penetrations of walls, ceilings, and floors.
- L. Install escutcheons for piping and tubing penetrations of walls, ceilings, and floors.

### 3.06 INSTALLATION OF SYSTEM CONDENSATE DRAIN PIPING

- A. General Requirements for Drain Piping and Tubing:
  - 1. Install a condensate drain line from each equipment's condensate point of connection to an approved drain location.

2. Install a union in piping at each threaded unit connection.
3. Install an adjustable stainless-steel hose clamp with adjustable gear operator on unit hose connections. Tighten clamp to provide a leak-free installation.
4. If required for unit installation, provide a trap assembly in drain piping to prevent air circulated through unit from passing through drain piping. Comply with more stringent of the following:
  - a. Details indicated on Drawings.
  - b. Manufacturer's requirements.
  - c. Governing codes.
  - d. In the absence of requirements, comply with requirements of ASHRAE handbooks.
5. Extend drain piping from units with drain connections to drain receptors as indicated on Drawings. If not indicated on Drawings, terminate drain connection at nearest accessible location that is not exposed to view by occupants.
6. Provide each 90-degree change in direction with a Y- or T-fitting. Install a threaded plug connection in the dormant side of fitting or future use as a service cleanout.

B. Gravity Drains:

1. Slope piping from unit connection toward drain termination at a constant slope of not less than two percent.

C. Pumped Drains:

1. If unit condensate pump or lift mechanism is not included with an integral check valve, install a full-size check valve in each branch pipe near unit connection to prevent backflow into unit.

### 3.07 INSTALLATION OF REFRIGERANT PIPING

- A. Size and install refrigerant piping in accordance with equipment manufacturer's requirements.

B. Refrigerant Tubing Kits:

1. Unroll and straighten tubing to suit installation. Deviations in straightness of exposed tubing shall be unnoticeable to observer.
2. Support tubing using hangers and supports indicated at intervals not to exceed 5 feet. Minimum rod size, 1/4 inch.
3. Prepare tubing ends and make mating connections to provide a pressure tight and leak-free installation.

- C. Install refrigerant piping according to ASHRAE 15 and governing codes.

- D. Select system components with pressure rating equal to or greater than system operating pressure.

- E. Install piping as short and direct as possible, with a minimum number of joints and fittings.

- F. Arrange piping to allow inspection and service of equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Section 083113 "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

- G. Install refrigerant piping and tubing in protective conduit where installed belowground.
- H. Install refrigerant piping and tubing in rigid or flexible conduit in locations where exposed to mechanical damage.
- I. Unless otherwise required by VRF HVAC system manufacturer, slope refrigerant piping and tubing as follows:
  - 1. Install horizontal hot-gas discharge piping and tubing with a uniform slope downward away from compressor.
  - 2. Install horizontal suction lines with a uniform slope downward to compressor.
  - 3. Install traps to entrain oil in vertical runs.
  - 4. Liquid lines may be installed level.
- J. When brazing, remove or protect components that could be damaged by heat.
- K. Before installation, clean piping, tubing, and fittings to cleanliness level required by VRF HVAC system manufacturer.
- L. Joint Construction:
  - 1. Ream ends of tubes and remove burrs.
  - 2. Remove scale, slag, dirt, and debris from inside and outside of tube and fittings before assembly.
  - 3. Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.
    - a. Use Type BCuP (copper-phosphorus) alloy for joining copper fittings with copper tubing.
    - b. Use Type BAg (cadmium-free silver) alloy for joining copper with bronze.

### 3.08 INSTALLATION OF METAL HANGERS AND SUPPORTS

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
- C. Comply with MFMA-103 for metal framing system selections and applications that are not specified.
- D. Fastener System Installation:
  - 1. Install powder-actuated fasteners, for use in lightweight concrete or concrete slabs less than 4 inches thick, in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
  - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
  - 3. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

- E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- F. Install hangers and supports to allow controlled thermal and movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- G. Install lateral bracing with pipe hangers and supports to prevent swaying.
- H. Install building attachments within concrete slabs or attach to structural steel.
  - 1. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- I. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- J. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- K. Piping and Tubing Insulation:
  - 1. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
  - 2. Shield Dimensions for Pipe: Not less than the following:
    - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
- L. Horizontal-Piping Hangers and Supports: Install the following types:
  - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
  - 2. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
  - 3. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
  - 4. Multiple horizontal pipes located indoors may use metal framing systems with split clamp attachment for each pipe in lieu of individual clevis hangers.
  - 5. Pipe stands for horizontal pipes located outdoors.
  - 6. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
  - 7. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.
- M. Horizontal Piping Hanger Spacing and Rod Size: Install hangers for drawn-temper copper piping with the following maximum horizontal spacing and minimum rod sizes:
  - 1. Sizes through NPS 3/4: Maximum span, 5 feet; minimum rod size, 1/4 inch.
  - 2. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.
  - 3. NPS 1-1/4: Maximum span, 7 feet; minimum rod size, 3/8 inch.
  - 4. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
  - 5. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
  - 6. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
  - 7. NPS 3 and Larger: Maximum span, 10 feet; minimum rod size, 3/8 inch.

- N. Plastic Pipe Hanger and Support Spacing:
1. Space hangers and supports according to pipe manufacturer's written instructions for service conditions.
  2. Maximum spacing, 5 feet; minimum rod size, 1/4 inch.
- O. Vertical-Piping Clamps: Install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8).
  2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): If longer ends are required for riser clamps.
- P. Support vertical runs at roof, at each floor, and at midpoint intervals between floors, not to exceed 5 feet.
- Q. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified.
- R. Use hangers, supports, and attachments with galvanized coatings unless otherwise indicated.
- S. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- T. Trim excess length of continuous-thread hanger and support rods to 1 inch.
- U. Hanger-Rod Attachments: Install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
  2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
  3. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
  4. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- V. Building Attachments: Install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
  2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction, to attach to top flange of structural shape.
  3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
  4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
  5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
  6. C-Clamps (MSS Type 23): For structural shapes.
  7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
  8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
  9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.

10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
  - a. Light (MSS Type 31): 750 lb.
  - b. Medium (MSS Type 32): 1500 lb.
13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

### 3.09 INSTALLATION OF PIPING AND TUBING INSULATION

- A. Seal longitudinal seams and end joints with manufacturers recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated. Installation to maintain a continuous vapor barrier.
- B. Insulation Installation on Pipe Fittings and Elbows:
  1. Install mitered sections of pipe insulation.
  2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Valves and Pipe Specialties:
  1. Install preformed valve covers manufactured of same material as pipe insulation when available.
  2. When preformed valve covers are unavailable, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
  3. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

### 3.10 ELECTRICAL INSTALLATION

- A. Comply with requirements indicated on Drawings and in applicable Division 26 Sections.
- B. To extent electrical power is required for system equipment, components, and controls, and is not indicated on Drawings and addressed in the Specifications, the design for such electrical power shall be delegated to VRF HVAC system provider.
  1. Delegated design of electrical power to equipment, components and controls, and associated installation shall be included at no additional cost to Owner.

- C. Connect field electrical power source to each separate electrical device requiring field electrical power. Coordinate termination point and connection type with Installer.
- D. Install nameplate or acrylic label with self-adhesive back for each electrical connection indicating electrical equipment designation and circuit number feeding connection.
  - 1. Nameplate shall be laminated phenolic layers of black with engraved white letters. Letters at least 1/2 inch high.
  - 2. Locate nameplate or label where easily visible.
- E. Comply with TIA-569-D for pull-box sizing and length of conduit and number of bends between pull points.
- F. Install manufactured conduit sweeps and long-radius elbows if possible.
- G. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

### 3.11 INSTALLATION OF SYSTEM CONTROL CABLE

- A. Comply with NECA 1.
- B. Installation Method:
  - 1. Install cables in raceways except as follows:
    - a. Within equipment and associated control enclosures.
    - b. In accessible ceiling spaces where open cable installation method may be used.
    - c. In gypsum board partitions where cable may be enclosed within wall cavity.
  - 2. Conceal raceway and cables except in unfinished spaces.
- C. General Requirements for Cabling:
  - 1. Comply with TIA-568-C Series of standards.
  - 2. Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems."
  - 3. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
  - 4. Cables may not be spliced and shall be continuous from terminal to terminal. Do not splice cable.
  - 5. Cables serving a common system may be grouped in a common raceway. Install control cable in separate raceway from power wiring. Do not group conductors from different systems or different voltages.
  - 6. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
  - 7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems." Install lacing bars and distribution spools.
  - 8. Do not install bruised, kinked, scored, deformed, or abraded cable. Remove and discard cable if damaged during installation and replace it with new cable.
  - 9. Cold-Weather Installation: Bring cable to room temperature before dereeling. Do not use heat lamps for heating.



10. Pulling Cable: Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems." Monitor cable pull tensions.
11. Support: Do not allow cables to lie on removable ceiling tiles or access panels.
12. Secure: Fasten securely in place with hardware specifically designed and installed so as to not damage cables.
13. Provide strain relief.
14. Keep runs short. Allow extra length for connecting to terminals.
15. Do not bend cables in a radius less than 10 times the cable OD.
16. Use sleeves or grommets to protect cables from vibration at points where they pass around sharp corners and through penetrations.
17. Ground wire shall be copper, and grounding methods shall comply with IEEE C2. Demonstrate ground resistance.

D. Balanced Twisted-Pair Cable Installation:

1. Comply with TIA-568-C.2.
2. Do not untwist balanced twisted-pair cables more than 1/2 inch at the point of termination to maintain cable geometry.

E. Open-Cable Installation:

1. Suspend copper cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 30 inches apart.
2. Cable shall not be run through or on structural members or in contact with pipes, ducts, or other potentially damaging items. Do not run cables between structural members and corrugated panels.

F. Separation from EMI Sources: Comply with BICSI TDMM and TIA-569-D recommendations for separating unshielded cable from potential EMI sources including electrical power wiring and equipment.

### 3.12 IDENTIFICATION

- A. Identify system equipment, piping, tubing, and valves.

### 3.13 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage VRF HVAC system manufacturer's service representative to advise and assist installers; witness testing; and observe and inspect components, assemblies, and equipment installations, including controls and connections.

1. Field service shall be performed by an employee or a factory-trained and -authorized service representative of VRF HVAC system manufacturer whose primary job responsibilities are to provide direct technical support of its products.
  - a. Additional factory-authorized representatives may assist with completion of certain activities only if supervised by manufacturer's employee. A factory-authorized representative shall not provide assistance without manufacturer's employee supervision.
2. Kick-off Meeting:
  - a. Meeting shall include system Installer and other related trades with sole purpose of reviewing VRF HVAC system installation requirements and close coordination required to make a successful installation.

- b. Meeting shall be held at Project site and scheduled at a mutually agreed to time that occurs before the start of any part of system installation.
- c. Meeting shall cover the following as a minimum requirement:
  - 1) Review of latest issue of Contract Documents, Drawings, and Specifications, relevant to VRF HVAC systems.
  - 2) Manufacturer's installation requirements specific to systems being installed.
  - 3) Review of all relevant VRF HVAC system submittals, including delegated-design submittals.
  - 4) Required field activities related installation of VRF HVAC system.
  - 5) Project team communication protocol, contact information, and exchange of responsibilities for each party involved, including manufacturer, supplier, system Installer, and other related trades.
- 3. Site Visits: Activities for each site visit shall include the following:
  - a. Meet with VRF HVAC system Installer to discuss field activities, issues, and suggested methods to result in a successful installation.
  - b. Offer technical support to Installer and related trades as related to VRF system(s) being installed.
  - c. Review progress of VRF HVAC system(s) installation for strict compliance with manufacturer's requirements.
  - d. Advise and if necessary assist Installer with updating related refrigerant calculations and system documentation.
  - e. Issue a report for each visit, documenting the visit.
    - 1) Report to include name and contact information of individual making the visit.
    - 2) Date(s) and time frames while on-site.
    - 3) Names and contact information of people meeting with while on-site.
    - 4) Clearly identify and list each separate issue that requires resolution. For each issue, provide a unique identification number, relevant importance, specific location or equipment identification, description of issue, recommended corrective action, and follow-up requirements needed. Include a digital photo for clarification if deemed to be beneficial.
- 4. Final Inspection before Startup:
  - a. Before inspection, Installer to provide written request to manufacturer stating the system is fully installed according manufacturer's requirements and ready for final inspection.
  - b. All system equipment and operating components shall be inspected. If components are inaccessible for inspection, they shall be made accessible before the final inspection can be completed.
  - c. Manufacturer shall provide a comprehensive inspection of all equipment and each operating component that comprise the complete system(s). Inspection shall follow a detailed checklist specific to each equipment and operating component.
  - d. Inspection reports for indoor units shall include, but not be limited to, the following:
    - 1) Unit designation on Drawings.
    - 2) Manufacturer model number.
    - 3) Serial number.
    - 4) Network address, if applicable.
    - 5) Each equipment setting.
    - 6) Mounting, supports, and restraints properly installed.
    - 7) Proper service clearance provided.

- 8) Wiring and power connections correct.
  - 9) Line-voltage reading(s) within acceptable range.
  - 10) Wiring and controls connections correct.
  - 11) Low-voltage reading(s) within an acceptable range.
  - 12) Controller type and model controlling unit.
  - 13) Controller location.
  - 14) Temperature settings and readings within an acceptable range.
  - 15) Humidity settings and readings within an acceptable range.
  - 16) Condensate removal acceptable.
  - 17) Fan settings and readings within an acceptable range.
  - 18) Unit airflow direction within an acceptable range.
  - 19) If applicable, fan external static pressure setting.
  - 20) Filter type and condition acceptable.
  - 21) Noise level within an acceptable range.
  - 22) Refrigerant piping properly connected and insulated.
  - 23) Condensate drain piping properly connected and insulated.
  - 24) If applicable, ductwork properly connected.
  - 25) If applicable, external interlocks properly connected.
  - 26) Remarks.
- e. Inspection reports for outdoor units shall include, but not be limited to, the following:
- 1) Unit designation on Drawings.
  - 2) Manufacturer model number.
  - 3) Serial number.
  - 4) Network address, if applicable.
  - 5) Each equipment setting.
  - 6) Mounting, supports, and restraints properly installed.
  - 7) Proper service clearance provided.
  - 8) Wiring and power connections correct.
  - 9) Line-voltage reading(s) within acceptable range.
  - 10) Wiring and controls connections correct.
  - 11) Low-voltage reading(s) within an acceptable range.
  - 12) Condensate removal acceptable.
  - 13) Noise level within an acceptable range.
  - 14) Refrigerant piping properly connected and insulated.
  - 15) Condensate drain piping properly connected and insulated.
  - 16) Remarks.
- f. Inspection reports for indoor, dedicated outdoor air ventilation units shall include, but not be limited to, the following:
- 1) Unit designation on Drawings.
  - 2) Manufacturer model number.
  - 3) Serial number.
  - 4) Network address, if applicable.
  - 5) Each equipment setting.
  - 6) Mounting, supports, and restraints properly installed.
  - 7) Proper service clearance provided.
  - 8) Wiring and power connections correct.
  - 9) Line-voltage reading(s) within acceptable range.
  - 10) Wiring and controls connections correct.
  - 11) Low-voltage reading(s) within an acceptable range.
  - 12) Controller type and model controlling unit.
  - 13) Controller location.
  - 14) Temperature settings and readings within an acceptable range.

- 15) Humidity settings and readings within an acceptable range.
  - 16) Condensate removal acceptable.
  - 17) Fan settings and readings within an acceptable range.
  - 18) Fan external static pressure setting.
  - 19) Filter type and condition acceptable.
  - 20) Noise level within an acceptable range.
  - 21) Refrigerant piping properly connected and insulated.
  - 22) Condensate drain piping properly connected and insulated.
  - 23) Automatic dampers properly installed and operating.
  - 24) Ductwork properly connected.
  - 25) If applicable, external interlocks properly connected.
  - 26) Remarks.
- g. Inspection reports for energy recovery ventilators shall include, but not be limited to, the following:
- 1) Unit designation on Drawings.
  - 2) Manufacturer model number.
  - 3) Serial number.
  - 4) Network address, if applicable.
  - 5) Each equipment setting.
  - 6) Mounting, supports, and restraints properly installed.
  - 7) Proper service clearance provided.
  - 8) Wiring and power connections correct.
  - 9) Line-voltage reading(s) within acceptable range.
  - 10) Wiring and controls connections correct.
  - 11) Low-voltage reading(s) within an acceptable range.
  - 12) Controller type and model controlling unit.
  - 13) Controller location.
  - 14) Temperature settings and readings within an acceptable range.
  - 15) Humidity readings.
  - 16) Condensate removal acceptable.
  - 17) Fan settings and readings within an acceptable range.
  - 18) Fan external static pressure setting.
  - 19) Filter type and condition acceptable.
  - 20) Noise level within an acceptable range.
  - 21) Automatic dampers properly installed and operating.
  - 22) Ductwork properly connected.
  - 23) If applicable, external interlocks properly connected.
  - 24) Remarks.
- h. Installer shall provide manufacturer with the requested documentation and technical support during inspection.
- i. Installer shall correct observed deficiencies found by the inspection.
- j. Upon completing the on-site inspection, manufacturer shall provide a written report with complete documentation describing each inspection step, the result, and any corrective action required.
- k. If corrective action is required by Installer that cannot be completed during the same visit, provide additional visits, as required, until deficiencies are resolved and systems are deemed ready for startup.
- l. Final report shall indicate the system(s) inspected are installed according to manufacturer's requirements and are ready for startup.

- B. Perform the following tests and inspections with the assistance of manufacturer's service representative:
1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
  2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Refrigerant Tubing Positive Pressure Testing:
1. Comply with more stringent of VRF HVAC system manufacturer's requirements and requirements indicated.
  2. After completion of tubing installation, pressurize tubing systems to a test pressure of not less than 1.2 times VRF HVAC system operating pressure, but not less than 600 psig, using dry nitrogen.
  3. Successful testing shall maintain a test pressure for a continuous and uninterrupted period of 24 hours. Allowance for pressure changes attributed to changes in ambient temperature are acceptable.
  4. Prepare test report to record the following information for each test:
    - a. Name of person starting test, company name, phone number, and e-mail address.
    - b. Name of manufacturer's service representative witnessing test, company name, phone number, and e-mail address.
    - c. Detailed description of extent of tubing tested.
    - d. Date and time at start of test.
    - e. Test pressure at start of test.
    - f. Outdoor temperature at start of test.
    - g. Name of person ending test, company name, phone number, and e-mail address.
    - h. Date and time at end of test.
    - i. Test pressure at end of test.
    - j. Outdoor temperature at end of test.
    - k. Remarks:
  5. Submit test reports for Project record.
- D. Refrigerant Tubing Evacuation Testing:
1. Comply with more stringent of VRF HVAC system manufacturer's requirements and requirements indicated.
  2. After completion of tubing positive-pressure testing, evacuate tubing systems to a pressure of 500 microns.
  3. Successful testing shall maintain a test pressure for a continuous and uninterrupted period of one hour(s) with no change.
  4. Prepare test report to record the following information for each test:
    - a. Name of person starting test, company name, phone number, and e-mail address.
    - b. Name of manufacturer's service representative witnessing test, company name, phone number, and e-mail address.
    - c. Detailed description of extent of tubing tested.
    - d. Date and time at start of test.
    - e. Test pressure at start of test.

- f. Outdoor temperature at start of test.
  - g. Name of person ending test, company name, phone number, and e-mail address.
  - h. Date and time at end of test.
  - i. Test pressure at end of test.
  - j. Outdoor temperature at end of test.
  - k. Remarks:
- 5. Submit test reports for Project record.
  - 6. Upon successful completion of evacuation testing, system shall be charged with refrigerant.

E. System Refrigerant Charge:

- 1. Using information collected from the refrigerant tubing evacuation testing, system Installer shall consult variable refrigerant system manufacturer to determine the correct system refrigerant charge.
- 2. Installer shall charge system following VRF HVAC system manufacturer's written instructions.
- 3. System refrigerant charging shall be witnessed by system manufacturer's representative.
- 4. Total refrigerant charge shall be recorded and permanently displayed at the system's outdoor unit.

F. Products will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports.

3.14 STARTUP SERVICE

A. Engage a VRF HVAC system manufacturer's service representative to perform system(s) startup service.

- 1. Service representative shall be an employee or a factory-trained and -authorized service representative of VRF HVAC system manufacturer.
- 2. Complete startup service of each separate system.
- 3. Complete system startup service according to manufacturer's written instructions.

B. Startup checks shall include, but not be limited to, the following:

- 1. Check control communications of equipment and each operating component in system(s).
- 2. Check each indoor unit's response to demand for cooling and heating.
- 3. Check each indoor unit's response to changes in airflow settings.
- 4. Check each indoor unit, HRCU, and outdoor unit for proper condensate removal.
- 5. Check sound levels of each indoor and outdoor unit.

C. Installer shall accompany manufacturer's service representative during startup service and provide manufacturer's service representative with requested documentation and technical support during startup service.

- 1. Installer shall correct deficiencies found during startup service for reverification.

## D. System Operation Report:

1. After completion of startup service, manufacturer shall issue a report for each separate system.
2. Report shall include complete documentation describing each startup check, the result, and any corrective action required.

## E. Witness:

1. Invite Owner to witness startup service procedures.
2. Provide written notice not less than 20 business days before start of startup service.

## 3.15 ADJUSTING

- A. Adjust equipment and components to function smoothly, and lubricate as recommended by manufacturer.
- B. Adjust initial temperature and humidity set points. Adjust initial airflow settings and discharge airflow patterns.
- C. Set field-adjustable switches and circuit-breaker trip ranges according to VRF HVAC system manufacturer's written instructions, and as indicated.

## 3.16 PROTECTION

- A. Protect products from moisture and water damage. Remove and replace products that are wet, moisture damaged, or mold damaged.
- B. Protect equipment from physical damage. Replace equipment with physical damage that cannot be repaired to new condition. Observable surface imperfections shall be grounds for removal and replacement.
- C. Protect equipment from electrical damage. Replace equipment suffering electrical damage.
- D. Cover and seal openings of equipment to keep inside of equipment clean. Do not remove covers until finish work is complete.

## 3.17 SOFTWARE SERVICE AGREEMENT

- A. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.
- B. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.
  1. Upgrade Notice: At least 30 days to allow Owner to schedule and access the system and to upgrade computer equipment if necessary.

3.18 DEMONSTRATION

- A. Engage a VRF HVAC system manufacturer's employed training instructor or factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain entire system.
- B. Instructor:
  - 1. Instructor shall be factory trained and certified by VRF HVAC system manufacturer with current training on the system(s), equipment, and controls that are installed.
- C. Schedule and Duration:
  - 1. Training shall occur before Owner occupancy.
  - 2. Training shall be held at mutually agreed date and time during normal business hours.
- D. Location: Owner shall provide a suitable on-site location to host classroom training.
- E. Training Materials: Provide training materials to each attendee.

END OF SECTION



SECTION 26 05 19 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

1.02 ACTION SUBMITTALS

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

1.03 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.

1.04 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

PART 2 - PRODUCTS

2.01 CONDUCTORS AND CABLES

- A. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.
- B. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN/THWN-2.

2.02 CONNECTORS AND SPLICES

- A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.03 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.

## PART 3 - EXECUTION

## 3.01 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger, except VFC cable, which shall be extra flexible stranded.

## 3.02 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN/THWN-2, single conductors in raceway.
- B. Exposed Branch Circuits, Including in Crawlspace: Type THHN/THWN-2, single conductors in raceway.
- C. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway.

## 3.03 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to Section 26 05 33 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- F. Support cables according to Section 26 05 29 "Hangers and Supports for Electrical Systems."

## 3.04 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.05 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.06 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly.

3.07 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  - 1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
  - 2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
- B. Test and Inspection Reports: Prepare a written report to record the following:
  - 1. Procedures used.
  - 2. Results that comply with requirements.
  - 3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- C. Cables will be considered defective if they do not pass tests and inspections.

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes grounding and bonding systems and equipment.
- B. Section includes grounding and bonding systems and equipment, plus the following special applications:
  - 1. Underground distribution grounding.
  - 2. Foundation steel electrodes.

1.02 ACTION SUBMITTALS

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

1.03 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.04 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.

1.05 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

2.02 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

- B. Bare Copper Conductors:
1. Solid Conductors: ASTM B 3.
  2. Stranded Conductors: ASTM B 8.
  3. Tinned Conductors: ASTM B 33.
  4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
  5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
  6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
  7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
- C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

## 2.03 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- D. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

## 2.04 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet.

## PART 3 - EXECUTION

### 3.01 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2/0 AWG minimum.
1. Bury at least 24 inches below grade.

- C. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
  - 1. Install bus horizontally, on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.
  - 2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.
- D. Conductor Terminations and Connections:
  - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
  - 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
  - 3. Connections to Structural Steel: Welded connectors.

### 3.02 GROUNDING AT THE SERVICE

- A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

### 3.03 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
  - 1. Feeders and branch circuits.
  - 2. Lighting circuits.
  - 3. Receptacle circuits.
  - 4. Single-phase motor and appliance branch circuits.
  - 5. Three-phase motor and appliance branch circuits.
  - 6. Flexible raceway runs.
  - 7. Armored and metal-clad cable runs.

### 3.04 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.
  - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
  - 2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

- C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
  - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
  - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
  - 3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.
  
- D. Grounding and Bonding for Piping:
  - 1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
  - 2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
  - 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
  
- E. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.
  
- F. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.

### 3.05 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. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
  - 2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.

3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at individual ground rods. Make tests at ground rods before any conductors are connected.
  - a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
  - b. Perform tests by fall-of-potential method according to IEEE 81.
- C. Grounding system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.
- E. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION



## SECTION 26 05 29

## HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

## PART 1 - GENERAL

## 1.01 SUMMARY

## A. Section Includes:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

## 1.02 ACTION SUBMITTALS

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

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
  - a. Hangers.
  - b. Steel slotted support systems.
  - c. Nonmetallic support systems.
  - d. Trapeze hangers.
  - e. Clamps.
  - f. Turnbuckles.
  - g. Sockets.
  - h. Eye nuts.
  - i. Saddles.
  - j. Brackets.
2. Include rated capacities and furnished specialties and accessories.

## 1.03 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M AWS D1.2/D1.2M.
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
  1. AWS D1.1/D1.1M.
  2. AWS D1.2/D1.2M.

## PART 2 - PRODUCTS

## 2.01 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4 factory-fabricated components for field assembly.
  1. Material: Galvanized steel.
  2. Channel Width: 1-5/8 inches.
  3. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.

4. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
  5. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
  6. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
  7. Channel Dimensions: Selected for applicable load criteria.
- B. Aluminum Slotted Support Systems: Comply with MFMA-4 factory-fabricated components for field assembly.
1. Channel Width: 1-5/8 inches.
  2. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
  3. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
  4. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
  5. Channel Dimensions: Selected for applicable load criteria.
- C. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with minimum 13/32-inch-diameter holes at a maximum of 8 inches on center, in at least one surface.
1. Channel Width: 1-5/8 inches.
  2. Fittings and Accessories: Products provided by channel and angle manufacturer and designed for use with those items.
  3. Fitting and Accessory Materials: Same as those for channels and angles, except metal items may be stainless steel.
  4. Rated Strength: Selected to suit applicable load criteria.
  5. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- D. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.
- F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.
- G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
  2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

## 2.02 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

## PART 3 - EXECUTION

### 3.01 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems unless requirements in this Section are stricter.
- B. Comply with requirements for raceways and boxes specified in Section 26 05 33 "Raceways and Boxes for Electrical Systems."
- C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMTs, IMCs, and RMCs as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- D. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
  1. Secure raceways and cables to these supports with two-bolt conduit clamps.
- E. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

### 3.02 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMTs, IMCs, and RMCs may be supported by openings through structure members, according to NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
1. To Wood: Fasten with lag screws or through bolts.
  2. To New Concrete: Bolt to concrete inserts.
  3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
  4. To Existing Concrete: Expansion anchor fasteners.
  5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
  6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
  7. To Light Steel: Sheet metal screws.
  8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

### 3.03 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- B. Field Welding: Comply with AWS D1.1/D1.1M.

### 3.04 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

## SECTION 26 05 33 RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

## PART 1 - GENERAL

## 1.01 SUMMARY

- A. Section Includes:
  - 1. Metal conduits, tubing, and fittings.
  - 2. Metal wireways and auxiliary gutters.
  - 3. Boxes, enclosures, and cabinets.

## 1.02 DEFINITIONS

- A. GRC: Galvanized rigid steel conduit.
- B. IMC: Intermediate metal conduit.
- C. EMT: Electrical metallic tubing.

## PART 2 - PRODUCTS

## 2.01 METAL CONDUITS, TUBING, AND FITTINGS

- A. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. GRC: Comply with ANSI C80.1 and UL 6.
- C. ARC: Comply with ANSI C80.5 and UL 6A.
- D. IMC: Comply with ANSI C80.6 and UL 1242.
- E. EMT: Comply with ANSI C80.3 and UL 797.
- F. FMC: Comply with UL 1; zinc-coated steel or aluminum.
- G. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- H. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
  - 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
  - 2. Fittings for EMT:
    - a. Material: Steel or die cast.
    - b. Type: Setscrew or compression.

3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
  4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.
- I. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

## 2.02 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.
  1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- C. Wireway Covers: Screw-cover type unless otherwise indicated.
- D. Finish: Manufacturer's standard enamel finish.

## 2.03 BOXES, ENCLOSURES, AND CABINETS

- A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- D. Metal Floor Boxes:
  1. Material: Cast metal or sheet metal.
  2. Type: Fully adjustable.
  3. Shape: Rectangular.
  4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- E. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.
- F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

- G. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.
- H. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- I. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.
- J. Gangable boxes are allowed.

### PART 3 - EXECUTION

#### 3.01 RACEWAY APPLICATION

- A. Indoors: Apply raceway products as specified below unless otherwise indicated:
  - 1. Exposed, Not Subject to Physical Damage: EMT.
  - 2. Exposed, Not Subject to Severe Physical Damage: EMT.
  - 3. Exposed and Subject to Severe Physical Damage: GRC. Raceway locations include the following:
    - a. Loading dock.
    - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
    - c. Mechanical rooms.
  - 4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
  - 5. Damp or Wet Locations: GRC.
  - 6. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250.
- B. Minimum Raceway Size: 3/4-inch trade size.
- C. Raceway Fittings: Compatible with raceways and suitable for use and location.
  - 1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
  - 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
  - 3. EMT: Use compression, steel fittings. Comply with NEMA FB 2.10.
  - 4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- D. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

#### 3.02 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

- B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for hangers and supports.
- E. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.
- G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- H. Support conduit within 12 inches of enclosures to which attached.
- I. Raceways Embedded in Slabs:
  - 1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot intervals.
  - 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
  - 3. Arrange raceways to keep a minimum of 2 inches of concrete cover in all directions.
  - 4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
- J. Stub-ups to Above Recessed Ceilings:
  - 1. Use EMT, IMC, or RMC for raceways.
  - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- K. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- L. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- M. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- N. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.



- O. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- P. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- Q. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- R. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- S. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.
- T. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
  - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
  - 2. Where an underground service raceway enters a building or structure.
  - 3. Where otherwise required by NFPA 70.
- U. Comply with manufacturer's written instructions for solvent welding RNC and fittings.
- V. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
  - 1. Use LFMC in damp or wet locations subject to severe physical damage.
  - 2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
- W. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
- X. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- Y. Locate boxes so that cover or plate will not span different building finishes.
- Z. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- AA. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

BB. Set metal floor boxes level and flush with finished floor surface.

3.03 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies as required to maintain integrity of existing fire rating.

3.04 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

END OF SECTION

SECTION 26 05 43 UNDERGROUND DUCTS AND RACEWAYS FOR  
ELECTRICAL SYSTEMS

## PART 1 - GENERAL

## 1.01 SUMMARY

## A. Section Includes:

1. Metal conduits and fittings, including GRC and PVC-coated steel conduit.
2. Rigid nonmetallic duct.
3. Flexible nonmetallic duct.
4. Duct accessories.
5. Precast concrete handholes.
6. Polymer concrete handholes and boxes with polymer concrete cover.
7. Fiberglass handholes and boxes with polymer concrete cover.
8. Fiberglass handholes and boxes.
9. High-density plastic boxes.
10. Precast manholes.
11. Cast-in-place manholes.
12. Utility structure accessories.

## 1.02 DEFINITIONS

- A. Direct Buried: Duct or a duct bank that is buried in the ground, without any additional casing materials such as concrete.
- B. Duct: A single duct or multiple ducts. Duct may be either installed singly or as component of a duct bank.
- C. Duct Bank:
  1. Two or more ducts installed in parallel, with or without additional casing materials.
  2. Multiple duct banks.
- D. GRC: Galvanized rigid (steel) conduit.
- E. Trafficways: Locations where vehicular or pedestrian traffic is a normal course of events.

## 1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  1. Include duct-bank materials, including spacers and miscellaneous components.
  2. Include duct, conduits, and their accessories, including elbows, end bells, bends, fittings, and solvent cement.
  3. Include accessories for manholes, handholes, boxes.
  4. Include underground-line warning tape.
  5. Include warning planks.

- B. Shop Drawings:
1. Precast or Factory-Fabricated Underground Utility Structures:
    - a. Include plans, elevations, sections, details, attachments to other work, and accessories.
    - b. Include duct entry provisions, including locations and duct sizes.
    - c. Include reinforcement details.
    - d. Include frame and cover design and manhole chimneys.
    - e. Include ladder or step details.
    - f. Include grounding details.
    - g. Include dimensioned locations of cable rack inserts, pulling-in and lifting irons, and sumps.
    - h. Include joint details.
  2. Factory-Fabricated Handholes and Boxes Other Than Precast Concrete:
    - a. Include dimensioned plans, sections, and elevations, and fabrication and installation details.
    - b. Include duct entry provisions, including locations and duct sizes.
    - c. Include cover design.
    - d. Include grounding details.
    - e. Include dimensioned locations of cable rack inserts, and pulling-in and lifting irons.

#### 1.04 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: For duct and duct bank. Show duct profiles and coordination with other utilities and underground structures.
1. Include plans and sections, drawn to scale, and show bends and locations of expansion fittings.
- B. Product Certificates: For concrete and steel used in precast concrete manholes and handholes, as required by ASTM C 858.
- C. Source quality-control reports.
- D. Field quality-control reports.

#### 1.05 MAINTENANCE MATERIALS SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
- B. Furnish cable-support stanchions, arms, insulators, and associated fasteners in quantities equal to 5 percent of quantity of each item installed.

#### 1.06 QUALITY ASSURANCE

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

## 1.07 FIELD CONDITIONS

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions, and then only after arranging to provide temporary electrical service according to requirements indicated:
  - 1. Notify Owner no fewer than two days in advance of proposed interruption of electrical service.
  - 2. Do not proceed with interruption of electrical service without Owner's written permission.
- B. Ground Water: Assume ground-water level is at grade level unless a lower water table is noted on Drawings.

## PART 2 - PRODUCTS

## 2.01 METAL CONDUIT AND FITTINGS

- A. GRC: Comply with ANSI C80.1 and UL 6.
- B. Coated Steel Conduit: PVC-coated GRC.
  - 1. Comply with NEMA RN 1.
  - 2. Coating Thickness: 0.040 inch, minimum.
- C. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.

## 2.02 RIGID NONMETALLIC DUCT

- A. Underground Plastic Utilities Duct: Type EPC-80-PVC and Type EPC-40-PVC RNC, complying with NEMA TC 2 and UL 651, with matching fittings complying with NEMA TC 3 by same manufacturer as duct.
- B. Underground Plastic Utilities Duct: Type EB-20 PVC RNC, complying with NEMA TC 6 & 8, ASTM F 512, and UL 651, with matching fittings complying with NEMA TC 9 by same manufacturer as duct.
- C. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.
- D. Solvents and Adhesives: As recommended by conduit manufacturer.

## 2.03 FLEXIBLE NONMETALLIC DUCTS

- A. HDPE Duct: Type EPEC-40 HDPE Type EPEC-80 HDPE, complying with NEMA TC 7 and UL 651A.
  - 1. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.

## 2.04 DUCT ACCESSORIES

- A. Duct Spacers: Factory-fabricated, rigid, PVC interlocking spacers; sized for type and size of duct with which used, and selected to provide minimum duct spacing indicated while supporting duct during concreting or backfilling.
- B. Underground-Line Warning Tape: Comply with requirements for underground-line warning tape specified in Section 260553 "Identification for Electrical Systems."
- C. Concrete Warning Planks: Nominal 12 by 24 by 3 inches in size, manufactured from 6000-psi concrete.
  - 1. Color: Red dye added to concrete during batching.
  - 2. Mark each plank with "ELECTRIC" in 2-inch- high, 3/8-inch- deep letters.

## 2.05 PRECAST CONCRETE HANDHOLES AND BOXES

- A. Description: Factory-fabricated, reinforced-concrete, monolithically poured walls and bottom unless open-bottom enclosures are indicated. Frame and cover shall form top of enclosure and shall have load rating consistent with that of handhole or box.
- B. Comply with ASTM C 858 for design and manufacturing processes.
- C. Frame and Cover: Weatherproof cast-iron frame, with cast-iron cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.
- D. Frame and Cover: Weatherproof steel frame, with steel cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.
- E. Frame and Cover: Weatherproof steel frame, with hinged steel access door assembly with tamper-resistant, captive, cover-securing bolts.
  - 1. Cover Hinges: Concealed, with hold-open ratchet assembly.
  - 2. Cover Handle: Recessed.
- F. Frame and Cover: Weatherproof aluminum frame with hinged aluminum access door assembly with tamper-resistant, captive, cover-securing bolts.
  - 1. Cover Hinges: Concealed, with hold-open ratchet assembly.
  - 2. Cover Handle: Recessed.
- G. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
- H. Cover Legend: Molded lettering, "ELECTRIC."
- I. Configuration: Units shall be designed for flush burial and have open bottom unless otherwise indicated.
- J. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.

- K. Knockout Panels: Precast openings in walls, arranged to match dimensions and elevations of approaching duct, plus an additional 12 inches vertically and horizontally to accommodate alignment variations.
    - 1. Center window location.
    - 2. Knockout panels shall be located no less than 6 inches from interior surfaces of walls, floors, or frames and covers of handholes, but close enough to corners to facilitate racking of cables on walls.
    - 3. Knockout panel opening shall have cast-in-place, welded-wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct.
    - 4. Knockout panels shall be framed with at least two additional No. 3 steel reinforcing bars in concrete around each opening.
    - 5. Knockout panels shall be 1-1/2 to 2 inches thick.
  - L. Duct Entrances in Handhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.
    - 1. Type and size shall match fittings to duct to be terminated.
    - 2. Fittings shall align with elevations of approaching duct and be located near interior corners of handholes to facilitate racking of cable.
  - M. Handholes 12 inches wide by 24 inches long and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.
- 2.06 FIBERGLASS HANDHOLES AND BOXES WITH POLYMER CONCRETE FRAME AND COVER
- A. Description: Sheet-molded, fiberglass-reinforced, polyester resin enclosure joined to polymer concrete top ring or frame.
  - B. Standard: Comply with SCTE 77. Comply with tier requirements in "Underground Enclosure Application" Article.
  - C. Color: Gray.
  - D. Configuration: Units shall be designed for flush burial and have open bottom unless otherwise indicated.
  - E. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
  - F. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
  - G. Cover Legend: Molded lettering, "ELECTRIC."
  - H. Direct-Buried Wiring Entrance Provisions: Knockouts equipped with insulated bushings or end-bell fittings, selected to suit box material, sized for wiring indicated, and arranged for secure, fixed installation in enclosure wall.
  - I. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering duct for secure, fixed installation in enclosure wall.

- J. Handholes 12 inches wide by 24 inches long and larger shall have factory-installed inserts for cable racks and pulling-in irons.

## 2.07 FIBERGLASS HANDHOLES AND BOXES

- A. Description: Molded of fiberglass-reinforced polyester resin, with covers made of polymer concrete.
- B. Standard: Comply with SCTE 77. Comply with tier requirements in "Underground Enclosure Application" Article.
- C. Color: Gray.
- D. Configuration: Units shall be designed for flush burial and have open bottom unless otherwise indicated.
- E. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
- F. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
- G. Cover Legend: Molded lettering, "ELECTRIC."
- H. Direct-Buried Wiring Entrance Provisions: Knockouts equipped with insulated bushings or end-bell fittings, selected to suit box material, sized for wiring indicated, and arranged for secure, fixed installation in enclosure wall.
- I. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering duct for secure, fixed installation in enclosure wall.
- J. Handholes 12 inches wide by 24 inches long and larger shall have factory-installed inserts for cable racks and pulling-in irons.

## 2.08 SOURCE QUALITY CONTROL

- A. Test and inspect precast concrete utility structures according to ASTM C 1037.
- B. Nonconcrete Handhole and Pull-Box Prototype Test: Test prototypes of manholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
  - 1. Tests of materials shall be performed by an independent testing agency.
  - 2. Strength tests of complete boxes and covers shall be by an independent testing agency or manufacturer.
  - 3. Testing machine pressure gages shall have current calibration certification, complying with ISO 9000 and ISO 10012, and traceable to NIST standards.



## PART 3 - EXECUTION

## 3.01 PREPARATION

- A. Coordinate layout and installation of duct, duct bank, manholes, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field. Notify Architect if there is a conflict between areas of excavation and existing structures or archaeological sites to remain.
- B. Coordinate elevations of duct and duct-bank entrances into handholes and boxes with final locations and profiles of duct and duct banks, as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations as required to suit field conditions and to ensure that duct and duct bank will drain to handholes, and as approved by Architect.

## 3.02 UNDERGROUND DUCT APPLICATION

- A. Duct for Electrical Cables More Than 600 V: Type EPC-40-PVC RNC, concrete-encased unless otherwise indicated.
- B. Duct for Electrical Feeders 600 V and Less: Type EPC-80-PVC RNC, concrete-encased unless otherwise indicated.
- C. Duct for Electrical Feeders 600 V and Less: Type EPC-80-PVC RNC, direct-buried unless otherwise indicated.
- D. Duct for Electrical Branch Circuits: Type EPC-40-PVC RNC, direct-buried unless otherwise indicated.
- E. Bored Underground Duct: Type EPEC-40-HDPE unless otherwise indicated.
- F. Underground Ducts Crossing Paved Paths Walks and Driveways: Type EPC-40 PVC RNC, encased in reinforced concrete.
- G. Stub-ups: Concrete-encased RNC.

## 3.03 UNDERGROUND ENCLOSURE APPLICATION

- A. Handholes and Boxes for 600 V and Less:
  - 1. Units in Roadways and Other Deliberate Traffic Paths: Precast concrete, AASHTO HB 17, H-10 structural load rating.
  - 2. Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Precast concrete, AASHTO HB 17, H-20 structural load rating.
  - 3. Units in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Polymer concrete units, SCTE 77, Tier 8 structural load rating.
  - 4. Units Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin or High-density plastic, structurally tested according to SCTE 77 with 3000-lbf vertical loading.
  - 5. Cover design load shall not exceed the design load of the handhole or box.

## 3.04 EARTHWORK

- A. Restoration: Replace area immediately after backfilling is completed or after construction vehicle traffic in immediate area is complete.
- B. Restore surface features at areas disturbed by excavation, and re-establish original grades unless otherwise indicated. Replace removed sod immediately after backfilling is completed.
- C. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching.

## 3.05 DUCT AND DUCT-BANK INSTALLATION

- A. Where indicated on Drawings, install duct, spacers, and accessories into the duct-bank configuration shown. Duct installation requirements in this Section also apply to duct bank.
- B. Install duct according to NEMA TCB 2.
- C. Slope: Pitch duct a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope duct from a high point between two manholes, to drain in both directions.
- D. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 inches, both horizontally and vertically, at other locations unless otherwise indicated.
  - 1. Duct shall have maximum of two 90 degree bends or the total of all bends shall be no more 180 degrees between pull points.
- E. Joints: Use solvent-cemented joints in duct and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent duct do not lie in same plane.
- F. Installation Adjacent to High-Temperature Steam Lines: Where duct is installed parallel to underground steam lines, perform calculations showing the duct will not be subject to environmental temperatures above 40 deg C. Where environmental temperatures are calculated to rise above 40 deg C, and anywhere the duct crosses above an underground steam line, install insulation blankets listed for direct burial to isolate the duct bank from the steam line.
- G. End Bell Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 10 inches o.c. for 5-inch duct, and vary proportionately for other duct sizes.
  - 1. Begin change from regular spacing to end-bell spacing 10 feet from the end bell, without reducing duct slope and without forming a trap in the line.
  - 2. Expansion and Deflection Fittings: Install an expansion and deflection fitting in each duct in the area of disturbed earth adjacent to manhole or handhole. Install an expansion fitting near the center of all straight line direct-buried duct with calculated expansion of more than 3/4 inch.

3. Grout end bells into structure walls from both sides to provide watertight entrances.
- H. Terminator Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use manufactured, cast-in-place duct terminators, with entrances into structure spaced approximately 6 inches o.c. for 4-inch duct, and vary proportionately for other duct sizes.
1. Begin change from regular spacing to terminator spacing 10 feet from the terminator, without reducing duct line slope and without forming a trap in the line.
  2. Expansion and Deflection Fittings: Install an expansion and deflection fitting in each duct in the area of disturbed earth adjacent to manhole or handhole. Install an expansion fitting near the center of all straight line duct with calculated expansion of more than 3/4 inch.
- I. Building Wall Penetrations: Make a transition from underground duct to GRC at least 10 feet outside the building wall, without reducing duct line slope away from the building and without forming a trap in the line. Use fittings manufactured for RNC-to-GRC transition. Sealing: Provide temporary closure at terminations of duct with pulled cables. Seal spare duct at terminations. Use sealing compound and plugs to withstand at least 15-psig hydrostatic pressure.
- J. Pulling Cord: Install 200-lbf- test nylon cord in empty ducts.
- K. Concrete-Encased Ducts and Duct Bank:
1. Excavate trench bottom to provide firm and uniform support for duct. Prepare trench bottoms per drawings.
  2. Width: Excavate trench 12 inches wider than duct on each side.
  3. Width: Excavate trench 3 inches wider than duct on each side.
  4. Depth: Install so top of duct envelope is at least 24 inches below finished grade in areas not subject to deliberate traffic, and at least 30 inches below finished grade in deliberate traffic paths for vehicles unless otherwise indicated.
  5. Support duct on duct spacers coordinated with duct size, duct spacing, and outdoor temperature.
  6. Spacer Installation: Place spacers close enough to prevent sagging and deforming of duct, with not less than four spacers per 20 feet of duct. Place spacers within 24 inches of duct ends. Stagger spacers approximately 6 inches between tiers. Secure spacers to earth and to duct to prevent floating during concreting. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
  7. Minimum Space between Duct: 3 inches between edge of duct and exterior envelope wall, 2 inches between ducts for like services, and 4 inches between power and communications ducts.
  8. Elbows: Use manufactured duct elbows for stub-ups, at building entrances, and at changes of direction in duct unless otherwise indicated. Extend encasement throughout length of elbow.

9. Elbows: Use manufactured GRC elbows for stub-ups, at building entrances, and at changes of direction in duct run.
  - a. Couple RNC duct to GRC with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
  - b. Stub-ups to Outdoor Equipment: Extend concrete-encased GRC horizontally a minimum of 60 inches from edge of base. Install insulated grounding bushings on terminations at equipment.
    - 1) Stub-ups shall be minimum 4 inches above finished floor and minimum 3 inches from conduit side to edge of slab
  - c. Stub-ups to Indoor Equipment: Extend concrete-encased GRC horizontally a minimum of 60 inches from edge of wall. Install insulated grounding bushings on terminations at equipment.
    - 1) Stub-ups shall be minimum 4 inches above finished floor and no less than 3 inches from conduit side to edge of slab
10. Reinforcement: Reinforce concrete-encased duct where crossing disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
11. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
12. Concrete Cover: Install a minimum of 3 inches of concrete cover between edge of duct to exterior envelope wall, 2 inches between duct of like services, and 4 inches between power and communications ducts.
13. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.
  - a. Start at one end and finish at the other, allowing for expansion and contraction of duct as its temperature changes during and after the pour. Use expansion fittings installed according to manufacturer's written instructions, or use other specific measures to prevent expansion-contraction damage.
  - b. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch reinforcing-rod dowels extending a minimum of 18 inches into concrete on both sides of joint near corners of envelope.
14. Pouring Concrete: Comply with requirements in concrete specifications. Place concrete carefully during pours to prevent voids under and between duct and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Allow concrete to flow around duct and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-installation application.

L. Direct-Buried Duct and Duct Bank:

1. Excavate trench bottom to provide firm and uniform support for duct.
2. Width: Excavate trench 12 inches wider than duct on each side.
3. Width: Excavate trench 3 inches wider than duct on each side.
4. Depth: Install top of duct at least 36 inches below finished grade unless otherwise indicated.
5. Set elevation of bottom of duct bank below frost line.
6. Support ducts on duct spacers coordinated with duct size, duct spacing, and outdoor temperature.

7. Spacer Installation: Place spacers close enough to prevent sagging and deforming of duct, with not less than four spacers per 20 feet of duct. Place spacers within 24 inches of duct ends. Stagger spacers approximately 6 inches between tiers. Secure spacers to earth and to ducts to prevent floating during concreting. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
  8. Install duct with a minimum of 3 inches between ducts for like services and 6 inches between power and communications duct.
  9. Elbows: Install manufactured duct elbows for stub-ups, at building entrances, and at changes of direction in duct direction unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
  10. Install manufactured GRC elbows for stub-ups, at building entrances, and at changes of direction in duct.
    - a. Couple RNC duct to GRC with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
    - b. Stub-ups to Outdoor Equipment: Extend concrete-encased GRC horizontally a minimum of 60 inches from edge of base. Install insulated grounding bushings on terminations at equipment.
      - 1) Stub-ups shall be minimum 4 inches above finished floor and minimum 3 inches from conduit side to edge of slab
    - c. Stub-ups to Indoor Equipment: Extend concrete-encased GRC horizontally a minimum of 60 inches from edge of wall. Install insulated grounding bushings on terminations at equipment.
      - 1) Stub-ups shall be minimum 4 inches above finished floor and no less than 3 inches from conduit side to edge of slab
  11. After installing first tier of duct, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand place backfill to 4 inches over duct and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction. Comply with requirements in Section 312000 "Earth Moving" for installation of backfill materials.
    - a. Place minimum 3 inches of sand as a bed for duct. Place sand to a minimum of 6 inches above top level of duct.
    - b. Place minimum 6 inches of engineered fill above concrete encasement of duct.
- M. Warning Planks: Bury warning planks approximately 12 inches above direct-buried duct, placing them 24 inches o.c. Align planks along the width and along the centerline of duct or duct bank. Provide an additional plank for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional planks 12 inches apart, horizontally.
- N. Underground-Line Warning Tape: Bury conducting underground line specified in Section 26 05 53 "Identification for Electrical Systems" no less than 12 inches above all concrete-encased duct and duct banks. Align tape parallel to and within 3 inches of centerline of duct bank. Provide an additional warning tape for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional tapes 12 inches apart, horizontally.

## 3.06 INSTALLATION OF CONCRETE HANDHOLES AND BOXES

## A. Precast Concrete Handhole Installation:

1. Comply with ASTM C 891 unless otherwise indicated.
2. Install units level and plumb and with orientation and depth coordinated with connecting duct, to minimize bends and deflections required for proper entrances.
3. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

## B. Elevations:

1. Manhole Roof: Install with rooftop at least 15 inches below finished grade.
2. Manhole Frame: In paved areas and traffic ways, set frames flush with finished grade. Set other manhole frames 1 inch above finished grade.
3. Install handholes with bottom below frost line.
4. Handhole Covers: In paved areas and traffic ways, set surface flush with finished grade. Set covers of other handholes 1 inch above finished grade.
5. Where indicated, cast handhole cover frame integrally with handhole structure.

## C. Drainage: Install drains in bottom of manholes where indicated. Coordinate with drainage provisions indicated.

## D. Waterproofing: Apply waterproofing to exterior surfaces of manholes and handholes after concrete has cured at least three days. After duct has been connected and grouted, and before backfilling, waterproof joints and connections, and touch up abrasions and scars. Waterproof exterior of manhole chimneys after mortar has cured at least three days.

## E. Dampproofing: Apply dampproofing to exterior surfaces of manholes and handholes after concrete has cured at least three days. Dampproofing materials and installation are specified in Division 07. After ducts are connected and grouted, and before backfilling, dampproof joints and connections, and touch up abrasions and scars. Dampproof exterior of manhole chimneys after mortar has cured at least three days.

## F. Hardware: Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated.

## G. Field-Installed Bolting Anchors in Concrete Handholes: Do not drill deeper than 2 inches for handholes, for anchor bolts installed in the field. Use a minimum of two anchors for each cable stanchion.

## 3.07 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting duct, to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of duct, and seal joint between box and extension as recommended by manufacturer.

- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas and traffic ways, set cover flush with finished grade. Set covers of other handholes 1 inch above finished grade.
- D. Install handholes and boxes with bottom below frost line.
- E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in enclosure.
- F. Field cut openings for duct according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.
- G. For enclosures installed in asphalt paving and subject to occasional, nondeliberate, heavy-vehicle loading, form and pour a concrete ring encircling, and in contact with, enclosure and with top surface screeded to top of box cover frame. Bottom of ring shall rest on.
  - 1. Concrete: 3000 psi, 28-day strength, with a troweled finish.
  - 2. Dimensions: 10 inches wide by 12 inches deep.

### 3.08 GROUNDING

- A. Ground underground ducts and utility structures according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."

### 3.09 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  - 1. Demonstrate capability and compliance with requirements on completion of installation of underground duct, duct bank, and utility structures.
  - 2. Pull solid aluminum or wood test mandrel through duct to prove joint integrity and adequate bend radii, and test for out-of-round duct. Provide a minimum 12-inch-long mandrel equal to duct size minus 1/4 inch. If obstructions are indicated, remove obstructions and retest.
  - 3. Test manhole and handhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Section 26 05 26 "Grounding and Bonding for Electrical Systems."
- B. Correct deficiencies and retest as specified above to demonstrate compliance.
- C. Prepare test and inspection reports.

3.10 CLEANING

- A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of duct until duct cleaner indicates that duct is clear of dirt and debris. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

END OF SECTION



## SECTION 26 05 53

## IDENTIFICATION FOR ELECTRICAL SYSTEMS

## PART 1 - GENERAL

## 1.01 SUMMARY

## A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Underground-line warning tape.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels, including arc-flash warning labels.
8. Miscellaneous identification products.

## 1.02 ACTION SUBMITTALS

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

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for electrical identification products.

## B. Samples: For each type of label and sign to illustrate composition, size, colors, lettering style, mounting provisions, and graphic features of identification products.

## C. Identification Schedule: For each piece of electrical equipment and electrical system components to be an index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.

## D. Delegated-Design Submittal: For arc-flash hazard study.

## PART 2 - PRODUCTS

## 2.01 PERFORMANCE REQUIREMENTS

## A. Comply with ASME A13.1.

## B. Comply with NFPA 70.

## C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

## D. Comply with ANSI Z535.4 for safety signs and labels.

## E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

- F. 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 COLOR AND LEGEND REQUIREMENTS

- A. Raceways and Cables Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage.

- B. Raceways and Cables Carrying Circuits at More Than 600 V:

1. Black letters on an orange field.
2. Legend: "DANGER - CONCEALED HIGH VOLTAGE WIRING."

- C. Warning labels and signs shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

## 2.03 LABELS

- A. Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.

- B. Snap-Around Labels for Raceways and Cables Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameters of raceways they identify, and that stay in place by gripping action.

- C. Self-Adhesive Labels:

1. Preprinted Write-on, 3-mil-thick, polyester flexible label with acrylic pressure-sensitive adhesive.
  - a. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized to fit the raceway diameter, such that the clear shield overlaps the entire printed legend.
2. Polyester, thermal, transfer-printed, 3-mil-thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.
  - a. Nominal Size: 3.5-by-5-inch.
3. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
4. Marker for Tags: Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.

## 2.04 BANDS AND TUBES:

- A. Snap-Around, Color-Coding Bands for Raceways and Cables: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches long, with diameters sized to suit diameters of raceways or cables they identify, and that stay in place by gripping action.
- B. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machine-printed identification labels, sized to suit diameters of and shrunk to fit firmly around cables they identify. Full shrink recovery occurs at a maximum of 200 deg F. Comply with UL 224.

## 2.05 TAPES AND STENCILS:

- A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils thick by 1 to 2 inches wide; compounded for outdoor use.
- C. Tape and Stencil for Raceways Carrying Circuits 600 V or Less: 4-inch-wide black stripes on 10-inch centers placed diagonally over orange background that extends full length of raceway or duct and is 12 inches wide. Stop stripes at legends.
- D. Underground-Line Warning Tape
  - 1. Tape:
    - a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical utility lines.
    - b. Printing on tape shall be permanent and shall not be damaged by burial operations.
    - c. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.
  - 2. Color and Printing:
    - a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4, and ANSI Z535.5.
    - b. Inscriptions for Red-Colored Tapes: "ELECTRIC LINE, HIGH VOLTAGE".
    - c. Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE".
- E. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

## 2.06 Signs

- A. Baked-Enamel Signs:
  - 1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
  - 2. 1/4-inch grommets in corners for mounting.
  - 3. Nominal Size: 7 by 10 inches.
- B. Metal-Backed Butyrate Signs:
  - 1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs, with 0.0396-inch galvanized-steel backing and with colors, legend, and size required for application.

2. 1/4-inch grommets in corners for mounting.
3. Nominal Size: 10 by 14 inches.

C. Laminated Acrylic or Melamine Plastic Signs:

1. Engraved legend.
2. Thickness:
  - a. For signs up to 20 sq. inches, minimum 1/16-inch.
  - b. For signs larger than 20 sq. inches, 1/8 inch thick.
  - c. Engraved legend with black letters on white face.
  - d. Self-adhesive.
  - e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.07 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F according to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black, except where used for color-coding.

B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F according to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black.

C. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, self-locking.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F according to ASTM D 638: 7000 psi.
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F.
5. Color: Black.

2.08 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

## PART 3 - EXECUTION

## 3.01 PREPARATION

- A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

## 3.02 INSTALLATION

- A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
- B. Install identifying devices before installing acoustical ceilings and similar concealment.
- C. Verify identity of each item before installing identification products.
- D. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.
- E. Apply identification devices to surfaces that require finish after completing finish work.
- F. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- G. Attach plastic raceway and cable labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.
- H. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:
  - 1. Outdoors: UV-stabilized nylon.
  - 2. In Spaces Handling Environmental Air: Plenum rated.
- I. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.
- J. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.
- K. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
- L. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches overall.

## 3.03 IDENTIFICATION SCHEDULE

- A. Concealed Raceways, Duct Banks, More Than 600 V, within Buildings: Tape and stencil 4-inch-wide black stripes on 10-inch centers over orange background that extends full length of raceway or duct and is 12 inches wide. Stencil legend "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch-high black letters on 20-inch centers. Stop stripes at legends. Apply stripes to the following finished surfaces:
1. Floor surface directly above conduits running beneath and within 12 inches of a floor that is in contact with earth or is framed above unexcavated space.
  2. Wall surfaces directly external to raceways concealed within wall.
  3. Accessible surfaces of concrete envelope around raceways in vertical shafts, exposed in the building, or concealed above suspended ceilings.
- B. Accessible Raceways, Armored and Metal-Clad Cables, More Than 600 V: Snap-around labels. Install labels at 30-foot maximum intervals.
- C. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits, More Than 50 A and 120 V to Ground: Identify with self-adhesive vinyl label. Install labels at 30-foot maximum intervals.
- D. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
1. Color-Coding for Phase- Identification, 600 V or Less: Use colors listed below for ungrounded service feeder and branch-circuit conductors.
    - a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit.
    - b. Colors for 208/120-V Circuits:
      - 1) Phase A: Black.
      - 2) Phase B: Red.
      - 3) Phase C: Blue.
    - c. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- E. Install instructional sign, including the color code for grounded and ungrounded conductors using adhesive-film-type labels.
- F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
  2. Use system of marker-tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
- G. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.
1. Limit use of underground-line warning tape to direct-buried cables.
  2. Install underground-line warning tape for direct-buried cables and cables in raceways.

- H. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- I. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.
  - 1. Comply with 29 CFR 1910.145.
  - 2. Identify system voltage with black letters on an orange background.
  - 3. Apply to exterior of door, cover, or other access.
- J. Arc Flash Warning Labeling: Self-adhesive thermal transfer vinyl labels.
  - 1. Comply with NFPA 70E and ANSI Z535.4.
- K. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- L. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm unless equipment is provided with its own identification.
  - 1. Labeling Instructions:
    - a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine plastic label. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.
    - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
    - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
    - d. Unless labels are provided with self-adhesive means of attachment, fasten them with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure

2. Equipment To Be Labeled:
  - a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be in the form of a self-adhesive, engraved, laminated acrylic or melamine label.
  - b. Enclosures and electrical cabinets.
  - c. Access doors and panels for concealed electrical items.
  - d. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
  - e. Enclosed switches.
  - f. Enclosed circuit breakers.
  - g. Enclosed controllers.
  - h. Variable-speed controllers.
  - i. Push-button stations.
  - j. Contactors.
  - k. Remote-controlled switches, dimmer modules, and control devices.

END OF SECTION



## SECTION 26 05 73.13

## SHORT-CIRCUIT STUDIES

## PART 1 - GENERAL

## 1.01 SUMMARY

- A. Section includes a computer-based, fault-current study to determine the minimum interrupting capacity of circuit protective devices.

## 1.02 DEFINITIONS

- A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed and salvaged, or removed and reinstalled. Existing to remain items shall remain functional throughout the construction period.
- B. Field Adjusting Agency: An independent electrical testing agency with full-time employees and the capability to adjust devices and conduct testing indicated and that is a member company of NETA.
- C. One-Line Diagram: A diagram that shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.
- D. Power System Analysis Software Developer: An entity that commercially develops, maintains, and distributes computer software used for power system studies.
- E. Power Systems Analysis Specialist: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located.
- F. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion of the circuit from the system.
- G. SCCR: Short-circuit current rating.
- H. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.
- I. Single-Line Diagram: See "One-Line Diagram."

## 1.03 ACTION SUBMITTALS

- A. Product Data:
  - 1. For computer software program to be used for studies.

2. Submit the following after the approval of system protective devices submittals. Submittals may be in digital form.
  - a. Short-circuit study input data, including completed computer program input data sheets.
  - b. Short-circuit study and equipment evaluation report; signed, dated, and sealed by a qualified professional engineer.
    - 1) Submit study report for action prior to receiving final approval of distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.
    - 2) Revised one-line diagram, reflecting field investigation results and results of short-circuit study.

#### 1.04 INFORMATIONAL SUBMITTALS

##### A. Qualification Data:

1. For Power Systems Analysis Software Developer.
2. For Power System Analysis Specialist.
3. For Field Adjusting Agency.

##### B. Product Certificates: For short-circuit study software, certifying compliance with IEEE 399.

#### 1.05 CLOSEOUT SUBMITTALS

##### A. Operation and Maintenance Data:

1. For overcurrent protective devices to include in emergency, operation, and maintenance manuals.
2. The following are from the Short-Circuit Study Report:
  - a. Final one-line diagram.
  - b. Final Short-Circuit Study Report.
  - c. Short-circuit study data files.
  - d. Power system data.

#### 1.06 QUALITY ASSURANCE

##### A. Study shall be performed using commercially developed and distributed software designed specifically for power system analysis.

##### B. Software algorithms shall comply with requirements of standards and guides specified in this Section.

##### C. Manual calculations are unacceptable.

1. Power System Analysis Software Qualifications: Computer program shall be designed to perform short-circuit studies or have a function, component, or add-on module designed to perform short-circuit studies.
2. Computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

- D. Power Systems Analysis Specialist Qualifications: Professional engineer licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.
- E. Short-Circuit Study Certification: Short-Circuit Study Report shall be signed and sealed by Power Systems Analysis Specialist.
- F. Field Adjusting Agency Qualifications: Acceptable to authorities having jurisdiction.

## PART 2 - PRODUCTS

### 2.01 POWER SYSTEM ANALYSIS SOFTWARE DEVELOPERS

- A. Comply with IEEE 399 and IEEE 551.
  - 1. Analytical features of power systems analysis software program shall have capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.
- B. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output.

### 2.02 SHORT-CIRCUIT STUDY REPORT CONTENTS

- A. Executive summary of study findings.
- B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.
- C. One-line diagram of modeled power system, showing the following:
  - 1. Protective device designations and ampere ratings.
  - 2. Conductor types, sizes, and lengths.
  - 3. Transformer kilovolt ampere (kVA) and voltage ratings.
  - 4. Motor and generator designations and kVA ratings.
  - 5. Switchgear, switchboard, motor-control center, and panelboard designations and ratings.
  - 6. Derating factors and environmental conditions.
  - 7. Any revisions to electrical equipment required by the study.
- D. Comments and recommendations for system improvements or revisions in a written document, separate from one-line diagram.
- E. Protective Device Evaluation:
  - 1. Evaluate equipment and protective devices and compare to available short-circuit currents. Verify that equipment withstand ratings exceed available short-circuit current at equipment installation locations.
  - 2. Tabulations of circuit breaker, fuse, and other protective device ratings versus calculated short-circuit duties.
  - 3. For 600-V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.

4. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in standards to 1/2-cycle symmetrical fault current.
  5. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
- F. Short-Circuit Study Input Data:
1. One-line diagram of system being studied.
  2. Power sources available.
  3. Manufacturer, model, and interrupting rating of protective devices.
  4. Conductors.
  5. Transformer data.
- G. Short-Circuit Study Output Reports:
1. Low-Voltage Fault Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:
    - a. Voltage.
    - b. Calculated fault-current magnitude and angle.
    - c. Fault-point X/R ratio.
    - d. Equivalent impedance.
  2. Momentary Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:
    - a. Voltage.
    - b. Calculated symmetrical fault-current magnitude and angle.
    - c. Fault-point X/R ratio.
    - d. Calculated asymmetrical fault currents:
      - 1) Based on fault-point X/R ratio.
      - 2) Based on calculated symmetrical value multiplied by 1.6.
      - 3) Based on calculated symmetrical value multiplied by 2.7.
  3. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:
    - a. Voltage.
    - b. Calculated symmetrical fault-current magnitude and angle.
    - c. Fault-point X/R ratio.
    - d. No AC Decrement (NACD) ratio.
    - e. Equivalent impedance.
    - f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
    - g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.

### PART 3 - EXECUTION

#### 3.01 POWER SYSTEM DATA

- A. Obtain all data necessary for conduct of the study.
1. Verify completeness of data supplied on one-line diagram. Call any discrepancies to Architect's attention.

2. For equipment included as Work of this Project, use characteristics submitted under provisions of action submittals and information submittals for this Project.
  3. For equipment that is existing to remain, obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers. Qualifications of technicians and engineers shall be as defined by NFPA 70E.
- B. Gather and tabulate the required input data to support the short-circuit study. Record data on a Record Document copy of one-line diagram. Comply with recommendations in IEEE 551 as to the amount of detail that is required to be acquired in the field. Field data gathering shall be under direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification. Data include, but are not limited to, the following:
1. Product Data for Project's overcurrent protective devices involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
  2. Obtain electrical power utility impedance at the service.
  3. Power sources and ties.
  4. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
  5. For reactors, provide manufacturer and model designation, voltage rating, and impedance.
  6. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip, SCCR, current rating, and breaker settings.
  7. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
  8. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
  9. Motor horsepower and NEMA MG 1 code letter designation.
  10. Conductor sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).
  11. Derating factors.
- 3.02 SHORT-CIRCUIT STUDY
- A. Perform study following the general study procedures contained in IEEE 399.
  - B. Calculate short-circuit currents according to IEEE 551.
  - C. Base study on device characteristics supplied by device manufacturer.
  - D. Extent of electrical power system to be studied is indicated on Drawings.
  - E. Begin short-circuit current analysis at the service, extending down to system overcurrent protective devices as follows:
    1. To normal system low-voltage load buses where fault current is 10 kA or less.
    2. Exclude equipment rated 240 V ac or less when supplied by a single transformer rated less than 125 kVA.
  - F. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study all cases of system-switching configurations and alternate operations that could result in maximum fault conditions.

- G. Include the ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and apply to low- and medium-voltage, three-phase ac systems. Also account for the fault-current dc decrement to address asymmetrical requirements of interrupting equipment.
- H. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault and a single line-to-ground fault at each equipment indicated on one-line diagram.
  - 1. For grounded systems, provide a bolted line-to-ground fault-current study for areas as defined for the three-phase bolted fault short-circuit study.
- I. Include in the report identification of any protective device applied outside its capacity.

END OF SECTION

## SECTION 26 05 73.16

## COORDINATION STUDIES

## PART 1 - GENERAL

## 1.01 SUMMARY

- A. Section includes computer-based, overcurrent protective device coordination studies to determine overcurrent protective devices and to determine overcurrent protective device settings for selective tripping.

- 1. Study results shall be used to determine coordination of series-rated devices.

## 1.02 DEFINITIONS

- A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled. Existing to remain items shall remain functional throughout the construction period.
- B. Field Adjusting Agency: An independent electrical testing agency with full-time employees and the capability to adjust devices and conduct testing indicated and that is a member company of NETA.
- C. One-Line Diagram: A diagram that shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.
- D. Power System Analysis Software Developer: An entity that commercially develops, maintains, and distributes computer software used for power system studies.
- E. Power System Analysis Specialist: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located.
- F. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion of the circuit from the system.
- G. SCCR: Short-circuit current rating.
- H. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.
- I. Single-Line Diagram: See "One-Line Diagram."

## 1.03 ACTION SUBMITTALS

- A. Product Data:

- 1. For computer software program to be used for studies.

2. Submit the following after the approval of system protective devices submittals. Submittals may be in digital form.
  - a. Coordination-study input data, including completed computer program input data sheets.
  - b. Study and equipment evaluation reports.
3. Overcurrent protective device coordination study report; signed, dated, and sealed by a qualified professional engineer.
  - a. Submit study report for action prior to receiving final approval of distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.

#### 1.04 INFORMATIONAL SUBMITTALS

##### A. Qualification Data:

1. For Power System Analysis Software Developer.
2. For Power Systems Analysis Specialist.
3. For Field Adjusting Agency.

##### B. Product Certificates: For overcurrent protective device coordination study software, certifying compliance with IEEE 399.

#### 1.05 CLOSEOUT SUBMITTALS

##### A. Operation and Maintenance Data: For overcurrent protective devices to include in emergency, operation, and maintenance manuals.

1. The following are from the Coordination Study Report:
  - a. Final one-line diagram.
  - b. Final protective device coordination study.
  - c. Coordination study data files.
  - d. List of all protective device settings.
  - e. Time-current coordination curves.
  - f. Power system data.

#### 1.06 QUALITY ASSURANCE

##### A. Studies shall be performed using commercially developed and distributed software designed specifically for power system analysis.

##### B. Software algorithms shall comply with requirements of standards and guides specified in this Section.

##### C. Manual calculations are unacceptable.

##### D. Power System Analysis Software Qualifications:

1. Computer program shall be designed to perform coordination studies or have a function, component, or add-on module designed to perform coordination studies.
2. Computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.



- E. Power Systems Analysis Specialist Qualifications: Professional engineer licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.
- F. Field Adjusting Agency Qualifications:
  - 1. Acceptable to authorities having jurisdiction.

## PART 2 - PRODUCTS

### 2.01 POWER SYSTEM ANALYSIS SOFTWARE DEVELOPERS

- A. Comply with IEEE 242 and IEEE 399.
- B. Analytical features of device coordination study computer software program shall have the capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.
- C. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots.
  - 1. Optional Features:
    - a. Arcing faults.
    - b. Simultaneous faults.
    - c. Explicit negative sequence.
    - d. Mutual coupling in zero sequence.

### 2.02 COORDINATION STUDY REPORT CONTENTS

- A. Executive summary of study findings.
- B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.
- C. One-line diagram of modeled power system, showing the following:
  - 1. Protective device designations and ampere ratings.
  - 2. Conductor types, sizes, and lengths.
  - 3. Transformer kilovolt ampere (kVA) and voltage ratings.
  - 4. Motor and generator designations and kVA ratings.
  - 5. Switchgear, switchboard, motor-control center, and panelboard designations.
  - 6. Any revisions to electrical equipment required by the study.
  - 7. Study Input Data: As described in "Power System Data" Article.
    - a. Short-Circuit Study Output: As specified in "Short-Circuit Study Output Reports" Paragraph in "Short-Circuit Study Report Contents" Article in Section 26 05 73.13 "Short-Circuit Studies."

- D. Protective Device Coordination Study:
1. Report recommended settings of protective devices, ready to be applied in the field. Use manufacturer's data sheets for recording the recommended setting of overcurrent protective devices when available.
    - a. Phase and Ground Relays:
      - 1) Device tag.
      - 2) Relay current transformer ratio and tap, time dial, and instantaneous pickup value.
      - 3) Recommendations on improved relaying systems, if applicable.
    - b. Circuit Breakers:
      - 1) Adjustable pickups and time delays (long time, short time, and ground).
      - 2) Adjustable time-current characteristic.
      - 3) Adjustable instantaneous pickup.
      - 4) Recommendations on improved trip systems, if applicable.
    - c. Fuses: Show current rating, voltage, and class.
- E. Time-Current Coordination Curves: Determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:
1. Device tag and title, one-line diagram with legend identifying the portion of the system covered.
  2. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which the device is exposed.
  3. Identify the device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.
  4. Plot the following listed characteristic curves, as applicable:
    - a. Power utility's overcurrent protective device.
    - b. Medium-voltage equipment overcurrent relays.
    - c. Medium- and low-voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands.
    - d. Low-voltage equipment circuit-breaker trip devices, including manufacturer's tolerance bands.
    - e. Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves.
    - f. Cables and conductors damage curves.
    - g. Ground-fault protective devices.
    - h. Motor-starting characteristics and motor damage points.
    - i. Generator short-circuit decrement curve and generator damage point.
    - j. The largest feeder circuit breaker in each motor-control center and panelboard.
  5. Maintain selectivity for tripping currents caused by overloads.
  6. Maintain maximum achievable selectivity for tripping currents caused by overloads on series-rated devices.
  7. Provide adequate time margins between device characteristics such that selective operation is achieved.
  8. Comments and recommendations for system improvements.

## PART 3 - EXECUTION

## 3.01 EXAMINATION

- A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance of the Work. Devices to be coordinated are indicated on Drawings.
1. Proceed with coordination study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to coordination study may not be used in study.

## 3.02 POWER SYSTEM DATA

- A. Obtain all data necessary for conduct of the overcurrent protective device study.
1. Verify completeness of data supplied in one-line diagram on Drawings. Call any discrepancies to Architect's attention.
  2. For equipment included as Work of this Project, use characteristics submitted under provisions of action submittals and information submittals for this Project.
  3. For equipment that is existing to remain, obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers. Qualifications of technicians and engineers shall be as defined by NFPA 70E.
- B. Gather and tabulate all required input data to support the coordination study. List below is a guide. Comply with recommendations in IEEE 551 for the amount of detail required to be acquired in the field. Field data gathering shall be under direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification. Data include, but are not limited to, the following:
1. Product Data for overcurrent protective devices specified in other Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
  2. Electrical power utility impedance at the service.
  3. Power sources and ties.
  4. Short-circuit current at each system bus (three phase and line to ground).
  5. Full-load current of all loads.
  6. Voltage level at each bus.
  7. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
  8. For reactors, provide manufacturer and model designation, voltage rating, and impedance.
  9. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, SCCR, current rating, and breaker settings.
  10. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
  11. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.
  12. Maximum demands from service meters.

13. Busway manufacturer and model designation, current rating, impedance, lengths, size, and conductor material.
14. Motor horsepower and NEMA MG 1 code letter designation.
15. Low-voltage cable sizes, lengths, number, conductor material, and conduit material (magnetic or nonmagnetic).
16. Medium-voltage cable sizes, lengths, conductor material, cable construction, metallic shield performance parameters, and conduit material (magnetic or nonmagnetic).
17. Data sheets to supplement electrical distribution system one-line diagram, cross-referenced with tag numbers on diagram, showing the following:
  - a. Special load considerations, including starting inrush currents and frequent starting and stopping.
  - b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capability.
  - c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
  - d. Generator thermal-damage curve.
  - e. Ratings, types, and settings of utility company's overcurrent protective devices.
  - f. Special overcurrent protective device settings or types stipulated by utility company.
  - g. Time-current-characteristic curves of devices indicated to be coordinated.
  - h. Manufacturer, frame size, interrupting rating in amperes root mean square (rms) symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.
  - i. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.
  - j. Switchgear, switchboards, motor-control centers, and panelboards ampacity, and SCCR in amperes rms symmetrical.
  - k. Identify series-rated interrupting devices for a condition where the available fault current is greater than the interrupting rating of downstream equipment. Obtain device data details to allow verification that series application of these devices complies with NFPA 70 and UL 489 requirements.

### 3.03 COORDINATION STUDY

- A. Comply with IEEE 242 for calculating short-circuit currents and determining coordination time intervals.
- B. Comply with IEEE 399 for general study procedures.
- C. Base study on device characteristics supplied by device manufacturer.
- D. Extent of electrical power system to be studied is indicated on Drawings.
- E. Begin analysis at the service, extending down to system overcurrent protective devices as follows:
  1. To normal system low-voltage load buses where fault current is 10 kA or less.
  2. Exclude equipment rated 240 V ac or less when supplied by a single transformer rated less than 125 kVA.

- F. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study all cases of system-switching configurations and alternate operations that could result in maximum fault conditions.
- G. Transformer Primary Overcurrent Protective Devices:
1. Device shall not operate in response to the following:
    - a. Inrush current when first energized.
    - b. Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.
    - c. Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.
  2. Device settings shall protect transformers according to IEEE C57.12.00, for fault currents.
- H. Motor Protection:
1. Select protection for low-voltage motors according to IEEE 242 and NFPA 70.
  2. Select protection for motors served at voltages more than 600 V according to IEEE 620.
- I. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and protection recommendations in IEEE 242. Demonstrate that equipment withstands the maximum short-circuit current for a time equivalent to the tripping time of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.
- J. Generator Protection: Select protection according to manufacturer's written instructions and to IEEE 242.
- K. Include the ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and apply to low- and medium-voltage, three-phase ac systems. Also account for fault-current dc decrement, to address asymmetrical requirements of interrupting equipment.
- L. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault and a single line-to-ground fault at each equipment indicated on one-line diagram.
1. For grounded systems, provide a bolted line-to-ground fault-current study for areas as defined for the three-phase bolted fault short-circuit study.
- M. Protective Device Evaluation:
1. Evaluate equipment and protective devices and compare to short-circuit ratings.
  2. Adequacy of switchgear, motor-control centers, and panelboard bus bars to withstand short-circuit stresses.
  3. Any application of series-rated devices shall be recertified, complying with requirements in NFPA 70.
  4. Include in the report identification of any protective device applied outside its capacity.

**3.04 LOAD-FLOW AND VOLTAGE-DROP STUDY**

- A. Perform a load-flow and voltage-drop study to determine the steady-state loading profile of the system. Analyze power system performance two times as follows:
  - 1. Determine load flow and voltage drop based on full-load currents obtained in "Power System Data" Article.
  - 2. Determine load flow and voltage drop based on 80 percent of the design capacity of load buses.
  - 3. Prepare load-flow and voltage-drop analysis and report to show power system components that are overloaded, or might become overloaded; show bus voltages that are less than as prescribed by NFPA 70.

**3.05 FIELD ADJUSTING**

- A. Adjust relay and protective device settings according to recommended settings provided by the coordination study. Field adjustments shall be completed by the engineering service division of equipment manufacturer under the "Startup and Acceptance Testing" contract portion.
- B. Make minor modifications to equipment as required to accomplish compliance with short-circuit and protective device coordination studies.

**3.06 DEMONSTRATION**

- A. Engage Power Systems Analysis Specialist to train Owner's maintenance personnel in the following:
  - 1. Acquaint personnel in fundamentals of operating the power system in normal and emergency modes.
  - 2. Hand-out and explain the coordination study objectives, study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpreting time-current coordination curves.

END OF SECTION

## SECTION 26 05 73.19

## ARC-FLASH HAZARD ANALYSIS

## PART 1 - GENERAL

## 1.01 SUMMARY

- A. Section includes a computer-based, arc-flash study to determine the arc-flash hazard distance and the incident energy to which personnel could be exposed during work on or near electrical equipment.

## 1.02 DEFINITIONS

- A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.
- B. Field Adjusting Agency: An independent electrical testing agency with full-time employees and the capability to adjust devices and conduct testing indicated and that is a member company of NETA.
- C. One-Line Diagram: A diagram that shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.
- D. Power System Analysis Software Developer: An entity that commercially develops, maintains, and distributes computer software used for power system studies.
- E. Power Systems Analysis Specialist: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located.
- F. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.
- G. SCCR: Short-circuit current rating.
- H. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.
- I. Single-Line Diagram: See "One-Line Diagram."

## 1.03 ACTION SUBMITTALS

- A. Product Data: For computer software program to be used for studies.
- B. Study Submittals: Submit the following submittals after the approval of system protective devices submittals. Submittals may be in digital form:
  - 1. Arc-flash study input data, including completed computer program input data sheets.

2. Arc-flash study report; signed, dated, and sealed by Power Systems Analysis Specialist.
3. Submit study report for action prior to receiving final approval of distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.

#### 1.04 INFORMATIONAL SUBMITTALS

##### A. Qualification Data:

1. For Power Systems Analysis Software Developer.
2. For Power System Analysis Specialist.
3. For Field Adjusting Agency.

##### B. Product Certificates: For arc-flash hazard analysis software, certifying compliance with IEEE 1584 and NFPA 70E.

#### 1.05 CLOSEOUT SUBMITTALS

##### A. Operation and Maintenance Data:

1. Provide maintenance procedures in equipment manuals according to requirements in NFPA 70E.

#### 1.06 QUALITY ASSURANCE

##### A. Study shall be performed using commercially developed and distributed software designed specifically for power system analysis.

##### B. Software algorithms shall comply with requirements of standards and guides specified in this Section.

##### C. Manual calculations are unacceptable.

##### D. Power System Analysis Software Qualifications: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.

1. Computer program shall be designed to perform arc-flash analysis or have a function, component, or add-on module designed to perform arc-flash analysis.
2. Computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

##### E. Power Systems Analysis Specialist Qualifications: Professional engineer in charge of performing the arc-flash study, analyzing the arc flash, and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.



- F. Arc-Flash Study Certification: Arc-Flash Study Report shall be signed and sealed by Power Systems Analysis Specialist.
- G. Field Adjusting Agency Qualifications: Acceptable to authorities having jurisdiction.

## PART 2 - PRODUCTS

### 2.01 COMPUTER SOFTWARE DEVELOPERS

- A. Comply with IEEE 1584 and NFPA 70E.
- B. Analytical features of device coordination study computer software program shall have the capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

### 2.02 ARC-FLASH STUDY REPORT CONTENT

- A. Executive summary of study findings.
- B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.
- C. One-line diagram, showing the following:
  - 1. Protective device designations and ampere ratings.
  - 2. Conductor types, sizes, and lengths.
  - 3. Transformer kilovolt ampere (kVA) and voltage ratings, including derating factors and environmental conditions.
  - 4. Motor and generator designations and kVA ratings.
  - 5. Switchgear, switchboard, motor-control center, panelboard designations, and ratings.
- D. Study Input Data: As described in "Power System Data" Article.
- E. Short-Circuit Study Output Data: As specified in "Short-Circuit Study Output Reports" Paragraph in "Short-Circuit Study Report Contents" Article in Section 26 05 73.13 "Short-Circuit Studies."
- F. Protective Device Coordination Study Report Contents: As specified in "Coordination Study Report Contents" Article in Section 26 05 73.16 "Coordination Studies."
- G. Arc-Flash Study Output Reports:
  - 1. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each equipment location included in the report:
    - a. Voltage.
    - b. Calculated symmetrical fault-current magnitude and angle.
    - c. Fault-point X/R ratio.
    - d. No AC Decrement (NACD) ratio.
    - e. Equivalent impedance.
    - f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
    - g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.

## H. Incident Energy and Flash Protection Boundary Calculations:

1. Arcing fault magnitude.
2. Protective device clearing time.
3. Duration of arc.
4. Arc-flash boundary.
5. Restricted approach boundary.
6. Limited approach boundary.
7. Working distance.
8. Incident energy.
9. Hazard risk category.
10. Recommendations for arc-flash energy reduction.

- I. Fault study input data, case descriptions, and fault-current calculations including a definition of terms and guide for interpretation of computer printout.

## 2.03 ARC-FLASH WARNING LABELS

- A. Comply with requirements in Section 26 05 53 "Identification for Electrical Systems" for self-adhesive equipment labels. Produce a 3.5-by-5-inch self-adhesive equipment label for each work location included in the analysis.

- B. Label shall have an orange header with the wording, "WARNING, ARC-FLASH HAZARD," and shall include the following information taken directly from the arc-flash hazard analysis:

1. Location designation.
2. Nominal voltage.
3. Protection boundaries.
  - a. Arc-flash boundary.
  - b. Restricted approach boundary.
  - c. Limited approach boundary.
4. Arc flash PPE category.
5. Required minimum arc rating of PPE in Cal/cm squared.
6. Available incident energy.
7. Working distance.
8. Engineering report number, revision number, and issue date.

- C. Labels shall be machine printed, with no field-applied markings.

## PART 3 - EXECUTION

## 3.01 EXAMINATION

- A. Examine Project overcurrent protective device submittals. Proceed with arc-flash study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to arc-flash study may not be used in study.

## 3.02 ARC-FLASH HAZARD ANALYSIS

- A. Comply with NFPA 70E and its Annex D for hazard analysis study.

- B. Preparatory Studies: Perform the Short-Circuit and Protective Device Coordination studies prior to starting the Arc-Flash Hazard Analysis.
1. Short-Circuit Study Output: As specified in "Short-Circuit Study Output Reports" Paragraph in "Short-Circuit Study Report Contents" Article in Section 26 05 73.13 "Short-Circuit Studies."
  2. Coordination Study Report Contents: As specified in "Coordination Study Report Contents" Article in Section 26 05 73.16 "Coordination Studies."
- C. Calculate maximum and minimum contributions of fault-current size.
1. Maximum calculation shall assume a maximum contribution from the utility and shall assume motors to be operating under full-load conditions.
  2. Calculate arc-flash energy at 85 percent of maximum short-circuit current according to IEEE 1584 recommendations.
  3. Calculate arc-flash energy at 38 percent of maximum short-circuit current according to NFPA 70E recommendations.
  4. Calculate arc-flash energy with the utility contribution at a minimum and assume no motor contribution.
- D. Calculate the arc-flash protection boundary and incident energy at locations in electrical distribution system where personnel could perform work on energized parts.
- E. Include medium- and low-voltage equipment locations, except equipment rated 240 V ac or less fed from transformers less than 125 kVA.
- F. Calculate the limited, restricted, and prohibited approach boundaries for each location.
- G. Incident energy calculations shall consider the accumulation of energy over time when performing arc-flash calculations on buses with multiple sources. Iterative calculations shall take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators shall be decremented as follows:
1. Fault contribution from induction motors shall not be considered beyond three to five cycles.
  2. Fault contribution from synchronous motors and generators shall be decayed to match the actual decrement of each as closely as possible (for example, contributions from permanent magnet generators will typically decay from 10 per unit to three per unit after 10 cycles).
- H. Arc-flash energy shall generally be reported for the maximum of line or load side of a circuit breaker. However, arc-flash computation shall be performed and reported for both line and load side of a circuit breaker as follows:
1. When the circuit breaker is in a separate enclosure.
  2. When the line terminals of the circuit breaker are separate from the work location.
- I. Base arc-flash calculations on actual overcurrent protective device clearing time. Cap maximum clearing time at two seconds based on IEEE 1584, Section B.1.2.

### 3.03 POWER SYSTEM DATA

- A. Obtain all data necessary for conduct of the arc-flash hazard analysis.
1. Verify completeness of data supplied on one-line diagram on Drawings. Call discrepancies to Architect's attention.
  2. For new equipment, use characteristics from approved submittals under provisions of action submittals and information submittals for this Project.
- B. Electrical Survey Data: Gather and tabulate the following input data to support study. Comply with recommendations in IEEE 1584 and NFPA 70E as to the amount of detail that is required to be acquired in the field. Field data gathering shall be under the direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification. Data include, but are not limited to, the following:
1. Product Data for overcurrent protective devices specified in other Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
  2. Obtain electrical power utility impedance or available short circuit current at the service.
  3. Power sources and ties.
  4. Short-circuit current at each system bus (three phase and line to ground).
  5. Full-load current of all loads.
  6. Voltage level at each bus.
  7. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
  8. For reactors, provide manufacturer and model designation, voltage rating and impedance.
  9. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, SCCR, current rating, and breaker settings.
  10. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
  11. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.
  12. Busway manufacturer and model designation, current rating, impedance, lengths, size, and conductor material.
  13. Motor horsepower and NEMA MG 1 code letter designation.
  14. Low-voltage conductor sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).
  15. Medium-voltage conductor sizes, lengths, conductor material, conductor construction and metallic shield performance parameters, and conduit material (magnetic or nonmagnetic).

### 3.04 LABELING

- A. Apply arc-flash label on the front cover for each equipment included in the study. Base arc-flash label data on highest values calculated at each location.

- B. Each piece of equipment listed below shall have an arc-flash label applied to it:
  - 1. Applicable panelboard and safety switch under 250 V.
- C. Note on record Drawings the location of equipment where the personnel could be exposed to arc-flash hazard during their work.
  - 1. Indicate arc-flash energy.
  - 2. Indicate protection level required.

3.05 APPLICATION OF WARNING LABELS

- A. Install arc-flash warning labels under the direct supervision and control of Power System Analysis Specialist.

3.06 DEMONSTRATION

- A. Engage Power Systems Analysis Specialist to train Owner's maintenance personnel in potential arc-flash hazards associated with working on energized equipment and the significance of arc-flash warning labels.

END OF SECTION

## SECTION 26 24 16 PANELBOARDS

## PART 1 - GENERAL

## 1.01 SUMMARY

- A. Section Includes: Lighting and appliance branch-circuit panelboards.

## 1.02 DEFINITIONS

- A. ATS: Acceptance testing specification.
- B. GFCI: Ground-fault circuit interrupter.
- C. GFEP: Ground-fault equipment protection.
- D. HID: High-intensity discharge.
- E. MCCB: Molded-case circuit breaker.
- F. SPD: Surge protective device.
- G. VPR: Voltage protection rating.

## 1.03 ACTION SUBMITTALS

- A. Product Data: For each type of panelboard.
  - 1. Include materials, switching and overcurrent protective devices, SPDs, accessories, and components indicated.
  - 2. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
  - 1. Include dimensioned plans, elevations, sections, and details.
  - 2. Show tabulations of installed devices with nameplates, conductor termination sizes, equipment features, and ratings.
  - 3. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
  - 4. Detail bus configuration, current, and voltage ratings.
  - 5. Short-circuit current rating of panelboards and overcurrent protective devices.
  - 6. Include evidence of NRTL listing for series rating of installed devices.
  - 7. Include evidence of NRTL listing for SPD as installed in panelboard.
  - 8. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

## 1.04 INFORMATIONAL SUBMITTALS

- A. Panelboard Schedules: For installation in panelboards.

## 1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. Include the following:
  - 1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
  - 2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

## 1.06 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.
  - 1. Panelboard Warranty Period: 18 months from date of Substantial Completion.
- B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace SPD that fails in materials or workmanship within specified warranty period.
  - 1. SPD Warranty Period: Five years from date of Substantial Completion.

## PART 2 - PRODUCTS

## 2.01 PANELBOARDS AND LOAD CENTERS COMMON REQUIREMENTS

- A. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NEMA PB 1.
- D. Comply with NFPA 70.
- E. Enclosures: Surface-mounted, dead-front cabinets.
  - 1. Rated for environmental conditions at installed location.
    - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
  - 2. Height: 84 inches maximum.
  - 3. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box. Trims shall cover all live parts and shall have no exposed hardware.
  - 4. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.
  - 5. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.

6. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
  7. Finishes:
    - a. Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
    - b. Back Boxes: Galvanized steel.
    - c. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components.
- F. Incoming Mains:
1. Location: Bottom.
  2. Main Breaker: Main lug interiors up to 400 amperes shall be field convertible to main breaker.
- G. Phase, Neutral, and Ground Buses:
1. Material: Tin-plated aluminum.
    - a. Plating shall run entire length of bus.
    - b. Bus shall be fully rated the entire length.
  2. Interiors shall be factory assembled into a unit. Replacing switching and protective devices shall not disturb adjacent units or require removing the main bus connectors.
  3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
  4. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure. Do not mount neutral bus in gutter.
- H. Conductor Connectors: Suitable for use with conductor material and sizes.
1. Material: Tin-plated aluminum.
  2. Terminations shall allow use of 75 deg C rated conductors without derating.
  3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.
  4. Main and Neutral Lugs: Compression type, with a lug on the neutral bar for each pole in the panelboard.
  5. Ground Lugs and Bus-Configured Terminators: Compression type, with a lug on the bar for each pole in the panelboard.
- I. NRTL Label: Panelboards or load centers shall be labeled by an NRTL acceptable to authority having jurisdiction for use as service equipment with one or more main service disconnecting and overcurrent protective devices. Panelboards or load centers shall have meter enclosures, wiring, connections, and other provisions for utility metering. Coordinate with utility company for exact requirements.
- J. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.
1. Panelboards and overcurrent protective devices rated 240 V or less shall have short-circuit ratings as shown on Drawings, but not less than 10,000 A rms symmetrical.



2. Panelboards and overcurrent protective devices rated above 240 V and less than 600 V shall have short-circuit ratings as shown on Drawings, but not less than 14,000 A rms symmetrical.

## 2.02 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- B. Mains: Circuit breaker.
- C. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- D. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

## 2.03 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.
  1. Thermal-Magnetic Circuit Breakers:
    - a. Inverse time-current element for low-level overloads.
    - b. Instantaneous magnetic trip element for short circuits.
    - c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
- B. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.
  1. Fused Switch Features and Accessories:
    - a. Standard ampere ratings and number of poles.
    - b. Mechanical cover interlock with a manual interlock override, to prevent the opening of the cover when the switch is in the on position. The interlock shall prevent the switch from being turned on with the cover open. The operating handle shall have lock-off means with provisions for three padlocks.
    - c. Auxiliary Contacts: One normally open and normally closed contact(s) that operate with switch handle operation.

## 2.04 IDENTIFICATION

- A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.
- B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.
- C. Circuit Directory: Directory card inside panelboard door, mounted in metal frame with transparent protective cover.
  1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

- D. Circuit Directory: Computer-generated circuit directory mounted inside panelboard door with transparent plastic protective cover.
  - 1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

## 2.05 ACCESSORY COMPONENTS AND FEATURES

- A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.
- B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.
- B. Receive, inspect, handle, and store panelboards according to NECA 407.
- C. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.
- D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 INSTALLATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Comply with NECA 1.
- C. Install panelboards and accessories according to NECA 407.
- D. Equipment Mounting: Attach panelboard to the vertical finished or structural surface behind the panelboard.
- E. Mount top of trim 90 inches above finished floor unless otherwise indicated.
- F. Mount panelboard cabinet plumb and rigid without distortion of box.
- G. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

- H. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.
- I. Install filler plates in unused spaces.

### 3.03 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."
- D. Device Nameplates: Label each branch circuit device in power panelboards with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

### 3.04 FIELD QUALITY CONTROL

- A. Acceptance Testing Preparation:
  - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
  - 2. Test continuity of each circuit.
- B. Tests and Inspections:
  - 1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers stated in NETA ATS, Paragraph 7.6 Circuit Breakers. Do not perform optional tests. Certify compliance with test parameters.
  - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- C. Panelboards will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results, with comparisons of the two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

### 3.05 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

- B. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes. Prior to making circuit changes to achieve load balancing, inform Architect of effect on phase color coding.
1. Measure loads during period of normal facility operations.
  2. Perform circuit changes to achieve load balancing outside normal facility operation schedule or at times directed by the Architect. Avoid disrupting services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
  3. After changing circuits to achieve load balancing, recheck loads during normal facility operations. Record load readings before and after changing circuits to achieve load balancing.
  4. Tolerance: Maximum difference between phase loads, within a panelboard, shall not exceed 20 percent.

END OF SECTION

SECTION 26 27 26 WIRING DEVICES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Straight-blade convenience.
2. GFCI receptacles.
3. Toggle switches.
4. Wall switch sensor light switches with dual technology sensors.
5. Wall plates.

1.02 DEFINITIONS

A. Abbreviations of Manufacturers' Names:

1. Cooper: Cooper Wiring Devices; Division of Cooper Industries, Inc.
2. Hubbell: Hubbell Incorporated: Wiring Devices-Kellems.
3. Leviton: Leviton Mfg. Company, Inc.
4. Pass & Seymour: Pass& Seymour/Legrand.

B. BAS: Building automation system.

C. EMI: Electromagnetic interference.

D. GFCI: Ground-fault circuit interrupter.

E. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

F. RFI: Radio-frequency interference.

G. SPD: Surge protective device.

H. UTP: Unshielded twisted pair.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

1.04 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

## PART 2 - PRODUCTS

## 2.01 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.
- C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
  - 1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
  - 2. Devices shall comply with the requirements in this Section.
- D. Devices for Owner-Furnished Equipment:
  - 1. Receptacles: Match plug configurations.
  - 2. Cord and Plug Sets: Match equipment requirements.
- E. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

## 2.02 STRAIGHT-BLADE RECEPTACLES

- A. Duplex Convenience Receptacles: 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

## 2.03 GFCI RECEPTACLES

- A. General Description:
  - 1. 125 V, 20 A, straight blade, non-feed-through type.
  - 2. Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, UL 943 Class A, and FS W-C-596.
  - 3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

## 2.04 TOGGLE SWITCHES

- A. Switches, 120/277 V, 20 A:
  - 1. Single Pole:
  - 2. Three Way:
  - 3. Four Way:

## 2.05 WALL SWITCH SENSOR LIGHT SWITCH, DUAL TECHNOLOGY

- A. Description: Switchbox-mounted, combination lighting-control sensor and conventional switch lighting-control unit using dual technology.
  - 1. Connections: Provisions for connection to BAS.
  - 2. Connections: Hard wired.

3. Connections: Wireless.
4. Rated 960 W at 120-V ac for tungsten lighting, 10 A at 120-V ac or 10 A at 277-V ac for fluorescent or LED lighting, and 1/4 hp at 120-V ac.
5. Integral relay for connection to BAS.
6. Adjustable time delay of 15 minutes.
7. Able to be locked to Automatic-On or Manual-On mode.
8. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc.
9. Comply with NEMA WD 1, UL 20, and FS W-S-896.

## 2.06 WALL PLATES

- A. Single and combination types shall match corresponding wiring devices.
1. Plate-Securing Screws: Metal with head color to match plate finish.
  2. Material for Finished Spaces: 0.035-inch-thick, satin-finished, Type 302 stainless steel.
  3. Material for Unfinished Spaces: Galvanized steel.
  4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

## 2.07 FINISHES

- A. Device Color:
1. Wiring Devices Connected to Normal Power System: White unless otherwise indicated or required by NFPA 70 or device listing.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- B. Coordination with Other Trades:
1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
  2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
  3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
  4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
  2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.

3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
  4. Existing Conductors:
    - a. Cut back and pigtail, or replace all damaged conductors.
    - b. Straighten conductors that remain and remove corrosion and foreign matter.
    - c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.
- D. Device Installation:
1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
  2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
  3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
  4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
  5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
  6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
  7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
  8. Tighten unused terminal screws on the device.
  9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.
- E. Receptacle Orientation: Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.
- F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
- G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.
- 3.02 IDENTIFICATION
- A. Comply with Section 26 05 53 "Identification for Electrical Systems."
  - B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.



3.03 FIELD QUALITY CONTROL

- A. Test Instruments: Use instruments that comply with UL 1436.
- B. Tests for Convenience Receptacles:
  - 1. Line Voltage: Acceptable range is 105 to 132 V.
  - 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
  - 3. Ground Impedance: Values of up to 2 ohms are acceptable.
  - 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
  - 5. Using the test plug, verify that the device and its outlet box are securely mounted.
  - 6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.
- C. Wiring device will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

END OF SECTION

## SECTION 26 28 16

## ENCLOSED SWITCHES AND CIRCUIT BREAKERS

## PART 1 - GENERAL

## 1.01 SUMMARY

- A. Section Includes: Molded-case circuit breakers (MCCBs).

## 1.02 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include nameplate ratings, dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
4. Include evidence of a nationally recognized testing laboratory (NRTL) listing for series rating of installed devices.
5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.

- B. Shop Drawings: For enclosed switches and circuit breakers.

1. Include plans, elevations, sections, details, and attachments to other work.

## 1.03 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:
  - a. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.

## 1.04 FIELD CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
2. Altitude: Not exceeding 6600 feet.

## 1.05 WARRANTY

- A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: One year(s) from date of Substantial Completion.

## PART 2 - PRODUCTS

## 2.01 GENERAL REQUIREMENTS

- A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single manufacturer.
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- D. Comply with NFPA 70.

## 2.02 MOLDED-CASE CIRCUIT BREAKERS

- A. Circuit breakers shall be constructed using glass-reinforced insulating material. Current carrying components shall be completely isolated from the handle and the accessory mounting area.
- B. Circuit breakers shall have a toggle operating mechanism with common tripping of all poles, which provides quick-make, quick-break contact action. The circuit-breaker handle shall be over center, be trip free, and reside in a tripped position between on and off to provide local trip indication. Circuit-breaker escutcheon shall be clearly marked on and off in addition to providing international I/O markings. Equip circuit breaker with a push-to-trip button, located on the face of the circuit breaker to mechanically operate the circuit-breaker tripping mechanism for maintenance and testing purposes.
- C. The maximum ampere rating and UL, IEC, or other certification standards with applicable voltage systems and corresponding interrupting ratings shall be clearly marked on face of circuit breaker. Circuit breakers shall be 100 percent rated. combinations for series connected interrupting ratings shall be listed by UL as recognized component combinations. MCCBs shall be equipped with a device for locking in the isolated position.
- D. Lugs shall be suitable for 140 deg F rated wire on 125-A circuit breakers and below.
- E. Standard: Comply with UL 489 with interrupting capacity to comply with available fault currents.
- F. Thermal-Magnetic Circuit Breakers: Inverse time-current thermal element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

## 2.03 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: UL 489, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
- B. Enclosure Finish: The enclosure shall be gray baked enamel paint, electrodeposited on cleaned, phosphatized galvanized steel (NEMA 250 Types 3R, 12).

- C. Operating Mechanism: The circuit-breaker operating handle shall be directly operable through the dead front trim of the enclosure (NEMA 250 Type 3R). The cover interlock mechanism shall have an externally operated override. The override shall not permanently disable the interlock mechanism, which shall return to the locked position once the override is released. The tool used to override the cover interlock mechanism shall not be required to enter the enclosure in order to override the interlock.

### PART 3 - EXECUTION

#### 3.01 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
  - 1. Commencement of work shall indicate Installer's acceptance of the areas and conditions as satisfactory.

#### 3.02 PREPARATION

- A. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
  - 1. Notify Owner no fewer than seven days in advance of proposed interruption of electric service.
  - 2. Indicate method of providing temporary electric service.
  - 3. Do not proceed with interruption of electric service without Owner's written permission.
  - 4. Comply with NFPA 70E.

#### 3.03 ENCLOSURE ENVIRONMENTAL RATING APPLICATIONS

- A. Enclosed Switches and Circuit Breakers: Provide enclosures at installed locations with the following environmental ratings.
  - 1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
  - 2. Outdoor Locations: NEMA 250, Type 3R.

#### 3.04 INSTALLATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- C. Temporary Lifting Provisions: Remove temporary lifting of eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

- D. Comply with NFPA 70 and NECA 1.

### 3.05 IDENTIFICATION

- A. Comply with requirements in Section 26 05 53 "Identification for Electrical Systems."
  - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
  - 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

### 3.06 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections for Molded Case Circuit Breakers:
  - 1. Visual and Mechanical Inspection:
    - a. Verify that equipment nameplate data are as described in the Specifications and shown on the Drawings.
    - b. Inspect physical and mechanical condition.
    - c. Inspect anchorage, alignment, grounding, and clearances.
    - d. Verify that the unit is clean.
    - e. Operate the circuit breaker to ensure smooth operation.
    - f. Inspect bolted electrical connections for high resistance using one of the two following methods:
      - 1) Use a low-resistance ohmmeter.
        - a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
      - 2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.
        - a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
    - g. Inspect operating mechanism, contacts, and chutes in unsealed units.
    - h. Perform adjustments for final protective device settings in accordance with the coordination study.
- C. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.
  - 1. Test procedures used.
  - 2. Include identification of each enclosed switch and circuit breaker tested and describe test results.
  - 3. List deficiencies detected, remedial action taken, and observations after remedial action.

3.07 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

END OF SECTION

## SECTION 26 32 13.17

## GASEOUS ENGINE GENERATORS

## PART 1 - GENERAL

## 1.01 SUMMARY

- A. Section includes packaged engine generators for non-emergency use with the following features:
1. Natural gas engine.
  2. Gaseous fuel system.
  3. Control and monitoring.
  4. Generator overcurrent and fault protection.
  5. Generator, exciter, and voltage regulator.
  6. Load banks.
  7. Outdoor generator-set enclosure.
  8. Remote radiator motors.
  9. Vibration isolation devices.
  10. Finishes.
- B. Related Requirements:
1. Section 26 36 00 "Transfer Switches" for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine generators.

## 1.02 DEFINITIONS

- A. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.

## 1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
  2. Include thermal damage curve for generator.
  3. Include time-current characteristic curves for generator protective device.
  4. Include fuel consumption in cubic feet per hour (cubic meters per hour) at 0.8 power factor at 0.5, 0.75 and 1.0 times generator capacity.
  5. Include generator efficiency at 0.8 power factor at 0.5, 0.75, and 1.0 times generator capacity.
  6. Include air flow requirements for cooling and combustion air in cfm at 0.8 power factor, with air supply temperature of 95 deg F, 80 deg F, 70 deg F, and 50 deg F. Provide drawings showing requirements and limitations for location of air intake and exhausts.
  7. Include generator characteristics, including, but not limited to, kilowatt rating, efficiency, reactances, and short-circuit current capability.
- B. Shop Drawings:
1. Include plans and elevations for engine generator and other components specified.

2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Identify fluid drain ports and clearance requirements for proper fluid drain.
4. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include base weights.
5. Include diagrams for power, signal, and control wiring. Complete schematic, wiring, and interconnection diagrams showing terminal markings for EPS equipment and functional relationship between all electrical components.

#### 1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer and testing agency.
- B. Source Quality-Control Reports: Including, but not limited to, the following:
  1. Certified summary of prototype-unit test report.
  2. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on prototype unit.
  3. Certified Summary of Performance Tests: Certify compliance with specified requirement to meet performance criteria for sensitive loads.
  4. Report of factory test on units to be shipped for this Project, showing evidence of compliance with specified requirements.
  5. Report of sound generation.
  6. Report of exhaust emissions showing compliance with applicable regulations.
- C. Field quality-control reports.
- D. Warranty: For special warranty.

#### 1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For engine generators to include in emergency, operation, and maintenance manuals.
  1. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:
    - a. List of tools and replacement items recommended to be stored at Project for ready access. Include part and drawing numbers, current unit prices, and source of supply.
    - b. Operating instructions laminated and mounted adjacent to generator location.
    - c. Training plan.

#### 1.06 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  1. Fuses: One for every 10 of each type and rating, but no fewer than one of each.
  2. Indicator Lamps: Two for every six of each type used, but no fewer than two of each.
  3. Filters: One set each of lubricating oil, fuel, and combustion-air filters.
  4. Tools: Each tool listed by part number in operations and maintenance manual.



1.07 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
- B. Testing Agency Qualifications: Accredited by NETA.
  - 1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.08 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturers
  - 1. Kohler Power Systems
  - 2. Cummins Power Generation
  - 3. Caterpillar, Inc.; Electric Power Division
  - 4. Other prior approved equal.
- B. Source Limitations: Obtain packaged engine generators and auxiliary components through one source from a single manufacturer.

2.02 PERFORMANCE REQUIREMENTS

- A. B11 Compliance: Comply with B11.19.
- B. NFPA Compliance:
  - 1. Comply with NFPA 37.
  - 2. Comply with NFPA 70.
- C. UL Compliance: Comply with UL 2200.
- D. Engine Exhaust Emissions: Comply with EPA Tier 4 requirements and applicable state and local government requirements.
- E. Noise Emission: Comply with applicable state and local government requirements for maximum noise level at adjacent property boundaries due to sound emitted by engine generator including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.

- F. Environmental Conditions: Engine generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:
1. Ambient Temperature: 5 to 104 deg F.
  2. Relative Humidity: Zero to 95 percent.
  3. Altitude: Sea level to 1000 feet.

### 2.03 ENGINE GENERATOR ASSEMBLY DESCRIPTION

- A. Factory-assembled and -tested, water-cooled engine, with brushless generator and accessories.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency acceptable to authorities having jurisdiction, and marked for intended location and use.
- C. Power Rating: Standby.
- D. Overload Capacity: 110 percent of service load for 1 hour in 12 consecutive hours.
- E. Service Load: 100 kVA.
- F. Power Factor: 0.8, lagging.
- G. Frequency: 60 Hz
- H. Voltage: 208 V ac.
- I. Phase: Three-phase, four wire, wye.
- J. Induction Method: Naturally aspirated.
- K. Governor: Adjustable isochronous, with speed sensing.
- L. Mounting Frame: Structural steel framework to maintain alignment of mounted components without depending on concrete foundation. Provide lifting attachments sized and spaced to prevent deflection of base during lifting and moving.
1. Rigging Diagram: Inscribed on metal plate permanently attached to mounting frame to indicate location and lifting capacity of each lifting attachment and generator-set center of gravity.
- M. Capacities and Characteristics:
1. Power Output Ratings: Nominal ratings as indicated at 0.8 power factor excluding power required for the continued and repeated operation of the unit and auxiliaries.
  2. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component.

## N. Engine Generator Performance:

1. Steady-State Voltage Operational Bandwidth: 3 percent of rated output voltage from no load to full load.
2. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within three seconds.
3. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
5. Transient Frequency Performance: Less than 5 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within five seconds.
6. Output Waveform: At no load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for single harmonics. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.
7. Sustained Short-Circuit Current: For a three-phase, bolted short circuit at system output terminals, system shall supply a minimum of 250 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to generator system components.
8. Start Time: 10 seconds.

## 2.04 GASEOUS ENGINE

- A. Fuel: Natural gas.
- B. Rated Engine Speed: 1800 rpm.
- C. Lubrication System: Engine or skid-mounted.
  1. Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.
  2. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.
  3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.
- D. Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine generator mounting frame and integral engine-driven coolant pump.
  1. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
  2. Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
  3. Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed-loop coolant system pressure for engine used. Equip with gage glass and petcock.

4. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
  5. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, ultraviolet-, and abrasion-resistant fabric.
    - a. Rating: 50-psig maximum working pressure with coolant at 180 deg F, and noncollapsible under vacuum.
    - b. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.
- E. Muffler/Silencer: Critical type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.
1. Minimum sound attenuation of 25 dB at 500 Hz.
  2. Sound level measured at a distance of 25 feet from exhaust discharge after installation is complete shall be 78 dBA or less.
- F. Air-Intake Filter: Standard-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.
- G. Starting System: 12-V electric, with negative ground.
1. Components: Sized so they are not damaged during a full engine-cranking cycle with ambient temperature at maximum specified in "Performance Requirements" Article.
  2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
  3. Cranking Cycle: 60 seconds.
  4. Battery: Lead acid, with capacity within ambient temperature range specified in "Performance Requirements" Article to provide specified cranking cycle at least twice without recharging.
  5. Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
  6. Battery Compartment: Factory fabricated of metal with acid-resistant finish and thermal insulation. Thermostatically controlled heater shall be arranged to maintain battery above 50 deg F regardless of external ambient temperature within range specified in "Performance Requirements" Article. Include accessories required to support and fasten batteries in place. Provide ventilation to exhaust battery gases.
  7. Battery Stand: Factory-fabricated, two-tier metal with acid-resistant finish designed to hold the quantity of battery cells required and to maintain the arrangement to minimize lengths of battery interconnections.
  8. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35 A minimum continuous rating.

9. Battery Charger: Current-limiting, automatic-equalizing and float-charging type designed for lead-acid batteries. Unit shall comply with UL 1236 and include the following features:
  - a. Operation: Equalizing-charging rate of 10 A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
  - b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40 deg F to 140 deg F to prevent overcharging at high temperatures and undercharging at low temperatures.
  - c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
  - d. Ammeter and Voltmeter: Flush mounted in door. Meters shall indicate charging rates.
  - e. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
  - f. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.

#### 2.05 GASEOUS FUEL SYSTEM

- A. Natural Gas Piping: Comply with requirements in Section 231123 "Facility Natural Gas Piping."
- B. Gas Train: Comply with NFPA 37.
- C. Engine Fuel System:
- D. Natural Gas, Vapor-Withdrawal System:
  1. Carburetor.
  2. Secondary Gas Regulators: One for each fuel type, with atmospheric vents piped to building exterior.
  3. Fuel-Shutoff Solenoid Valves: NRTL-listed, normally closed, safety shutoff valves; one for each fuel source.
  4. Fuel Filters: One for each fuel type.
  5. Manual Fuel Shutoff Valves: One for each fuel type.
  6. Flexible Fuel Connectors: Minimum one for each fuel connection.

#### 2.06 CONTROL AND MONITORING

- A. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of engine generator. When mode-selector switch is switched to the on position, engine generator starts. The off position of same switch initiates generator-set shutdown. When engine generator is running, specified system or equipment failures or derangements automatically shut down engine generator and initiate alarms.

- B. Manual Starting System Sequence of Operation: Switching on-off switch on the generator control panel to the on position starts engine generator. The off position of same switch initiates generator-set shutdown. When engine generator is running, specified system or equipment failures or derangements automatically shut down engine generator and initiate alarms.
- C. Provide minimum run time control set for 15 minutes with override only by operation of a remote emergency-stop switch.
- D. Comply with UL 508A.
- E. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common control and monitoring panel mounted on the engine generator. Mounting method shall isolate the control panel from generator-set vibration. Panel shall be powered from the engine generator battery.
- F. Control and Monitoring Panel:
  - 1. Digital controller with integrated LCD, controls, and microprocessor, capable of local and remote control, monitoring, and programming, with battery backup.
  - 2. Instruments: Located on the control and monitoring panel and viewable during operation.
    - a. Engine lubricating-oil pressure gage.
    - b. Engine-coolant temperature gage.
    - c. DC voltmeter (alternator battery charging).
    - d. Running-time meter.
    - e. AC voltmeter, for each phase.
    - f. AC ammeter, for each phase.
    - g. AC frequency meter.
    - h. Generator-voltage adjusting rheostat.
  - 3. Controls and Protective Devices: Controls, shutdown devices, and common visual alarm indication, including the following:
    - a. Cranking control equipment.
    - b. Run-Off-Auto switch.
    - c. Control switch not in automatic position alarm.
    - d. Overcrank alarm.
    - e. Overcrank shutdown device.
    - f. Low water temperature alarm.
    - g. High engine temperature prealarm.
    - h. High engine temperature.
    - i. High engine temperature shutdown device.
    - j. Overspeed alarm.
    - k. Overspeed shutdown device.
    - l. Low fuel main tank.
    - m. Coolant low-level alarm.
    - n. Coolant low-level shutdown device.
    - o. Coolant high-temperature prealarm.
    - p. Coolant high-temperature alarm.
    - q. Coolant low-temperature alarm.
    - r. Coolant high-temperature shutdown device.
    - s. EPS supplying load indicator.
    - t. Battery high-voltage alarm.
    - u. Low cranking voltage alarm.
    - v. Battery-charger malfunction alarm.
    - w. Battery low-voltage alarm.
    - x. Lamp test.

- y. Contacts for local and remote common alarm.
- z. Low-starting air pressure alarm.
- aa. Low-starting hydraulic pressure alarm.
- bb. Remote manual stop shutdown device.
- cc. Air shutdown damper alarm when used.
- dd. Air shutdown damper shutdown device when used.
- ee. Hours of operation.
- ff. Engine generator metering, including voltage, current, Hz, kW, kVA, and power factor.
- gg. Generator overcurrent protective device not closed alarm.

G. Connection to Datalink:

- 1. A separate terminal block, factory wired to Form C dry contacts, for each alarm and status indication.

H. Common Remote Panel with Common Audible Alarm: Include necessary contacts and terminals in control and monitoring panel. Remote panel shall be powered from the engine generator battery.

## 2.07 GENERATOR OVERCURRENT AND FAULT PROTECTION

A. Generator Circuit Breaker: Molded-case, thermal-magnetic type; 100 percent rated; complying with UL 489.

- 1. Tripping Characteristic: Designed specifically for generator protection.
- 2. Trip Rating: Matched to generator output rating.
- 3. Shunt Trip: Connected to trip breaker when engine generator is shut down by other protective devices.
- 4. Mounting: Adjacent to or integrated with control and monitoring panel.

B. Generator Protector: Microprocessor-based unit shall continuously monitor current level in each phase of generator output, integrate generator heating effect over time, and predict when thermal damage of alternator will occur. When signaled by generator protector or other generator-set protective devices, a shunt-trip device in the generator disconnect switch shall open the switch to disconnect the generator from load circuits. Protector performs the following functions:

- 1. Initiates a generator overload alarm when generator has operated at an overload equivalent to 110 percent of full-rated load for 60 seconds. Indication for this alarm is integrated with other generator-set malfunction alarms. Contacts shall be available for load shed functions.
- 2. Under single or three-phase fault conditions, regulates generator to 300 percent of rated full-load current for up to 10 seconds.
- 3. As overcurrent heating effect on the generator approaches the thermal damage point of the unit, protector switches the excitation system off, opens the generator disconnect device, and shuts down the engine generator.
- 4. Senses clearing of a fault by other overcurrent devices and controls recovery of rated voltage to avoid overshoot.

## 2.08 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

A. Comply with NEMA MG 1.

B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.

- C. Electrical Insulation: Class H.
- D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required. Provide 12 lead alternator.
- E. Range: Provide limited range of output voltage by adjusting the excitation level.
- F. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.
- G. Enclosure: Weatherproof Sound-rated.
- H. Instrument Transformers: Mounted within generator enclosure.
- I. Voltage Regulator: Solid-state type, separate from exciter.
  - 1. Adjusting Rheostat on Control and Monitoring Panel: Provide plus or minus 5 percent adjustment of output-voltage operating band.
  - 2. Maintain voltage within 20 percent on one step, full load.
  - 3. Provide anti-hunt provision to stabilize voltage.
  - 4. Maintain frequency within 10 percent and stabilize at rated frequency within 5 seconds.
- J. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.
- K. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.
- L. Subtransient Reactance: 12 percent, maximum.

## 2.09 OUTDOOR GENERATOR-SET ENCLOSURE

- A. Description: Vandal-resistant, sound-attenuating, weatherproof steel housing, wind resistant up to 100 mph. Multiple panels shall be lockable and provide adequate access to components requiring maintenance. Panels shall be removable by one person without tools. Instruments and control shall be mounted within enclosure.
  - 1. Sound Attenuation Level: 75.
- B. Description: Prefabricated or pre-engineered galvanized-steel-clad, integral structural-steel-framed, walk-in enclosure, erected on concrete foundation.
- C. Structural Design and Anchorage: Comply with ASCE/SEI 7 for wind loads up to 100 mph.
- D. Hinged Doors: With padlocking provisions.
- E. Space Heater: Thermostatically controlled and sized to prevent condensation.
- F. Thermal Insulation: Manufacturer's standard materials and thickness selected in coordination with space heater to maintain winter interior temperature within operating limits required by engine generator components.
- G. Muffler Location: Within enclosure.



- H. Engine Cooling Airflow through Enclosure: Maintain temperature rise of system components within required limits when unit operates at 110 percent of rated load for 2 hours with ambient temperature at top of range specified in system service conditions.
1. Louvers: Fixed-engine, cooling-air inlet and discharge. Storm-proof and drainable louvers prevent entry of rain and snow.
  2. Ventilation: Provide temperature-controlled exhaust fan interlocked to prevent operation when engine is running.

#### 2.10 VIBRATION ISOLATION DEVICES

- A. Elastomeric Isolator Pads: Oil- and water-resistant elastomer or natural rubber, arranged in single or multiple layers, molded with a nonslip pattern and galvanized-steel baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment.
1. Material: Standard neoprene separated by steel shims.
- B. Vibration isolation devices shall not be used to accommodate misalignments or to make bends.

#### 2.11 FINISHES

- A. Indoor and Outdoor Enclosures and Components: Manufacturer's standard finish over corrosion-resistant pretreatment and compatible primer.

#### 2.12 SOURCE QUALITY CONTROL

- A. Prototype Testing: Factory test engine generator using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.
1. Tests: Comply with IEEE 115.
- B. Project-Specific Equipment Tests: Before shipment, factory test engine generator and other system components and accessories manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:
1. Test components and accessories furnished with installed unit that are not identical to those on tested prototype to demonstrate compatibility and reliability.
  2. Test generator, exciter, and voltage regulator as a unit.
  3. Full load run.
  4. Maximum power.
  5. Voltage regulation.
  6. Transient and steady-state governing.
  7. Single-step load pickup.
  8. Safety shutdown.
  9. Provide 14 days' advance notice of tests and opportunity for observation of tests by Owner's representative.
  10. Report factory test results within 10 days of completion of test.

## PART 3 - EXECUTION

## 3.01 EXAMINATION

- A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine generator performance.
- B. Examine roughing-in for piping systems and electrical connections. Verify actual locations of connections before packaged engine generator installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.02 PREPARATION

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
  - 1. Notify Owner no fewer than five working days in advance of proposed interruption of electrical service.
  - 2. Do not proceed with interruption of electrical service without Owner's written permission.

## 3.03 INSTALLATION

- A. Comply with NECA 1 and NECA 404.
- B. Comply with packaged engine generator manufacturers' written installation.
- C. Equipment Mounting:
  - 1. Install packaged engine generators on cast-in-place concrete equipment bases.
  - 2. Coordinate size and location of concrete bases for packaged engine generators. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.
  - 3. Install packaged engine generator with elastomeric isolator pads having a minimum deflection of 1 inch on 4-inch-high concrete base. Secure engine generator to anchor bolts installed in concrete bases.
- D. Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.
- E. Drain Piping: Install condensate drain piping to muffler drain outlet with a shutoff valve, stainless-steel flexible connector, and Schedule 40, black steel pipe, the full size of the drain connection, with welded joints.
- F. Gaseous Fuel Piping:
  - 1. Natural gas piping, valves, and specialties for gas distribution are specified in Section 23 11 23 "Facility Natural Gas Piping."
- G. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

### 3.04 CONNECTIONS

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping and specialties.
- B. Connect fuel, cooling-system, and exhaust-system piping adjacent to packaged engine generator to allow service and maintenance.
- C. Connect cooling-system water piping to engine generator and heat exchanger with flexible connectors.
- D. Connect engine exhaust pipe to engine with flexible connector.
- E. Gaseous Fuel Connections:
  - 1. Connect fuel piping to engines with a gate valve and union and flexible connector.
  - 2. Install manual shutoff valve in a remote location to isolate gaseous fuel supply to the generator.
  - 3. Vent gas pressure regulators outside building a minimum of 60 inches from building openings.
- F. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."
- G. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables." Provide a minimum of one 90-degree bend in flexible conduit routed to the engine generator from a stationary element.
- H. Balance single-phase loads to obtain a maximum of 10 percent unbalance between any two phases.

### 3.05 IDENTIFICATION

- A. Identify system components according to Section 26 05 53 "Identification for Electrical Systems."
- B. Install a sign indicating the generator neutral is bonded to the main service neutral at the main service location.

### 3.06 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Tests and Inspections:
  - 1. Perform tests recommended by manufacturer and each visual and mechanical inspection and electrical and mechanical test listed in the first two subparagraphs below as specified in the NETA ATS. Certify compliance with test parameters.
    - a. Visual and Mechanical Inspection
      - 1) Compare equipment nameplate data with drawings and specifications.
      - 2) Inspect physical and mechanical condition.

- 3) Inspect anchorage, alignment, and grounding.
  - 4) Verify the unit is clean.
  - b. Electrical and Mechanical Tests
    - 1) Perform insulation-resistance tests in accordance with IEEE 43.
      - a) Machines 200 hp or less. Test duration shall be one minute. Calculate the dielectric-absorption ratio.
    - 2) Test protective relay devices.
    - 3) Verify phase rotation, phasing, and synchronized operation as required by the application.
    - 4) Functionally test engine shutdown for low oil pressure, overtemperature, overspeed, and other protection features as applicable.
    - 5) Perform vibration test for each main bearing cap.
    - 6) Verify correct functioning of the governor and regulator.
  2. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.
    - a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
    - b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
    - c. Verify acceptance of charge for each element of the battery after discharge.
    - d. Verify that measurements are within manufacturer's specifications.
  3. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
  4. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine generator system before and during system operation. Check for air, exhaust, and fluid leaks.
  5. Exhaust-System Back-Pressure Test: Use a manometer with a scale exceeding 40-inch wg. Connect to exhaust line close to engine exhaust manifold. Verify that back pressure at full-rated load is within manufacturer's written allowable limits for the engine.
  6. Exhaust Emissions Test: Comply with applicable government test criteria.
  7. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases, and verify that performance is as specified.
  8. Harmonic-Content Tests: Measure harmonic content of output voltage at 25 percent and 100 percent of rated linear load. Verify that harmonic content is within specified limits.
  9. Noise Level Tests: Measure A-weighted level of noise emanating from generator-set installation, including engine exhaust and cooling-air intake and discharge, at four locations 25 feet from edge of the generator enclosure, and compare measured levels with required values.
- C. Coordinate tests with tests for transfer switches and run them concurrently.
- D. Test instruments shall have been calibrated within the last 12 months, traceable to NIST Calibration Services, and adequate for making positive observation of test results. Make calibration records available for examination on request.
- E. Leak Test: After installation, charge exhaust, coolant, and fuel systems and test for leaks. Repair leaks and retest until no leaks exist.
- F. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation for generator and associated equipment.

- G. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- H. Remove and replace malfunctioning units and retest as specified above.
- I. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.
- J. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.
- K. Infrared Scanning: After Substantial Completion, but not more than 60 days after final acceptance, perform an infrared scan of each power wiring termination and each bus connection while running with maximum load. Remove all access panels so terminations and connections are accessible to portable scanner.
  - 1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan 11 months after date of Substantial Completion.
  - 2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
  - 3. Record of Infrared Scanning: Prepare a certified report that identifies terminations and connections checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

### 3.07 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months' full maintenance by skilled employees of manufacturer's designated service organization. Include quarterly exercising to check for proper starting, load transfer, and running under load. Include routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation. Provide parts and supplies same as those used in the manufacture and installation of original equipment.

### 3.08 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators.

END OF SECTION

## SECTION 26 36 00                      TRANSFER SWITCHES

## PART 1 - GENERAL

## 1.01      SUMMARY

- A. Section includes automatic transfer switches rated 600 V and less.

## 1.02      ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for transfer switches.
  - 2. Include rated capacities, operating characteristics, electrical characteristics, and accessories.
- B. Shop Drawings:
  - 1. Include plans, elevations, sections, details showing minimum clearances, conductor entry provisions, gutter space, and installed features and devices.
  - 2. Include material lists for each switch specified.
  - 3. Single-Line Diagram: Show connections between transfer switch, power sources, and load; and show interlocking provisions for each combined transfer switch.
  - 4. Riser Diagram: Show interconnection wiring between transfer switches and control panels.

## 1.03      INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer-authorized service representative and testing agency.
- B. Field quality-control reports.

## 1.04      CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.
  - 1. In addition to items otherwise specified, include the following:
    - a. Features and operating sequences, both automatic and manual.
    - b. List of all factory settings of relays; provide relay-setting and calibration instructions, including software, where applicable.

## 1.05      QUALITY ASSURANCE

- A. Testing Agency Qualifications:
  - 1. Member company of NETA.
    - a. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

## 1.06 FIELD CONDITIONS

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service:
1. Notify Owner no fewer than two days in advance of proposed interruption of electrical service.
  2. Do not proceed with interruption of electrical service without Owner's written permission.

## 1.07 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of transfer switch or transfer switch components that fail in materials or workmanship within specified warranty period.
1. Warranty Period: 12 months from date of Substantial Completion.

## PART 2 - PRODUCTS

## 2.01 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NEMA ICS 1.
- C. Comply with NFPA 99.
- D. Comply with NFPA 110.
- E. Comply with UL 1008 unless requirements of these Specifications are stricter.
- F. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.
- G. Tested Fault-Current Closing and Short-Circuit Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.
1. Where transfer switch includes internal fault-current protection, rating of switch and trip unit combination shall exceed indicated fault-current value at installation location.
  2. Short-time withstand capability for 30 cycles.
- H. Repetitive Accuracy of Solid-State Controls: All settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.

- I. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.62. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.
- J. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism. Switches for emergency or standby purposes shall be mechanically and electrically interlocked in both directions to prevent simultaneous connection to both power sources unless closed transition.
  - 1. Surge Protective Device: Service rated.
  - 2. Ground-Fault Protection: Comply with UL 1008 for normal and alternative buses.
  - 3. Service Disconnecting Means: Externally operated, manual mechanically actuated.
- K. Neutral Switching: Provide neutral pole switched simultaneously with phase poles.
  - 1. Ammeter to display charging current.
  - 2. Fused ac inputs and dc outputs.
- L. Annunciation, Control, and Programming Interface Components: Devices at transfer switches for communicating with remote programming devices, annunciators, or annunciator and control panels shall have communication capability matched with remote device.
- M. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, by color-code or by numbered or lettered wire and cable with printed markers at terminations. Color-coding and wire and cable markers are specified in Section 26 05 53 "Identification for Electrical Systems."
  - 1. Designated Terminals: Pressure type, suitable for types and sizes of field wiring indicated.
  - 2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
  - 3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.
  - 4. Accessible via front access.
- N. Enclosures: General-purpose NEMA 250, Type 1, complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

## 2.02 CONTACTOR-TYPE AUTOMATIC TRANSFER SWITCHES

- A. Comply with Level 1 equipment according to NFPA 110.
- B. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
  - 1. Limitation: Switches using molded-case switches or circuit breakers or insulated-case circuit-breaker components are unacceptable.
  - 2. Switch Action: Double throw; mechanically held in both directions.
  - 3. Contacts: Silver composition or silver alloy for load-current switching. Contactor-style automatic transfer-switch units, rated 600 A and higher, shall have separate arcing contacts.
  - 4. Conductor Connectors: Suitable for use with conductor material and sizes.
  - 5. Material: Hard-drawn copper, 98 percent conductivity.
  - 6. Main and Neutral Lugs: Mechanical type.



7. Ground Lugs and Bus-Configured Terminators: Mechanical type.
  8. Ground bar.
  9. Connectors shall be marked for conductor size and type according to UL 1008.
- C. Automatic Open-Transition Transfer Switches: Interlocked to prevent the load from being closed on both sources at the same time.
1. Sources shall be mechanically and electrically interlocked to prevent closing both sources on the load at the same time.

## 2.03 SOURCE QUALITY CONTROL

- A. Factory Tests: Test and inspect components, assembled switches, and associated equipment according to UL 1008. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.
- B. Prepare test and inspection reports.
1. For each of the tests required by UL 1008, performed on representative devices, for emergency systems. Include results of test for the following conditions:
    - a. Overvoltage.
    - b. Undervoltage.
    - c. Loss of supply voltage.
    - d. Reduction of supply voltage.
    - e. Alternative supply voltage or frequency is at minimum acceptable values.
    - f. Temperature rise.
    - g. Dielectric voltage-withstand; before and after short-circuit test.
    - h. Overload.
    - i. Contact opening.
    - j. Endurance.
    - k. Short circuit.
    - l. Short-time current capability.
    - m. Receptacle withstand capability.
    - n. Insulating base and supports damage.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Floor-Mounting Switch: Anchor to floor by bolting.
1. Install transfer switches on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified on drawings.
  2. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.
  3. Provide workspace and clearances required by NFPA 70.
- B. Annunciator and Control Panel Mounting: Flush in wall unless otherwise indicated.
- C. Identify components according to Section 26 05 53 "Identification for Electrical Systems."
- D. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

- E. Comply with NECA 1.

### 3.02 CONNECTIONS

- A. Wiring to Remote Components: Match type and number of cables and conductors to generator sets, control, and communication requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.
- B. Wiring Method: Install cables in raceways and cable trays except within electrical enclosures. Conceal raceway and cables except in unfinished spaces.
  - 1. Comply with requirements for raceways and boxes specified in Section 26 05 33 "Raceways and Boxes for Electrical Systems."
- C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.
- D. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."
- E. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."
- F. Route and brace conductors according to manufacturer's written instructions. Do not obscure manufacturer's markings and labels.
- G. Final connections to equipment shall be made with liquidtight, flexible metallic conduit no more than 18 inches in length.

### 3.03 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
  - 1. After installing equipment, test for compliance with requirements according to NETA ATS.
  - 2. Visual and Mechanical Inspection:
    - a. Compare equipment nameplate data with Drawings and Specifications.
    - b. Inspect physical and mechanical condition.
    - c. Inspect anchorage, alignment, grounding, and required clearances.
    - d. Verify that the unit is clean.
    - e. Verify appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.
    - f. Verify that manual transfer warnings are attached and visible.
    - g. Verify tightness of all control connections.

- h. Inspect bolted electrical connections for high resistance using one of the following methods, or both:
    - 1) Use of low-resistance ohmmeter.
    - 2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method according to manufacturer's published data.
  - i. Perform manual transfer operation.
  - j. Verify positive mechanical interlocking between normal and alternate sources.
  - k. Perform visual and mechanical inspection of surge arresters.
  - l. Inspect control power transformers.
    - 1) Inspect for physical damage, cracked insulation, broken leads, tightness of connections, defective wiring, and overall general condition.
    - 2) Verify that primary and secondary fuse or circuit-breaker ratings match Drawings.
    - 3) Verify correct functioning of drawout disconnecting contacts, grounding contacts, and interlocks.
3. Electrical Tests:
- a. Perform insulation-resistance tests on all control wiring with respect to ground.
  - b. Perform a contact/pole-resistance test. Compare measured values with manufacturer's acceptable values.
  - c. Verify settings and operation of control devices.
  - d. Calibrate and set all relays and timers.
  - e. Verify phase rotation, phasing, and synchronized operation.
  - f. Perform automatic transfer tests.
  - g. Verify correct operation and timing of the following functions:
    - 1) Normal source voltage-sensing and frequency-sensing relays.
    - 2) Engine start sequence.
    - 3) Time delay on transfer.
    - 4) Alternative source voltage-sensing and frequency-sensing relays.
    - 5) Automatic transfer operation.
    - 6) Interlocks and limit switch function.
    - 7) Time delay and retransfer on normal power restoration.
    - 8) Engine cool-down and shutdown feature.
4. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.
- a. Check for electrical continuity of circuits and for short circuits.
  - b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
  - c. Verify that manual transfer warnings are properly placed.
  - d. Perform manual transfer operation.
5. After energizing circuits, perform each electrical test for transfer switches stated in NETA ATS and demonstrate interlocking sequence and operational function for each switch at least three times.
- a. Simulate power failures of normal source to automatic transfer switches and retransfer from emergency source with normal source available.
  - b. Simulate loss of phase-to-ground voltage for each phase of normal source.
  - c. Verify time-delay settings.
  - d. Verify pickup and dropout voltages by data readout or inspection of control settings.
  - e. Test bypass/isolation unit functional modes and related automatic transfer-switch operations.

- f. Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for one pole deviating by more than 50 percent from other poles.
  - g. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.
6. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.
- a. Verify grounding connections and locations and ratings of sensors.
- D. Coordinate tests with tests of generator and run them concurrently.
- E. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.
- F. Transfer switches will be considered defective if they do not pass tests and inspections.
- G. Remove and replace malfunctioning units and retest as specified above.
- H. Prepare test and inspection reports.
- I. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switch. Remove all access panels so joints and connections are accessible to portable scanner.
1. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
  2. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
  3. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switch 11 months after date of Substantial Completion.

### 3.04 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment.
- B. Training shall include testing ground-fault protective devices and instructions to determine when the ground-fault system shall be retested. Include instructions on where ground-fault sensors are located and how to avoid negating the ground-fault protection scheme during testing and circuit modifications.
- C. Coordinate this training with that for generator equipment.

END OF SECTION

## SECTION 26 51 19

## LED INTERIOR LIGHTING

## PART 1 - GENERAL

## 1.01 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. LED: Light-emitting diode.
- F. Lumen: Measured output of lamp and luminaire, or both.
- G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

## 1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Arrange in order of luminaire designation.
  - 2. Include data on features, accessories, and finishes.
  - 3. Include physical description and dimensions of luminaires.
  - 4. Include emergency lighting units, including batteries and chargers.
  - 5. Include life, output (lumens, CCT, and CRI), and energy efficiency data.
  - 6. Photometric data and adjustment factors based on laboratory tests IES LM-79 and IES LM-80.
    - a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
    - b. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
- B. Shop Drawings: For nonstandard or custom luminaires.
  - 1. Include plans, elevations, sections, and mounting and attachment details.
  - 2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 3. Include diagrams for power, signal, and control wiring.
- C. Product Schedule: For luminaires and lamps.

## 1.03 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.

#### 1.04 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.
- B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.
- C. Provide luminaires from a single manufacturer for each luminaire type.
- D. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.
- E. Mockups: For interior luminaires in room or module mockups, complete with power and control connections.
  - 1. Obtain Architect's approval of luminaires in mockups before starting installations.
  - 2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
  - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
  - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### 1.05 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

#### 1.06 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
- B. Warranty Period: Five year(s) from date of Substantial Completion.

### PART 2 - PRODUCTS

#### 2.01 LUMINAIRE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Standards:
  - 1. ENERGY STAR certified.
  - 2. California Title 24 compliant.

3. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.
  4. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
  5. UL Listing: Listed for damp location.
  6. Recessed luminaires shall comply with NEMA LE 4.
- C. CRI of minimum 70. CCT of 4000 K.
- D. Rated lamp life of 50,000 hours to L70.
- E. Internal driver.
- F. Nominal Operating Voltage: 120 and 277 V ac, see Light Fixture Schedule.
1. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

## 2.02 METAL FINISHES

- A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

## 2.03 LUMINAIRE SUPPORT

- A. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.
- C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gage.
- D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.
- E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.02 TEMPORARY LIGHTING

- A. If approved by the Owner, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

## 3.03 INSTALLATION

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Install lamps in each luminaire.
- D. Supports:
  - 1. Sized and rated for luminaire weight.
  - 2. Able to maintain luminaire position after cleaning and relamping.
  - 3. Provide support for luminaire without causing deflection of ceiling or wall.
  - 4. Luminaire mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and vertical force of 400 percent of luminaire weight.
- E. Flush-Mounted Luminaire Support:
  - 1. Secured to outlet box.
  - 2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
  - 3. Trim ring flush with finished surface.
- F. Ceiling-Grid-Mounted Luminaires:
  - 1. Secure to any required outlet box.
  - 2. Secure luminaire to the luminaire opening using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
  - 3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.
- G. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

## 3.04 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."



3.05 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  - 1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
  - 2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.
- C. Prepare test and inspection reports.

3.06 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.
  - 1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
  - 2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
  - 3. Adjust the aim of luminaires in the presence of the Architect.

END OF SECTION

SECTION 26 52 19

EMERGENCY AND EXIT LIGHTING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Exit signs.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of emergency lighting unit, exit sign, and emergency lighting support.
  - 1. Include data on features, accessories, and finishes.
  - 2. Include physical description of the unit and dimensions.
  - 3. Battery and charger for light units.

1.03 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For luminaires and lighting systems to include in emergency, operation, and maintenance manuals.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.05 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: Two year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS FOR EMERGENCY LIGHTING

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. NRTL Compliance: Fabricate and label emergency lighting units, exit signs, and batteries to comply with UL 924.
- C. Comply with NFPA 70 and NFPA 101.

2.02 EXIT SIGNS

- A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

- B. Internally Lighted Signs:
  - 1. Operating at nominal voltage of 277 V ac.
  - 2. Lamps for AC Operation: LEDs; 50,000 hours minimum rated lamp life.

## 2.03 MATERIALS

- A. Metal Parts:
  - 1. Free of burrs and sharp corners and edges.
  - 2. Sheet metal components shall be steel unless otherwise indicated.
  - 3. Form and support to prevent warping and sagging.
- B. Doors, Frames, and Other Internal Access:
  - 1. Smooth operating, free of light leakage under operating conditions.
  - 2. Designed to permit relamping without use of tools.
  - 3. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- C. Conduit: Electrical metallic tubing, minimum 3/4 inch in diameter.

## 2.04 METAL FINISHES

- A. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## 2.05 LUMINAIRE SUPPORT COMPONENTS

- A. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for conditions affecting performance of luminaires.
- B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.
- C. Examine walls, floors, roofs, and ceilings for suitable conditions where emergency lighting luminaires will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

3.03 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

END OF SECTION

## SECTION 26 56 19

## LED EXTERIOR LIGHTING

## PART 1 - GENERAL

## 1.01 SUMMARY

## A. Section Includes:

1. Exterior solid-state luminaires that are designed for and exclusively use LED lamp technology.
2. Luminaire-mounted photoelectric relays.

## 1.02 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color rendering index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. Lumen: Measured output of lamp and luminaire, or both.
- F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

## 1.03 ACTION SUBMITTALS

- A. Product Data: For each type of luminaire.
  1. Arrange in order of luminaire designation.
  2. Include data on features, accessories, and finishes.
  3. Include physical description and dimensions of luminaire.
  4. Lamps, include life, output (lumens, CCT, and CRI), and energy-efficiency data.
  5. Photoelectric relays.
- B. Product Schedule: For luminaires and lamps.

## 1.04 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For luminaires and photoelectric relays to include in operation and maintenance manuals.
  1. Provide a list of all lamp types used on Project. Use ANSI and manufacturers' codes.
  2. Provide a list of all photoelectric relay types used on Project; use manufacturers' codes.

## 1.05 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturers' laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.
- B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products and complying with applicable IES testing standards.
- C. Provide luminaires from a single manufacturer for each luminaire type.
- D. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.
- E. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

## 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering prior to shipping.

## 1.07 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: 2 year(s) from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.01 LUMINAIRE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. NRTL Compliance: Luminaires shall be listed and labeled for indicated class and division of hazard by an NRTL.
- C. UL Compliance: Comply with UL 1598 and listed for wet location.
- D. Internal driver.
- E. Nominal Operating Voltage: 277 or 480 V ac, see Light Fixture Schedule.
- F. Source Limitations: Obtain luminaires from single source from a single manufacturer.
- G. Source Limitations: For luminaires, obtain each color, grade, finish, type, and variety of luminaire from single source with resources to provide products of consistent quality in appearance and physical properties.

**2.02 LUMINAIRE-MOUNTED PHOTOELECTRIC RELAYS**

- A. Comply with UL 773 or UL 773A.
- B. Contact Relays: Factory mounted, single throw, designed to fail in the on position, and factory set to turn light unit on at 1.5 to 3 fc and off at 4.5 to 10 fc with 15-second minimum time delay. Relay shall have directional lens in front of photocell to prevent artificial light sources from causing false turnoff.
  - 1. Relay with locking-type receptacle shall comply with ANSI C136.10.
  - 2. Adjustable window slide for adjusting on-off set points.

**2.03 MATERIALS**

- A. Metal Parts: Free of burrs and sharp corners and edges.
- B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses.
- C. Diffusers and Globes:
  - 1. Acrylic Diffusers: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
  - 2. Glass: Annealed crystal glass unless otherwise indicated.
  - 3. Retain "Lens Thickness" Subparagraph below for all diffuser and globe types.
- D. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:
  - 1. White Surfaces: 85 percent.
  - 2. Specular Surfaces: 83 percent.
  - 3. Diffusing Specular Surfaces: 75 percent.
- E. Housings:
  - 1. Rigidly formed, weather- and light-tight enclosure that will not warp, sag, or deform in use.
  - 2. Provide filter/breather for enclosed luminaires.

**2.04 FINISHES**

- A. Variations in Finishes: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- B. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

- C. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
  2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20 requirements; and seal aluminum surfaces with clear, hard-coat wax.
  3. Class I, Clear-Anodic Finish: AA-M32C22A41 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
  4. Class I, Color-Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker), complying with AAMA 611.
    - a. Color: Dark bronze, or as indicated in Light Fixture Schedule.

## 2.05 LUMINAIRE SUPPORT COMPONENTS

- A. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for luminaire electrical conduit to verify actual locations of conduit connections before luminaire installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 GENERAL INSTALLATION REQUIREMENTS

- A. Comply with NECA 1.
- B. Fasten luminaire to structural support.
- C. Supports:
1. Sized and rated for luminaire weight.
  2. Able to maintain luminaire position after cleaning and relamping.
  3. Support luminaires without causing deflection of finished surface.
  4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.
- D. Wall-Mounted Luminaire Support: Attached to structural members in walls.



- E. Wiring Method: Install cables in raceways. Conceal raceways and cables.
  - F. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.
  - G. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables" and Section 26 05 33 "Raceways and Boxes for Electrical Systems" for wiring connections and wiring methods.
- 3.03 IDENTIFICATION
- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."
- 3.04 FIELD QUALITY CONTROL
- A. Inspect each installed luminaire for damage. Replace damaged luminaires and components.
  - B. Illumination Tests:
    - 1. Measure light intensities at night. Use photometers with calibration referenced to NIST standards. Comply with the following IES testing guide(s):
      - a. IES LM-5.
      - b. IES LM-50.
      - c. IES LM-52.
      - d. IES LM-64.
      - e. IES LM-72.
    - 2. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
  - C. Luminaire will be considered defective if it does not pass tests and inspections.
- 3.05 ADJUSTING
- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.
    - 1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
    - 2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
    - 3. Adjust the aim of luminaires in the presence of the Architect.

END OF SECTION

## SECTION 27 11 16

## COMMUNICATIONS RACKS, FRAMES, AND ENCLOSURES

## PART 1 - GENERAL

## 1.01 SUMMARY

## A. Section Includes:

1. 19-inch equipment racks.
2. Power strips.
3. Grounding.
4. Labeling.

## B. Related Requirements:

1. Section 27 15 13 "Communications Copper Horizontal Cabling" for copper data cabling associated with system panels and devices.

## 1.02 DEFINITIONS

- A. Access Provider: An operator that provides a circuit path or facility between the service provider and user. An access provider can also be a service provider.
- B. BICSI: Building Industry Consulting Service International.
- C. LAN: Local area network.
- D. RCDD: Registered communications distribution designer.
- E. Service Provider: The operator of a telecommunications transmission service delivered through access provider facilities.
- F. TGB: Telecommunications grounding bus bar.
- G. TMGB: Telecommunications main grounding bus bar.

## 1.03 ACTION SUBMITTALS

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

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for equipment racks and cabinets.
2. Include rated capacities, operating characteristics, electrical characteristics, certifications, standards compliance, and furnished specialties and accessories.

## B. Shop Drawings: For communications racks, frames, and enclosures. 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. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.
3. Grounding: Indicate location of TGB and its mounting detail showing standoff insulators and wall-mounting brackets.

1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.
- B. Seismic Qualification Data: Certificates, from manufacturer.
  1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions. Base certification on the maximum number of components capable of being mounted in each rack type. Identify components on which certification is based.
  3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling installer must have personnel certified by BICSI on staff.
  1. Layout Responsibility: Preparation of Shop Drawings shall be under direct supervision of RCDD.
  2. Installation Supervision: Installation shall be under direct supervision of Technician, who shall be present at all times when Work of this Section is performed at Project site.
  3. Field Inspector: Currently registered by BICSI as Technician to perform on-site inspection.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. UL listed.
- B. RoHS compliant.
- C. Compliant with requirements of the Payment Card Industry Data Security Standard.

2.02 BACKBOARDS

- A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches. Comply with requirements for plywood backing panels specified in Section 061000 "Rough Carpentry."

## 2.03 19-INCH EQUIPMENT RACKS

- A. Description: Two- and four- post racks with threaded rails designed for mounting telecommunications equipment. Width is compatible with EIA/ECIA 310-E, 19-inch equipment mounting with an opening of 17.72-inches between rails.
- B. General Requirements:
1. Frames: Modular units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
  2. Material: Extruded steel.
  3. Finish: Manufacturer's standard, baked-polyester powder coat.
  4. Color: Black.
- C. Wall-Mounted Racks:
1. Height: As indicated on Drawings.
  2. Depth: 23 inches.
  3. Load Rating: 200 lb minimum.
  4. Number of Rack Units per Rack: As indicated on Drawings.
  5. Threads: Universal square.
  6. Wall Attachment: Four mounting holes.
  7. Equipment Access: Integral swing.
- D. Cable Management:
1. Metal, with integral wire retaining fingers.
  2. Baked-polyester powder coat finish.
  3. Vertical cable management panels shall have front and rear channels, with covers.
  4. Provide horizontal crossover cable manager at the top of each relay rack, with a minimum height of two rack units each.

## 2.04 POWER STRIPS

- A. Power Strips: Comply with UL 1363.
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  2. Rack mounting.
  3. Six 20-A, 120-V ac, NEMA WD 6, Configuration 5-20R receptacles.
  4. LED indicator lights for power and protection status.
  5. LED indicator lights for reverse polarity and open outlet ground.
  6. Circuit Breaker and Thermal Fusing: When protection is lost, circuit opens and cannot be reset.
  7. Circuit Breaker and Thermal Fusing: Unit continues to supply power if protection is lost.
  8. Close-coupled, direct plug-in line cord.
  9. Rocker-type on-off switch, illuminated when in on position.
  10. Peak Single-Impulse Surge Current Rating: 33 kA per phase.
  11. Protection modes shall be line to neutral, line to ground, and neutral to ground. UL 1449 clamping voltage for all three modes shall be not more than 330 V.

## 2.05 GROUNDING

- A. Comply with requirements in Division 26.
- B. Rack and Cabinet TGBs: Rectangular bars of hard-drawn solid copper, accepting conductors ranging from No. 14 to No. 2/0 AWG, NRTL listed as complying with UL 467, and complying with TIA-606-B. Predrilling shall be with holes for use with lugs specified in this Section.
  - 1. Cabinet-Mounted TGB: Terminal block, with stainless-steel or copper-plated hardware for attachment to cabinet.
  - 2. Rack-Mounted Horizontal TGB: Designed for mounting in 19- or 23-inch equipment racks. Include a copper splice bar for transitioning to an adjoining rack, and stainless-steel or copper-plated hardware for attachment to the rack.
  - 3. Rack-Mounted Vertical TGB: 72 or 36 inches long, with stainless-steel or copper-plated hardware for attachment to rack.

## 2.06 LABELING

- A. Comply with TIA-606-B and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Comply with NECA 1.
- B. Comply with BICSI TDMM for layout of communications equipment spaces.
- C. Comply with BICSI ITSIMM for installation of communications equipment spaces.
- D. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
- E. Coordinate layout and installation of communications equipment in racks and room. Coordinate service entrance configuration with service provider.
  - 1. Meet jointly with system providers, equipment suppliers, and Owner to exchange information and agree on details of equipment configurations and installation interfaces.
  - 2. Record agreements reached in meetings and distribute them to other participants.
  - 3. Adjust configurations and locations of distribution frames, cross-connects, and patch panels in equipment spaces to accommodate and optimize configuration and space requirements of telecommunications equipment.
  - 4. Adjust configurations and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in equipment room.
- F. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

3.02 GROUNDING

- A. Comply with NECA/BICSI 607.
- B. Install grounding according to BICSI ITSIMM, "Bonding, Grounding (Earthing) and Electrical Protection" Ch.
- C. Locate TGB to minimize length of bonding conductors. Fasten to wall, allowing at least 2 inches of clearance behind TGB. Connect TGB with a minimum No. 4 AWG grounding electrode conductor from TGB to suitable electrical building ground. Connect rack TGB to near TGB or the TMGB.
  - 1. Bond the shield of shielded cable to patch panel, and bond patch panel to TGB or TMGB.

3.03 IDENTIFICATION

- A. Coordinate system components, wiring, and cabling complying with TIA-606-B.
- B. See the Evaluations for discussion of TIA-606-B as it applies to this Section.
- C. Paint and label colors for equipment identification shall comply with TIA-606-B
- D. Labels shall be machine printed. Type shall be 3/16 inch in height.

END OF SECTION

## SECTION 27 13 23.01 FIBER OPTIC

## PART 1 - GENERAL

## 1.01 SUMMARY

- A. Contractor shall place the following fiber, copper and necessary LIU and copper termination equipment to the new Maintenance Building as well as terminating equipment in the Project Office, according to the specifications below:
1. Six (6) strands MM fiber must be 50/125 micron OM3 laser optimized
  2. Six (6) strands SM fiber must be 8.7/125 micron
  3. LIUs with LC Connector terminations
  4. Fifty (50) pair Copper Cabling for Voice

## 1.02 SUBMITTALS

- A. Product Data: For each type of product, including schedule and manufacturer's technical product data / literature and certified test data.

## 1.03 EXTRA STOCK MATERIALS

- A. Provide an additional 25 percent space on all LIU patch panels for future use.
- B. Provide a 20 foot slack loop for all cable in buildings for future changes and upgrades.
- C. Provide a 100 foot slack loop at all splice locations that is neatly coiled and secured, for future splicing.

## 1.04 QUALITY ASSURANCE

- A. Comply with **SAFETY GUIDELINES as instituted by O.S.H.A.** Any individual member of the selected Contractor's project team that violates these guidelines will be instructed to leave the project site immediately.
- B. Contractor shall be responsible for all necessary permits including city, county, state, railroad, MDOT, gas line, and federal permits and regulations prior to beginning work. A copy of all permits shall be emailed to the Project Engineer.
- C. Contractor shall have a Registered Communications Distribution Designer (RCDD) on staff.
- D. Contractor's RCDD must sign off on the completed job in writing stating that the job was completed to Bicsi standards and recommendations.
- E. Maintain a single point of contact/jobsite supervisor at all times. A daily work log shall be maintained at the job site and be available for review by MDOT at any time.
- F. All fiber strands shall be tested prior to installation, after installation, with a final test after terminators have been installed. For single-mode optical fiber, Contractor must perform optical fiber end-to-end attenuation tests in accordance with TIA-568-C.3 and TIA-526-7 using Method A, Optical Power Meter and Light Source for single-mode optical fiber. Test results shall be provided to The Project Engineer who will forward one copy to MDOT IS.

- G. Test all fiber cables for length, polarity, and attenuation at 850 nm or 1300 nm for 50/125 micron multimode (MM) and 1310 nm or 1550 nm for the appropriate single mode (SM) cable in at least one direction. Length must be tested using an Optical Time Domain Reflectometer (**OTDR**). The warranty shall be for link and/or channel coverage for horizontal and backbone cables. The testing performed must be done in accordance with the type of warranty required.

#### 1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials and products in labeled protective packages. Store and handle in strict compliance with manufacturers' instructions and recommendations. Protect from damage from weather, excessive temperatures and construction operations

#### 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 materials 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 MATERIALS

- A. MDOT has a campus standard for the following materials. Contractor must propose the following materials where applicable:
  1. Coming 24/12/6 strand Single Mode 8/125 OSP fiber optic cable (Contractor to determine quantity)
  2. Coming 12 strand Single Mode 8/125 riser rated fiber optic cable (Contractor to determine quantity)
  3. Coming 12/6 strand Multimode 50/125 OM3 riser rated fiber optic cable (Contractor to determine quantity)
  4. Coming fiber enclosures - PCH-01U, PCH-02U, PCH-03U, PCH-04U (Contractor to determine quantity).
  5. Coming fiber enclosure adapter panels - CCH-CP-06-A9, CCH-CP-12-A9, CCH-CP-06-D3, CCH-CP-12-D3 (Contractor to determine quantity)
- B. Provide and install only approved and suitable materials.
  1. SM fiber shall be 8.7/125 micron.
  2. MM fiber shall be 50/125 micron OM3 laser optimized.
  3. Copper feeder cables shall be 100Ω UTP cables

### PART 3 - EXECUTION

#### 3.01 INSTALLATION

- A. Properly seal all applicable service entrances.



- B. Should a handhole be installed the size shall be 24 inches by 36 inches by 24 inches with open bottom with 12 inches of gravel installed for drainage.
- C. All conduits shall sweep into the handhole. No drilling will be allowed.
- D. The cable shall be labeled with source, destination, fiber count, and type of fiber on an orange heavy-duty tag every time a fiber enters and exits a handhole or splice case.
- E. Splice cases shall be pressurized and flash tested when closed to ensure integrity.
- F. Pulling tensions shall be monitored during the installation and approved cable lubricant used as necessary. At no time will the manufacturer's bend radius or maximum tensile load be exceeded.
- G. Fiber cables shall be marked with the size, type, count and number of the cable and where the other end terminates.
- H. Provide and install pull string for all Contractor supplied innerduct or conduit.
- I. Ensure proper separation for all cables from sources of EMI.
- J. Conduit paths shall be bored, and a handhole (if required) shall be placed every 700-800 feet with a 40 foot slack loop placed in each pull-thru handhole. Placement of handholes shall be approved by MDOT Project Engineer..
- K. Fiber cables shall be installed in a conduit with minimum schedule 40 wall thicknesses.
- L. Conduit shall be installed at a minimum depth of 36 inches to the top of the conduit.
- M. Fiber pigtails or fusion spliced connectors providing a UPC factory installed connectors shall be installed. The combined loss of the connector and fusion splice at the patch panel shall not exceed .75 db at 1550 nm.
- N. Ensure that all grounding/earthing and bonding shall be performed in accordance with applicable codes and regulations. Observe the requirements of IEC 1000-5-2 and ANSI/TIA/EIA-607 throughout the entire cabling system.
- O. Select pathways to protect the minimum bend radius and pulling tensions of all cables as detailed within the manufacturer's specifications for both during and after installations.
- P. Comply with standards and codes regarding non-plenum spaces when routing cable through non-plenum environments.
- R. All fiber shall be terminated using LC connectors.
- S. Provide and install a #12 copper locate wire in the outside plant (OSP) conduit run.

END OF SECTION

SECTION 27 15 13

COMMUNICATIONS COPPER HORIZONTAL CABLING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Category 6 twisted pair cable.
2. Twisted pair cable hardware, including plugs and jacks.
3. Cable management system.
4. Cabling identification products.
5. Grounding provisions for twisted pair cable.
6. Source quality control requirements for twisted pair cable.

1.02 DEFINITIONS

- A. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
- B. EMI: Electromagnetic interference.
- C. FTP: Shielded twisted pair.
- D. F/FTP: Overall foil screened cable with foil screened twisted pair.
- E. F/UTP: Overall foil screened cable with unscreened twisted pair.
- F. IDC: Insulation displacement connector.
- G. LAN: Local area network.
- H. Jack: Also commonly called an "outlet," it is the fixed, female connector.
- I. Plug: Also commonly called a "connector," it is the removable, male telecommunications connector.
- J. RCDD: Registered Communications Distribution Designer.
- K. Screen: A metallic layer, either a foil or braid, placed around a pair or group of conductors.
- L. Shield: A metallic layer, either a foil or braid, placed around a pair or group of conductors.
- M. S/FTP: Overall braid screened cable with foil screened twisted pair.
- N. S/UTP: Overall braid screened cable with unscreened twisted pairs.
- O. UTP: Unscreened (unshielded) twisted pair.

### 1.03 COPPER HORIZONTAL CABLING DESCRIPTION

- A. Horizontal cable cabling system shall provide interconnections between Distributor A, Distributor B, or Distributor C, and the equipment outlet, otherwise known as "Cabling Subsystem 1," in the telecommunications cabling system structure. Cabling system consists of horizontal cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for horizontal-to-horizontal cross-connection.
  - 1. TIA-568-C.1 requires that a minimum of two equipment outlets be installed for each work area.
  - 2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications equipment outlet.
  - 3. Bridged taps and splices shall not be installed in the horizontal cabling.
- B. A work area is approximately 100 sq. ft., and includes the components that extend from the equipment outlets to the station equipment.
- C. The maximum allowable horizontal cable length is 295 feet. This maximum allowable length does not include an allowance for the length of 16 feet to the workstation equipment or in the horizontal cross-connect.

### 1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Reviewed and stamped by RCDD.
  - 1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
  - 2. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
  - 3. Cabling administration Drawings and printouts.
  - 4. Wiring diagrams and installation details of telecommunications equipment, to show location and layout of telecommunications equipment, including the following:
    - a. Telecommunications rooms plans and elevations.
    - b. Telecommunications pathways.
    - c. Telecommunications system access points.
    - d. Telecommunications grounding system.
    - e. Telecommunications conductor drop locations.
    - f. Typical telecommunications details.
    - g. Mechanical, electrical, and plumbing systems.
- C. Twisted pair cable testing plan.
- D. Samples: For telecommunications jacks and plugs, in specified finish, one for each type and configuration and faceplates for color selection and evaluation of technical features.

### 1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For RCDD, Installer, installation supervisor, and field inspector.
- B. Product Certificates: For each type of product.

- C. Source quality-control reports.
  - D. Field quality-control reports.
- 1.06 CLOSEOUT SUBMITTALS
- A. Maintenance Data: For splices and connectors to include in maintenance manuals.
  - B. Software and Firmware Operational Documentation:
    - 1. Software operating and upgrade manuals.
    - 2. Program Software Backup: On USB media or compact disk, complete with data files.
    - 3. Device address list.
    - 4. Printout of software application and graphic screens.
- 1.07 MAINTENANCE MATERIAL SUBMITTALS
- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
    - 1. Connecting Blocks: One of each type.
    - 2. Faceplates: One of each type.
    - 3. Jacks: Ten of each type.
    - 4. Patch-Panel Units: One of each type.
    - 5. Plugs: Ten of each type.
- 1.08 QUALITY ASSURANCE
- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
    - 1. Layout Responsibility: Preparation of Shop Drawings, cabling administration Drawings, and field testing program development by an RCDD.
    - 2. Installation Supervision: Installation shall be under the direct supervision of Technician, who shall be present at all times when Work of this Section is performed at Project site.
    - 3. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.
  - B. Testing Agency Qualifications: Testing agency must have personnel certified by BICSI on staff.
    - 1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD.
- 1.09 DELIVERY, STORAGE, AND HANDLING
- A. Test cables upon receipt at Project site.
    - 1. Test each pair of twisted pair cable for open and short circuits.

## 1.10 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

## 1.11 COORDINATION

- A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

## 1.12 SOFTWARE SERVICE AGREEMENT

- A. Technical Support: Beginning with Substantial Completion, provide software support for two years.
- B. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.
  - 1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

## PART 2 - PRODUCTS

## 2.01 PERFORMANCE REQUIREMENTS

- A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA-568-C.1, when tested according to test procedures of this standard.
- B. Telecommunications Pathways and Spaces: Comply with TIA-569-D.
- C. Grounding: Comply with TIA-607-B.

## 2.02 GENERAL CABLE CHARACTERISTICS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with the applicable standard and NFPA 70 for the following types:
  - 1. Communications, Plenum Rated: Type CMP complying with UL 1685 or Type CMP in listed plenum communications raceway.
  - 2. Communications, Non-plenum: Type CMP or Type CMR in listed plenum or riser communications raceway.
- 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: 25 or less.
  - 2. Smoke-Developed Index: 50 or less.
- C. RoHS compliant.

## 2.03 CATEGORY 6 TWISTED PAIR CABLE

- A. Description: Four-pair, balanced-twisted pair cable, with internal spline, certified to meet transmission characteristics of Category 6 cable at frequencies up to 250MHz.
- B. Standard: Comply with NEMA WC 66/ICEA S-116-732 and TIA-568-C.2 for Category 6 cables.
- C. Conductors: 100-ohm, 23 AWG solid copper.
- D. Shielding/Screening: Unshielded twisted pairs (UTP).
- E. Cable Rating: Plenum.
- F. Jacket: Blue thermoplastic.

## 2.04 TWISTED PAIR CABLE HARDWARE

- A. Description: Hardware designed to connect, splice, and terminate twisted pair copper communications cable.
- B. General Requirements for Twisted Pair Cable Hardware:
  - 1. Comply with the performance requirements of Category 6.
  - 2. Comply with TIA-568-C.2, IDC type, with modules designed for punch-down caps or tools.
  - 3. Cables shall be terminated with connecting hardware of same category or higher.
- C. Source Limitations: Obtain twisted pair cable hardware from single source from single manufacturer.
- D. Connecting Blocks:
  - 1. 110-style IDC for Category 6.
  - 2. Provide blocks for the number of cables terminated on the block, plus 25 percent spare, integral with connector bodies, including plugs and jacks where indicated.
- E. Patch Panel: Modular panels housing numbered jack units with IDC-type connectors at each jack location for permanent termination of pair groups of installed cables.
  - 1. Features:
    - a. Universal T568A and T568B wiring labels.
    - b. Labeling areas adjacent to conductors.
    - c. Replaceable connectors.
    - d. 24 or 48 ports.
  - 2. Construction: 16-gauge steel and mountable on 19-inch equipment racks.
  - 3. Number of Jacks per Field: One for each four-pair conductor group of indicated cables, plus spares and blank positions adequate to suit specified expansion criteria.

- F. Patch Cords: Factory-made, four-pair cables in 48-inch lengths; terminated with an eight-position modular plug at each end.
1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure performance. Patch cords shall have latch guards to protect against snagging.
  2. Patch cords shall have color-coded boots for circuit identification.
- G. Plugs and Plug Assemblies:
1. Male; eight position; color-coded modular telecommunications connector designed for termination of a single four-pair, 100-ohm, unshielded or shielded twisted pair cable.
  2. Standard: Comply with TIA-568-C.2.
  3. Marked to indicate transmission performance.
- H. Jacks and Jack Assemblies:
1. Female; eight position; modular; fixed telecommunications connector designed for termination of a single four-pair, 100-ohm, unshielded or shielded twisted pair cable.
  2. Designed to snap-in to a patch panel or faceplate.
  3. Standard: Comply with TIA-568-C.2.
  4. Marked to indicate transmission performance.
- I. Faceplate:
1. Two port, vertical single gang faceplates designed to mount to single gang wall boxes or single gang plaster rings for double gang wall boxes.
  2. Plastic Faceplate: High-impact plastic. Coordinate color with Section 26 27 26 "Wiring Devices."
  3. Metal Faceplate: Stainless steel, complying with requirements in Section 26 27 26 "Wiring Devices."
  4. For use with snap-in jacks accommodating any combination of twisted pair, optical fiber, and coaxial work area cords.
    - a. Flush mounting jacks, positioning the cord at a 45-degree angle.
- J. Legend:
1. Machine printed, in the field, using adhesive-tape label.
  2. Snap-in, clear-label covers and machine-printed paper inserts.
- 2.05 IDENTIFICATION PRODUCTS
- A. Comply with TIA-606-B and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- 2.06 GROUNDING
- A. Comply with requirements in Section 26 05 26 "Grounding and Bonding for Electrical Systems" for grounding conductors and connectors.
- B. Comply with TIA-607-B.

## 2.07 SOURCE QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to evaluate cables.
- B. Factory test cables on reels according to TIA-568-C.1.
- C. Factory test twisted pair cables according to TIA-568-C.2.
- D. Cable will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

## PART 3 - EXECUTION

## 3.01 WIRING METHODS

- A. Wiring Method: Install cables in raceways and cable trays, except within consoles, cabinets, desks, and counters. Conceal raceway and cables, except in unfinished spaces.
  - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
- B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- C. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools. Install conductors parallel with or at right angles to sides and back of enclosure.

## 3.02 INSTALLATION OF TWISTED-PAIR HORIZONTAL CABLES

- A. Comply with NECA 1 and NECA/BICSI 568.
- B. General Requirements for Cabling:
  - 1. Comply with TIA-568-C.0, TIA-568-C.1, and TIA-568-C.2.
  - 2. Comply with BICSI's "Information Transport Systems Installation Methods Manual (ITSIMM), Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section.
  - 3. Install 110-style IDC termination hardware unless otherwise indicated.
  - 4. Do not untwist twisted pair cables more than 1/2 inch from the point of termination to maintain cable geometry.
  - 5. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
  - 6. MUTOA shall not be used as a cross-connect point.
  - 7. Consolidation points may be used only for making a direct connection to equipment outlets:
    - a. Do not use consolidation point as a cross-connect point, as a patch connection, or for direct connection to workstation equipment.
    - b. Locate consolidation points for twisted-pair cables at least 49 feet from communications equipment room.



8. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
  9. Install lacing bars to restrain cables, prevent straining connections, and prevent bending cables to smaller radii than minimums recommended by manufacturer.
  10. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI Information Transport Systems Installation Methods Manual, Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section. Use lacing bars and distribution spools.
  11. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation, and replace it with new cable.
  12. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
  13. In the communications equipment room, install a 10-foot-long service loop on each end of cable.
  14. Pulling Cable: Comply with BICSI Information Transport Systems Installation Methods Manual, Ch. 5, "Copper Structured Cabling Systems," "Pulling and Installing Cable" Section. Monitor cable pull tensions.
- C. Open-Cable Installation:
1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
  2. Suspend twisted pair cabling, not in a wireway or pathway, a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.
  3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
- D. Group connecting hardware for cables into separate logical fields.
- E. Separation from EMI Sources:
1. Comply with recommendations from BICSI's "Telecommunications Distribution Methods Manual" and TIA-569-D for separating unshielded copper communication cable from potential EMI sources, including electrical power lines and equipment.
  2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
    - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
    - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
    - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.
  3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
    - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
    - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
    - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.
  4. Separation between communications cables in grounded metallic raceways, power lines, and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
    - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
    - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
    - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.

5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

### 3.03 FIRESTOPPING

- A. Comply with TIA-569-D, Annex A, "Firestopping."
- B. Comply with "Firestopping Systems" Article in BICSI's "Telecommunications Distribution Methods Manual."

### 3.04 GROUNDING

- A. Install grounding according to the "Grounding, Bonding, and Electrical Protection" chapter in BICSI's "Telecommunications Distribution Methods Manual."
- B. Comply with TIA-607-B and NECA/BICSI-607.
- C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall, allowing at least a 2-inch clearance behind the grounding bus bar. Connect grounding bus bar to suitable electrical building ground, using a minimum No. 4 AWG grounding electrode conductor.
- D. Bond metallic equipment to the grounding bus bar, using not smaller than a No. 6 AWG equipment grounding conductor.

### 3.05 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA-606-B.
- B. Paint and label colors for equipment identification shall comply with TIA-606-B.
- C. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.
- D. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.
- E. Cable and Wire Identification:
  1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
  2. Each wire connected to building-mounted devices is not required to be numbered at the device if wire color is consistent with associated wire connected and numbered within panel or cabinet.
  3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.

4. Label each terminal strip, and screw terminal in each cabinet, rack, or panel.
    - a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group, extended from a panel or cabinet to a building-mounted device, with the name and number of a particular device.
    - b. Label each unit and field within distribution racks and frames.
  5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and -connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
- F. Labels shall be preprinted or computer-printed type, with a printing area and font color that contrast with cable jacket color but still comply with TIA-606-B requirements for the following:
1. Cables use flexible vinyl or polyester that flexes as cables are bent.

### 3.06 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.
- D. Tests and Inspections:
  1. Visually inspect jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA-568-C.1.
  2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
  3. Test twisted pair cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.
    - a. Test instruments shall meet or exceed applicable requirements in TIA-568-C.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
- E. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similarly to Table 10.1 in BICSI's "Telecommunications Distribution Methods Manual," or shall be transferred from the instrument to the computer, saved as text files, printed, and submitted.
- F. Remove and replace cabling where test results indicate that they do not comply with specified requirements.
- G. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- H. Prepare test and inspection reports.

3.07 SOFTWARE SERVICE AGREEMENT

- A. Technical Support: Beginning with Substantial Completion, provide software support for two years.
- B. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.
  - 1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

END OF SECTION

## SECTION 28 46 21.11

## ADDRESSABLE FIRE-ALARM SYSTEMS

## PART 1 - GENERAL

## 1.01 SUMMARY

## A. Section Includes:

1. Fire-alarm control unit.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Heat detectors.
5. Carbon monoxide sensors.
6. Notification appliances.
7. Remote annunciator.
8. Addressable interface device.
9. Radio alarm transmitter.

## 1.02 DEFINITIONS

- A. EMT: Electrical Metallic Tubing.
- B. FACP: Fire Alarm Control Panel.
- C. HLI: High Level Interface.
- D. NICET: National Institute for Certification in Engineering Technologies.

## 1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product, including furnished options and accessories.
  1. Include construction details, material descriptions, dimensions, profiles, and finishes.
  2. Include rated capacities, operating characteristics, and electrical characteristics.
- B. Shop Drawings: For fire-alarm system.
  1. Comply with recommendations and requirements in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
  2. Include plans, elevations, sections, details, and attachments to other work.
  3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
  4. Detail assembly and support requirements.
  5. Include voltage drop calculations for notification-appliance circuits.
  6. Include battery-size calculations.
  7. Include input/output matrix.
  8. Include statement from manufacturer that all equipment and components have been tested as a system and meet all requirements in this Specification and in NFPA 72.
  9. Include performance parameters and installation details for each detector.

10. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
11. Provide program report showing that air-sampling detector pipe layout balances pneumatically within the airflow range of the air-sampling detector.
12. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale; coordinate location of duct smoke detectors and access to them.
  - a. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators.
  - b. Show field wiring required for HVAC unit shutdown on alarm.
  - c. Show field wiring and equipment required for HVAC unit shutdown on alarm and override by firefighters' control system.
  - d. Show field wiring and equipment required for HVAC unit shutdown on alarm and override by firefighters' smoke-evacuation system.
  - e. Locate detectors according to manufacturer's written recommendations.
  - f. Show air-sampling detector pipe routing.
13. Include alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
14. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits and point-to-point wiring diagrams.

C. General Submittal Requirements:

1. Shop Drawings shall be prepared by persons with the following qualifications:
  - a. Trained and certified by manufacturer in fire-alarm system design.
  - b. NICET-certified, fire-alarm technician; Level III minimum.
  - c. Licensed or certified by authorities having jurisdiction.

D. Delegated-Design Submittal: For notification appliances and smoke and heat detectors, in addition to submittals listed above, indicate compliance with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Drawings showing the location of each notification appliance and smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the device.
2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72. Calculate spacing and intensities for strobe signals and sound-pressure levels for audible appliances.
3. Indicate audible appliances required to produce square wave signal per NFPA 72.

1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Field quality-control reports.

## 1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.
1. Include the following:
    - a. Comply with the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
    - b. Provide "Fire Alarm and Emergency Communications System Record of Completion Documents" according to the "Completion Documents" Article in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
    - c. Complete wiring diagrams showing connections between all devices and equipment. Each conductor shall be numbered at every junction point with indication of origination and termination points.
    - d. Riser diagram.
    - e. Device addresses.
    - f. Air-sampling system sample port locations and modeling program report showing layout meets performance criteria.
    - g. Record copy of site-specific software.
    - h. Provide "Inspection and Testing Form" according to the "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:
      - 1) Equipment tested.
      - 2) Frequency of testing of installed components.
      - 3) Frequency of inspection of installed components.
      - 4) Requirements and recommendations related to results of maintenance.
      - 5) Manufacturer's user training manuals.
    - i. Manufacturer's required maintenance related to system warranty requirements.
    - j. Abbreviated operating instructions for mounting at fire-alarm control unit and each annunciator unit.
- B. Software and Firmware Operational Documentation:
1. Software operating and upgrade manuals.
  2. Program Software Backup: On magnetic media or compact disk, complete with data files.
  3. Device address list.
  4. Printout of software application and graphic screens.

## 1.06 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Keys and Tools: One extra set for access to locked or tamper proofed components.
  2. Fuses: Two of each type installed in the system. Provide in a box or cabinet with compartments marked with fuse types and sizes.
  3. Filters for Air-Sampling Detectors: Quantity equal to two percent of amount of each type installed, but no fewer than one unit of each type.

## 1.07 QUALITY ASSURANCE

- A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
- B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level II technician.
- C. NFPA Certification: Obtain certification according to NFPA 72 by an NRTL (nationally recognized testing laboratory).
- D. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.
- E. NFPA Certification: Obtain certification according to NFPA 72 in the form of a placard by an FM Global-approved alarm company.

## 1.08 PROJECT CONDITIONS

- A. Use of Devices during Construction: Protect devices during construction unless devices are placed in service to protect the facility during construction.

## PART 2 - PRODUCTS

## 2.01 SYSTEM DESCRIPTION

- A. Source Limitations for Fire-Alarm System and Components: Components shall be compatible with, and operate as an extension of, existing system. Provide system manufacturer's certification that all components provided have been tested as, and will operate as, a system.
- B. Noncoded, addressable system, with multiplexed signal transmission and horn/strobe evacuation.
- C. Automatic sensitivity control of certain smoke detectors.
- D. All components provided shall be listed for use with the selected system.
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

## 2.02 SYSTEMS OPERATIONAL DESCRIPTION

- A. Fire-alarm signal initiation shall be by one or more of the following devices:
  - 1. Manual stations.
  - 2. Heat detectors.
  - 3. Smoke detectors.
  - 4. Duct smoke detectors.
  - 5. Carbon monoxide detectors.



- B. Fire-alarm signal shall initiate the following actions:
1. Continuously operate alarm notification appliances.
  2. Identify alarm and specific initiating device at fire-alarm control unit.
  3. Transmit an alarm signal to the remote alarm receiving station.
  4. Activate alarm communication system.
  5. Record events in the system memory.
  6. Indicate device in alarm on the annunciator.
- C. Supervisory signal initiation shall be by one or more of the following devices and actions:
1. User disabling of zones or individual devices.
  2. Loss of communication with any panel on the network.
- D. System trouble signal initiation shall be by one or more of the following devices and actions:
1. Open circuits, shorts, and grounds in designated circuits.
  2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
  3. Loss of communication with any addressable sensor, input module, relay, control module, remote annunciator, printer interface, or Ethernet module.
  4. Loss of primary power at fire-alarm control unit.
  5. Ground or a single break in internal circuits of fire-alarm control unit.
  6. Abnormal ac voltage at fire-alarm control unit.
  7. Break in standby battery circuitry.
  8. Failure of battery charging.
  9. Abnormal position of any switch at fire-alarm control unit or annunciator.
- E. System Supervisory Signal Actions:
1. Identify specific device initiating the event at fire-alarm control unit.
  2. Record the event.
  3. After a time delay of 200 seconds, transmit a trouble or supervisory signal to the remote alarm receiving station.
  4. Display system status on annunciator.

## 2.03 FIRE-ALARM CONTROL UNIT

- A. General Requirements for Fire-Alarm Control Unit:
1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864.
    - a. System software and programs shall be held in nonvolatile flash, electrically erasable, programmable, read-only memory, retaining the information through failure of primary and secondary power supplies.
    - b. Include a real-time clock for time annotation of events on the event recorder and printer.
    - c. Provide communication between the FACP and remote circuit interface panels, annunciators, and displays.
    - d. The FACP shall be listed for connection to a central-station signaling system service.

- e. Provide nonvolatile memory for system database, logic, and operating system and event history. The system shall require no manual input to initialize in the event of a complete power down condition. The FACP shall provide a minimum 500-event history log.
  2. Addressable Initiation Device Circuits: The FACP shall indicate which communication zones have been silenced and shall provide selective silencing of alarm notification appliance by building communication zone.
  3. Addressable Control Circuits for Operation of Notification Appliances and Mechanical Equipment: The FACP shall be listed for releasing service.
- B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
1. Annunciator and Display: Liquid-crystal type, 80 characters, minimum.
  2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.
- C. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
1. Annunciator and Display: Liquid-crystal type 80 characters, minimum.
  2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.
- D. Initiating-Device, Notification-Appliance, and Signaling-Line Circuits: Pathway Class Designations: NFPA 72, Class A.
- E. Notification-Appliance Circuit:
1. Pathway Class Designations: NFPA 72, Class A.
  2. Audible appliances shall sound in a three-pulse temporal pattern, as defined in NFPA 72.
  3. Visual alarm appliances shall flash in synchronization where multiple appliances are in the same field of view, as defined in NFPA 72.
- F. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and print out the final adjusted values on system printer.
- G. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.

- H. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory signals supervisory and digital alarm communicator transmitters and digital alarm radio transmitters shall be powered by 24-V dc source.
  - 1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.
- I. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.
  - 1. Batteries: Sealed lead.
- J. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

#### 2.04 MANUAL FIRE-ALARM BOXES

- A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
  - 1. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
  - 2. Station Reset: Key- or wrench-operated switch.

#### 2.05 SYSTEM SMOKE DETECTORS

- A. General Requirements for System Smoke Detectors:
  - 1. Comply with UL 268; operating at 24-V dc, nominal.
  - 2. Detectors shall be four-wire type.
  - 3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
  - 4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
  - 5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
  - 6. Integral Visual-Indicating Light: LED type, indicating detector has operated.
  - 7. Remote Control: Unless otherwise indicated, detectors shall be digital-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.
    - a. Rate-of-rise temperature characteristic of combination smoke- and heat-detection units shall be selectable at fire-alarm control unit for 15 or 20 deg F per minute.
    - b. Fixed-temperature sensing characteristic of combination smoke- and heat-detection units shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F.
    - c. Multiple levels of detection sensitivity for each sensor.
    - d. Sensitivity levels based on time of day.

## B. Photoelectric Smoke Detectors:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
  - a. Primary status.
  - b. Device type.
  - c. Present average value.
  - d. Present sensitivity selected.
  - e. Sensor range (normal, dirty, etc.).

## C. Duct Smoke Detectors: Photoelectric type complying with UL 268A.

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
  - a. Primary status.
  - b. Device type.
  - c. Present average value.
  - d. Present sensitivity selected.
  - e. Sensor range (normal, dirty, etc.).
3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector for smoke detection in HVAC system ducts.
4. Each sensor shall have multiple levels of detection sensitivity.
5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
6. Relay Fan Shutdown: Fully programmable relay rated to interrupt fan motor-control circuit.

## 2.06 CARBON MONOXIDE DETECTORS

## A. General: Carbon monoxide detector listed for connection to fire-alarm system.

1. Mounting: Adapter plate for outlet box mounting.
2. Testable by introducing test carbon monoxide into the sensing cell.
3. Detector shall provide alarm contacts and trouble contacts.
4. Detector shall send trouble alarm when nearing end-of-life, power supply problems, or internal faults.
5. Comply with UL 2075.
6. Locate, mount, and wire according to manufacturer's written instructions.
7. Provide means for addressable connection to fire-alarm system.
8. Test button simulates an alarm condition.

## 2.07 HEAT DETECTORS

## A. General Requirements for Heat Detectors: Comply with UL 521.

1. Temperature sensors shall test for and communicate the sensitivity range of the device.

- B. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature.
  - 1. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

## 2.08 NOTIFICATION APPLIANCES

- A. General Requirements for Notification Appliances: Individually addressed, connected to a signaling-line circuit, equipped for mounting as indicated, and with screw terminals for system connections.
- B. General Requirements for Notification Appliances: Connected to notification-appliance signal circuits, zoned as indicated, equipped for mounting as indicated, and with screw terminals for system connections.
  - 1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.
- C. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet from the horn, using the coded signal prescribed in UL 464 test protocol.
- D. Visible Notification Appliances: Xenon strobe lights complying with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch-high letters on the lens.
  - 1. Mounting: Wall mounted unless otherwise indicated.
  - 2. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
  - 3. Flashing shall be in a temporal pattern, synchronized with other units.
  - 4. Strobe Leads: Factory connected to screw terminals.
  - 5. Mounting Faceplate: Factory finished, red or white.

## 2.09 REMOTE ANNUNCIATOR

- A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.
  - 1. Mounting: Flush cabinet, NEMA 250, Type 1.
- B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

## 2.10 ADDRESSABLE INTERFACE DEVICE

### A. General:

1. Include address-setting means on the module.
2. Store an internal identifying code for control panel use to identify the module type.
3. Listed for controlling HVAC fan motor controllers.

### B. Monitor Module: Microelectronic module providing a system address for alarm-initiating devices for wired applications with normally open contacts.

### C. Integral Relay: Capable of providing a direct signal.

1. Allow the control panel to switch the relay contacts on command.
2. Have a minimum of two normally open and two normally closed contacts available for field wiring.

### D. Control Module:

1. Operate notification devices.
2. Operate solenoids for use in sprinkler service.

## 2.11 RADIO ALARM TRANSMITTER

### A. Transmitter shall comply with NFPA 1221 and 47 CFR 90.

### B. Description: Manufacturer's standard commercial product; factory assembled, wired, and tested; ready for installation and operation.

1. Packaging: A single, modular, NEMA 250, Type 1 metal enclosure with a tamper-resistant flush tumbler lock.
2. Signal Transmission Mode and Frequency: VHF or UHF 2-W power output, coordinated with operating characteristics of the established remote alarm receiving station designated by Owner.
3. Normal Power Input: 120-V ac.
4. Secondary Power: Integral-sealed, rechargeable, 12-V battery and charger. Comply with NFPA 72 requirements for battery capacity; submit calculations.
5. Antenna: Omnidirectional, coaxial half-wave, dipole type with driving point impedance matched to transmitter and antenna cable output impedance. Wind-load strength of antenna and mounting hardware and supports shall withstand 100 mph with a gust factor of 1.3 without failure.
6. Antenna Cable: Coaxial cable with impedance matched to the transmitter output impedance.
7. Antenna-Cable Connectors: Weatherproof.
8. Alarm Interface Devices: Circuit boards, modules, and other auxiliary devices, integral to the transmitter, matching fire-alarm and other system outputs to message-generating inputs of the transmitter that produce required message transmissions.

- C. Functional Performance: Unit shall receive alarm, supervisory, or trouble signal from fire-alarm control unit or from its own internal sensors or controls and shall automatically transmit signal along with a unique code that identifies the transmitting station to the remote alarm receiving station. Transmitted messages shall correspond to standard designations for fire-reporting system to which the signal is being transmitted and shall include separately designated messages in response to the following events or conditions:
1. Transmitter Low-Battery Condition: Sent when battery voltage is below 85 percent of rated value.
  2. System Test Message: Initiated manually by a test switch within the transmitter cabinet, or automatically at an optionally preselected time, once every 24 hours, with transmission time controlled by a programmed timing device integral to transmitter controls.
  3. Transmitter Trouble Message: Actuated by failure, in excess of one-minute duration, of the transmitter normal power source, derangement of the wiring of the transmitter, or any alarm input interface circuit or device connected to it.
  4. Local Fire-Alarm-System Trouble Message: Initiated by events or conditions that cause a trouble signal to be indicated on the building system.
  5. Local Fire-Alarm-System Alarm Message: Actuated when the building system goes into an alarm state. Identifies device that initiated the alarm.
  6. Local Fire-Alarm-System, Supervisory-Alarm Message: Actuated when the building alarm system indicates a supervisory alarm.

#### 2.12 NETWORK COMMUNICATIONS

- A. Provide network communications for fire-alarm system according to fire-alarm manufacturer's written requirements.
- B. Provide network communications pathway per manufacturer's written requirements and requirements in NFPA 72 and NFPA 70.

### PART 3 - EXECUTION

#### 3.01 EXAMINATION

- A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.
  1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.
- B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.02 EQUIPMENT INSTALLATION

- A. Comply with NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."
1. Devices placed in service before all other trades have completed cleanup shall be replaced.
  2. Devices installed but not yet placed in service shall be protected from construction dust, debris, dirt, moisture, and damage according to manufacturer's written storage instructions.
- B. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.
1. Connect new equipment to existing control panel in existing part of the building.
  2. Connect new equipment to existing monitoring equipment at the supervising station.
  3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  4. Install anchor bolts to elevations required for proper attachment to supported equipment.
- C. Install wall-mounted equipment, with tops of cabinets not more than 78 inches above the finished floor.
- D. Manual Fire-Alarm Boxes:
1. Install manual fire-alarm box in the normal path of egress within 60 inches of the exit doorway.
  2. Mount manual fire-alarm box on a background of a contrasting color.
  3. The operable part of manual fire-alarm box shall be between 42 inches and 48 inches above floor level. All devices shall be mounted at the same height unless otherwise indicated.
- E. Smoke- or Heat-Detector Spacing:
1. Comply with the "Smoke-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for smoke-detector spacing.
  2. Comply with the "Heat-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for heat-detector spacing.
  3. Smooth ceiling spacing shall not exceed 30 feet.
  4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Annex A in NFPA 72.
  5. HVAC: Locate detectors not closer than 36 inches from air-supply diffuser or return-air opening.
  6. Lighting Fixtures: Locate detectors not closer than 12 inches from any part of a lighting fixture and not directly above pendant mounted or indirect lighting.
- F. Install a cover on each smoke detector that is not placed in service during construction. Cover shall remain in place except during system testing. Remove cover prior to system turnover.



- G. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct. Tubes more than 36 inches long shall be supported at both ends.
  - 1. Do not install smoke detector in duct smoke-detector housing during construction. Install detector only during system testing and prior to system turnover.
- H. Remote Status and Alarm Indicators: Install in a visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position.
- I. Audible Alarm-Indicating Devices: Install not less than 6 inches below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Install all devices at the same height unless otherwise indicated.
- J. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches below the ceiling. Install all devices at the same height unless otherwise indicated.
- K. Device Location-Indicating Lights: Locate in public space near the device they monitor.
- L. Antenna for Radio Alarm Transmitter: Mount to building structure where indicated. Use mounting arrangement and substrate connection that resists 100-mph wind load with a gust factor of 1.3 without damage.

### 3.03 PATHWAYS

- A. Pathways shall be installed in EMT conduit.
- B. Exposed vertical EMT shall be painted to match adjacent wall color.
- C. Junction box covers shall be painted red enamel.

### 3.04 CONNECTIONS

- A. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 36 inches from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.

### 3.05 IDENTIFICATION

- A. Install instructions in a metal cabinet, location visible from fire-alarm control unit.

### 3.06 GROUNDING

- A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.
- B. Ground shielded cables at the control panel location only. Insulate shield at device location.

## 3.07 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections.
- C. Perform the following tests and inspections:
  - 1. Visual Inspection: Conduct visual inspection prior to testing.
    - a. Inspection shall be based on completed record Drawings and system documentation that is required by the "Completion Documents, Preparation" table in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
    - b. Comply with the "Visual Inspection Frequencies" table in the "Inspection" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
  - 2. System Testing: Comply with the "Test Methods" table in the "Testing" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
  - 3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
  - 4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
  - 5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
  - 6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" section of the "Fundamentals" chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
- D. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.
- E. Fire-alarm system will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.
- G. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.
- H. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

### 3.08 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of manufacturer's designated service organization. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
  - 1. Include visual inspections according to the "Visual Inspection Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
  - 2. Perform tests in the "Test Methods" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
  - 3. Perform tests per the "Testing Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

### 3.09 SOFTWARE SERVICE AGREEMENT

- A. Comply with UL 864.
- B. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.
- C. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.
  - 1. Upgrade Notice: At least 30 days to allow Owner to schedule access to system and to upgrade computer equipment if necessary.

### 3.10 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION

## SECTION 31 23 11

## EXCAVATION, FILLING AND GRADING FOR BUILDING

## PART 1 - GENERAL

## 1.01 SUMMARY

- A. Section Includes: The extent of excavation, filling and grading is shown on the Drawings.
  - 1. Preparation of subgrade for building slabs is included as part of this Work
  - 2. Backfilling for trenches within the building lines is included as part of this Work.
- B. Related Sections:
  - 1. Section 01 40 00 – Quality Requirements (For Testing Laboratory Services).
  - 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. Preexcavation Conference: Conduct conference at Project site.
- B. Perform excavation Work in compliance with applicable requirements of governing authorities having jurisdiction.
- C. Compaction density shall be 95 percent of the maximum dry density value as determined by ASTM D 698 (Standard Proctor Test) of AASHTO T-99.
- D. Soils compaction control tests shall be performed as specified herein and under Section 01 40 00 –Quality Requirements. Stability is defined as absence of significant yielding or pumping of soils under compaction effort.
- E. Number of Tests: Make test(s) in accordance with AASHTO T-99 for each class of material. Make in-place density tests in accordance with AASHTO T-238 (Nuclear Method) for density tests, as the fill and backfill work progresses. At least one test per lift of any isolated portions and each footing.
- F. Work on Non-Tested Areas: Placing permanent construction over fill that has not been tested and approved may require removal of permanent Work, 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.
- C. Granular Fill:
  - 1. Below existing natural grade line: Sandy clay with a liquid limit less than 45 and PI in range of 10 to 22, or clayey sand with PI not less than 7 and liquid limit not greater than 35.
  - 2. Above existing natural grade under slabs and footings: Silty or sandy clay as above or clayey-sand with LL less than 35 and PI of 3 to 15.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Examine the areas and conditions under which excavating, filling, and grading are to be performed and notify the Contractor, in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in an acceptable manner.

3.02 EXCAVATION

- A. Excavation consists of removal and disposal of material encountered when establishing required grade elevations.

- B. Earth excavation includes removal and disposal of pavements and other obstructions visible on ground surface, underground structures and utilities indicated to be demolished and removed, material of any classification indicated in data on subsurface conditions, and other materials encountered that are not classified as rock excavation or unauthorized excavation.
- C. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Project Engineer. Unauthorized excavation, as well as remedial Work directed by the Project Engineer, shall be at the Contractor's expense. Under footings, foundation bases, or retaining walls, fill unauthorized excavation by extending the indicated bottom elevation of the footing or base to the excavation bottom, without altering required top elevation. Lean concrete fill may be used to bring elevations to proper position, when acceptable to Project Engineer.
- D. Elsewhere, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by Project Engineer.
- E. Additional Excavation: When excavation has reached required subgrade elevations, notify the Project Engineer who will make an inspection of conditions. If unsuitable bearing materials are encountered at the required subgrade elevations, carry excavations deeper and replace the excavated material as directed by the Project Engineer. Removal of unsuitable material and its replacement as directed will be paid on the basis of contract conditions relative to changes in work.
- F. Stability of Excavations. Slope sides of excavations to comply with local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in a safe condition until completion of backfilling.
- G. Shoring and Bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers and cross braces, in good serviceable condition. Establish requirements for trench shoring and bracing to comply with local codes and authorities having jurisdiction. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses.
- H. Dewatering: Prevent surface water and subsurface or groundwater from flowing into excavations and from flooding project site and surrounding area. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrade and foundations.
  - 1. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.
  - 2. Convey water removed from excavations and rainwater to collecting or run-off areas. Establish and maintain temporary drainage ditches and other diversions outside excavation limits for each structure. Do not use trench excavations as temporary drainage ditches.

### 3.03 STORAGE OF SOIL MATERIALS

- A. Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade and shape stockpiles for proper drainage. Locate and retain soil materials away from edge of excavations. Dispose of excess soil material and waste materials as herein specified.

### 3.04 EXCAVATION FOR STRUCTURES

- A. Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 feet, and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection. In excavating for footings and foundations, take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed. Trim bottoms to required lines and grades to leave solid base to receive concrete.

### 3.05 EXCAVATION FOR TRENCHES

- A. Dig trenches to the uniform width required for the particular item to be installed, sufficiently wide to provide ample working room. Excavate trenches to the depth indicated or required. Carry the depth of trenches for piping to establish the indicated flow lines and invert elevations. Beyond the building perimeter, keep bottoms of trenches sufficiently below finish grade to avoid freeze-ups.
- B. Grade bottoms of trenches as indicated, notching under pipe bells to provide solid bearing for the entire body of the pipe. Backfill trenches with concrete where trench excavations pass within 18 inches of column or wall footings and which are carried below the bottom of such footings, or which pass under wall footings. Place concrete to the level of the bottom of adjacent footings.
- C. Do not backfill trenches until tests and inspections have been made and backfilling authorized by the Project Engineer. Use care in backfilling to avoid damage or displacement of pipe systems.

### 3.06 COLD WEATHER PROTECTION

- A. Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F.

### 3.07 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Architect.
  - 1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

### 3.08 COMPACTION

- A. Control soil compaction during construction providing minimum percentage of density specified for each area classification.



- B. Building Slab: Compact top 12 inches of subgrade and each layer of backfill or fill material at 95 percent maximum dry density.

### 3.09 SOIL MOISTURE CONTROL

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

### 3.10 BACKFILL AND FILL

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. Place acceptable soil material in layers to required subgrade elevations, for each area classification listed below.
- C. Under buildings use sub-base material, or satisfactory excavated or borrow material, or combination of both. Backfill excavations as promptly as work permits, but not until completion of the following:
  - 1. Acceptance by Project Engineer of construction below finish grade including, where applicable, dampproofing, waterproofing, and soil treatment.
  - 2. Inspection, testing, approval, and recording locations of underground utilities.
  - 3. Removal of concrete formwork, shoring and bracing, and backfilling of voids with satisfactory materials.
  - 4. Removal of trash and debris.

### 3.11 GROUND SURFACE PREPARATION

- A. When existing ground surface has a density less than that specified under "Compaction" for the particular area classification, break up the ground surface, pulverize, moisture condition to the optimum moisture content, and compact to required depth and percentage of maximum density.

### 3.12 PLACEMENT AND COMPACTION

- A. Place backfill and fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Before compaction, moisten or aerate each layer as necessary to provide the optimum moisture content. Compact each layer to required percentage of maximum dry density for each area classification. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
- C. Place backfill and fill materials evenly adjacent to structures, to required elevations. Take care to prevent wedging action of backfill against structures by carrying the material uniformly around structure to approximately same elevation in each lift.

### 3.13 GRADING

- A. Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades.
- B. Grading Outside Building Lines: Grade areas adjacent to building lines to drain away from structures and to prevent ponding. Finish surfaces free from irregular surface changes, and as follows:
- C. Grading Surface of Fill Under Building Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of 1/2 inch when tested with a 10-foot straightedge.

### 3.14 COMPACTION AFTER GRADING

- A. After grading, compact subgrade surfaces to the depth and percentage of maximum density for each area classification.

### 3.15 MAINTENANCE

- A. Protect newly graded areas from traffic and erosion. Keep free of trash and debris. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.
- B. Reconditioning Compacted Areas: Where subsequent construction operations or adverse weather disturbs completed compacted areas, scarify surface, re-shape, and compact to required density prior to further construction.

### 3.16 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
  - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

### 3.17 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION

SECTION 31 31 16 TERMITE CONTROL

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Soil treatment for control of all species of subterranean termites including Formosan termites.

1.02 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical product data and application instructions prior to application for Project Engineer's approval. Include the EPA-Registered Label for termiticide products.
- B. Sample Warranty: Submit sample copies of the Termite Soil Treatment Guarantee form prior to application for Project Engineer's approval.
- C. Quality Control: Submit identification of at least 3 projects of similar scope along with name, address, and telephone number of the Architect, Owner and General Contractor.

1.03 INFORMATIONAL SUBMITTALS

- A. Product certificates.
- B. Soil Treatment Application Report: Include the following:
  - 1. Date and time of application.
  - 2. Moisture content of soil before application.
  - 3. Termiticide brand name and manufacturer.
  - 4. Quantity of undiluted termiticide used.
  - 5. Dilutions, methods, volumes used, and rates of application.
  - 6. Areas of application.
  - 7. Water source for application.

1.04 QUALITY ASSURANCE

- A. In addition to the requirements of these Specifications, comply with manufacturer's instructions and recommendations for the Work, including preparation of substrate and application.
- B. Installer Qualifications: Engage a professional pest control operator, licensed by the State of Mississippi, Mississippi Department of Agriculture and Commerce, Bureau of Plant Industry, and in accordance with regulations of governing authorities for application of soil treatment solution.
  - 1. The pest control operator is to have the aforementioned valid license, the company technician is to have a valid identification card for pest control, and the company vehicle is to be clearly marked with the company name.
  - 2. The professional pest control operator specializing in Soil Treatment for Termite Control, with 5 years minimum experience, shall have completed work similar to that indicated for this Project and have a record of successful in-service performance.

- C. Regulatory Requirements: Formulate and apply termiticides and termiticide devices according to the EPA-Registered Label.
- D. Comply with Mississippi Regulations Governing Pest Control Operators in following the labels of the termiticide.
- E. 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.
- B. Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.
- C. Remove all non-pressure treated wood contacting soil. Remove grade stakes prior to applying horizontal barrier and all form boards, stakes and concrete over pour prior to applying vertical soil treatment.

1.06 WARRANTY

- A. Soil Treatment Special Warranty: Furnish 3 copies of written warranty certifying that the applied soil poisoning treatment will prevent the infestation of subterranean termites, including Formosan termites, and that termite contractor will re-treat the soil and also repair or replace damage caused by termite infestation WITHOUT EXPENSE to the Owner.
  - 1. Warranty Period: Provide warranty for a period of 5 YEARS from the date of treatment, signed by the Applicator and the Contractor.

1.07 MAINTENANCE SERVICE

- A. Continuing Service: Beginning at Final Completion, provide 12 months' continuing service including monitoring, inspection, and re-treatment for occurrences of termite activity. Provide a standard continuing service agreement. State services, obligations, conditions, terms for agreement period, and terms for future renewal options.

PART 2 - PRODUCTS

2.01 SOIL TREATMENT SOLUTION

- A. Termiticide: Use an emulsible concentrate insecticide for dilution with water specially formulated to prevent infestation by subterranean termites as recommended by the Southern Forest Experiment Station, Forest Insect Laboratory at Gulfport, Mississippi, and registered by the Bureau of Plant Industry for use in structural pest control work. Fuel oil will not be permitted as a diluent. Provide a working solution of one of the following chemical elements:
  - 1. Horizontal Barrier: Cypermethrin, Prevail or Talstar.
  - 2. Vertical Barrier: Fipronil.

- B. Other solutions may be used as recommended by Applicator and if acceptable to local and state governing authorities. Use soil treatment solutions that are not injurious to plants.

### PART 3 - EXECUTION

#### 3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil per termiticide label requirements, interfaces with earthwork, slab and foundation work, landscaping, utility installation, and other conditions affecting performance of termite control.
- B. Proceed with application only after unsatisfactory conditions have been corrected.

#### 3.02 APPLICATION, GENERAL

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

#### 3.03 APPLYING SOIL TREATMENT

- A. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.
  - 1. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.
- B. Prior to each application, the applicator shall notify the Contractor of the intended application and instruct the responsible person to notify construction workers and other site individuals to leave the treated area and not to return until chemical has been installed into the soil.
  - 1. Post warning signs in areas of application warning workers that soil poisoning has been applied. Remove signs when areas are covered by other construction.
- C. Application: Mix soil treatment termiticide solution to a uniform consistency. Use COLOR DYE MARKING AGENT to insure the area is treated. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute treatment evenly.
  - 1. Slabs-on-Grade: Underground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
  - 2. Foundations: Adjacent soil, including soil along the entire inside perimeter of foundation walls; along both sides of interior partition walls; around plumbing pipes and electric conduit penetrating the slab; around interior column footers, piers, and chimney bases; and along the entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.

- D. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.
  - 1. Allow a minimum of 12 hours for drying after application, before beginning concrete placement or other construction activities.
- E. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.
- F. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION

## MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-258-1

CODE: (SP)

DATE: 01/17/2017

SUBJECT: Miscellaneous Site Amenities

Section 907-258, Miscellaneous Site Amenities, is hereby added to and made a part of the 2017 Edition of the Mississippi Standard Specifications for Road and Bridge Construction as follows.

### SECTION 907-258 -- MISCELLANEOUS SITE AMENITIES

**907-258.01--Description.** This item shall consist of constructing and installing concrete picnic tables and benches, wooden picnic tables and benches, charcoal grills, drinking fountains, trash receptacles, water hydrants, sewage dump station, cast stone benches, sign (masonry and stone), metal benches, bollards, pavilions, survey monument, car stops, cigarette receptacles, and picnic shelters, each complete in place, in accordance with these Specifications and in reasonably close conformity with the locations, lines, grades, configurations, dimensions and other requirements shown on the Drawings or established.

**907-258.02--Materials.** 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. Contractor shall submit eight (8) copies of brochures or shop drawings for approval prior to ordering manufactured items. Other items may require testing as directed by the Engineer.

A. **Charcoal Grill.** Charcoal Grill shall be the Model No. 100001085 Rotating Grill with post as manufactured by Iron Mountain Forge, Dumor Site Furnishings – Model No. 22-00, PW Athletic Manufacturing Co. – Model No. 1140-00, or approved equal. Post shall be set within a Class C concrete footing, size as recommended by manufacturer.

B. **Drinking Fountain.**

1. **Waste Pipe.** Waste pipe shall be of the size and type as shown on the Drawings and shall be standard PVC drain waste and vent piping.
2. **Drain Pipe.** Drain pipe shall be the size shown on the Drawings and shall conform to or exceed Commercial Standard CS 272-65 or CS 272.65.
3. **Drinking Fountain.** The drinking fountain shall be designed similar to the details shown on the Drawings, freeze-proof, and conforming to approved Handicapped Standards by the Engineer.

4. Concrete. Concrete, unless otherwise specified, shall be paid for as sidewalk, and have an approved exposed aggregate finish to match the finish on the adjacent sidewalk.
5. Valves (Stop and Drain). The cut-off valve shall be a standard brass stop and drain cut-off valve of the proper size and type as shown on the plans.

C. Concrete Picnic Table and Benches.

1. Concrete. Concrete for table top, seat top, and end supports shall be Class "A" Concrete. Concrete for table slabs will be paid for as concrete sidewalks - Pay Item No. 608-B.
2. Reinforcing Steel. Reinforcing steel shall conform to Section 711.
3. Paint for Table top and Seats. Paint or coating for table top and seats shall be an approved HP Acrylic Latex paint conforming to or exceeding Master Paint Institute (MPI) numbers, primer MPI # 3 and topcoat MPI #141.

D. Wooden Picnic Tables and Benches. ADA Accessible Wooden Picnic Tables shall be the model number No.100000186, eight feet long with galvanized pipe frame and treated wood top and seats, as manufactured by Iron Mountain Forge, Picnic Table Source – Model No. M115-1061, All Picnic Tables – Model No. UPB158H-PT8, or approved equal.

Picnic tables shall be secured to the concrete with lead shields, anchors, or other means as approved by the Engineer.

E. Trash Receptacle.

1. Trash Receptacle. The trash receptacle shall be Upbeat Site Furnishings Model No. WR32AGBCT, 32-gallon Essence Receptacle Outdoor Trash Can with curved top, rounded corners and stone panels with leveling devices, rigid plastic liner, and hardware to secure the receptacle to the sidewalk, stone panel color shall be Golden Glo. United Receptacle, Inc. – Model No. R-38HT-202, Barco Products – Earth-Tone Panel Commercial Trash Cans, Model No. 38SQSTDMA, or approved equal.
2. Concrete. Concrete, unless otherwise specified, shall be paid for as sidewalk, and have a finish to match the finish on the adjacent sidewalk.

F. Water Hydrant.

1. Water Hydrant. Steel body, self-closing, anti-freezing hydrant with heavy stainless operating springs, with 3/4-inch supply as the model M-175 hydrant as manufactured by Murdock-Super Secur, The Kupferle Foundry Company model Total Eclipse #1 Yard Hydrant, , or approved equal. Color shall be black.
2. Concrete. Concrete, unless otherwise specified, shall be paid for as sidewalk and have same finish as finish on adjacent sidewalk.



3. Valves (Stop and Drain). The cut-off valve shall be standard brass stop and drain cut-off valve of the proper size and type as shown on the Drawings.

G. Travel Trailer Sewage Dump Station (Modifications).

1. Sewage Dump Station. The sewage dump station shall be constructed similar to the details shown on the Drawings, with Schedule 40 galvanized steel pipe and fittings complete with vacuum breaker, and hose, in accordance with the Drawing details, and State Health Department minimum standards.
2. Concrete. Concrete unless otherwise specified shall be Class "B" conforming to Section 804 of the Standard Specifications and have an approved trowel finish.
3. Stand Pipe. Water stand pipe shall be standard galvanized Schedule 40 of the size shown on the Drawings.
4. Vent Pipe. Vent pipe shall be standard galvanized Schedule 40 of the size shown on the Drawings.
5. Signs. The signs shall be designed as shown on the details on the Drawings, constructed of 0.080-inch aluminum or 14 Ga. galvanized steel. The signs shall be manufactured by an approved sign company. The Contractor shall submit shop drawings.

H. Cast Stone Bench. Cast stone benches shall be constructed from the same material or an approved equal material as concrete picnic tables and benches.

I. Sign (Masonry and Stone).

1. Brick and Mortar. Brick and mortar shall be produced by the same manufacturer(s), and be the same type and kind, including bullnose and watertable units, and shall match the existing brick used on the Welcome Center Building, or approved equal.
2. Concrete Masonry Units. The concrete masonry units shall be hollow non-load bearing, light-weight aggregate, concrete masonry units conforming to ASTM Designation: C331-64T. Units shall be normal modular size for typical 3/8-inch mortar joint.
3. Concrete. Concrete, unless otherwise specified, shall be Class "B" conforming to Section 804 of the Standard Specifications.
4. Reinforcing Steel. Reinforcing steel shall conform to Section 711.
5. Precast Architectural Panel.

a. General.

Cement: Portland Cement shall conform to ASTM Designation: C-150, Type I or III.

Fine and coarse aggregate: Fine and coarse aggregate shall conform to ASTM Designation: C-33. Variations from aggregate gradations are permissible for the facing mix.

Reinforcement shall conform to ASTM Designation: C-185 for welded wire fabric.

Hot-dip galvanizing shall conform to ASTM Designation: A-153

Anchoring devices, inserts, etc., shall be either galvanized or corrosion resistant types approved by the Architect and as detailed on the Drawings.

- b. Textures and Finishes. Precast architectural concrete shall be honed finish, lightly textured, approximating finish of limestone, with color as selected by the Engineer.
- c. Fabrication. Precast architectural concrete shall be sufficiently reinforced to withstand conditions on the sign, including handling and erection stresses. Deformed bars with one inch (1") or less clearance to an exterior face shall be galvanized.

Units shall be fabricated straight, smooth, and true to size and shape, with exposed edges and corners precise and square unless otherwise indicated.

Reglets, slots, holes, and other accessories shall be provided in units to receive cramps, dowels, reglets, waterstops, flashings, and other similar work as indicated.

Arises, inscriptions and details shall be faithfully executed to the Engineer's design.

Each precast item shall be marked to correspond to identification mark on shop drawings.

Location of anchors, inserts and blockouts shall be plus or minus 3/8 inch from center line of location shown on drawings.

Rust-inhibitive coating shall be applied on damaged areas at welded connections, same as shop-applied material. Galvanizing repair coating shall be used on galvanized surfaces.

- d. Mixes. Standard 6-inch by 12-inch cylinder strength of precast concrete shall not be less than 5,000 psi at 28 days when tested in accordance with ASTM Designation: C-39.

Absorption shall not be less than three percent (3%) and not more than seven percent (7%) when tested in accordance with ASTM Designation: C-97.

Minimum thickness of facing mix shall be 1½ inches thick. Backup concrete may be made with grey cement and aggregates conforming to requirements for cast-in-place concrete.

e. Joint Material. Joint material shall be as recommended by the precast architectural concrete manufacturer, and as approved by the Engineer.

6. Letters and Symbols. Letters, including custom letters, and symbols shall be brass, in the shapes and sizes noted on the drawings, as manufactured by Metal Arts, A. R. K. Ramos, Matthews, or approved equal.

The Engineer will provide camera ready art work of the symbols and custom letters to the Contractor for the manufacturer.

Method(s) of attaching letters and symbols to precast architectural concrete panel shall be approved by the Engineer.

J. Metal Bench. Garden – Style all – steel bench, six feet long, color – green, as Bench 118 series as manufactured by DuMor, Inc., Highland Products Group – 6-foot ‘Sunshine’ Thermoplastic-Coated expanded Metal Bench, Columbia Cascade Co. – Manor Bench No. 2824-6, or approved equal.

Metal Bench shall be secured to pavement. Method of securing shall be reviewed with and approved by the Engineer.

K. Bollard. Pipe shall be schedule 40 steel pipe, in the size as noted on the drawings. Finial shall be the Linn Park Ball Finial, as manufactured by Robinson Iron, Tennessee Fabricating Company, Reliance Foundry Co., Ltd., or approved equal. Pipe and finial shall be painted with 1 shop coat of a rust inhibitive primer and two (2) field coats of an oil base exterior paint, color selected by the Engineer. Class B concrete required for pipe infill.

L. Pavilion:

1. Masonry Components, Concrete, and Cast Stone. Masonry components, concrete, and cast stone shall conform to the specifications described in Sign (Masonry and Stone), above.

2. Steel. Steel shall be provided in the shapes, sizes, and fabricated as noted on the Drawings.

Steel shall receive the following paints/ coatings, all as manufactured by PPG, Sherwin Williams, Tnemec Company, Inc., or approved equal, and applied in strict accordance with the manufacturer’s written instructions.

PPG Products

First Shop Coat (primer)	UC65147 Zinc	3.0 – 4.0 Mils Dry Film Thickness
Field Spot Primer (if necessary)	UC65147 Zinc	3.0 – 4.0 Mils Dry Film Thickness
Second Field Coat	94-2800 pitthame*	3.0 – 6.0 Mils Dry Film Thickness
Third Field Coat	94-2800 pitthame*	3.0 – 6.0 Mils Dry Film Thickness

Sherwin Williams Products

First Shop Coat (primer)	B65G10 Zinc	3.0 – 4.0 Mils Dry Film Thickness
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Field Spot Primer (if necessary)	B65G10 Zinc	3.0 – 4.0 Mils Dry Film Thickness
Polyurethane finish		
Second Field Coat	B65-600 Series*	3.0 – 6.0 Mils Dry Film Thickness
Third Field Coat	B65-600 Series*	3.0 – 6.0 Mils Dry Film Thickness
Tnemec Products		
First Shop Coat (primer)	90-97 Tneme Zinc	2.5 – 3.5 Mils Dry Film Thickness
Field Spot Primer (if necessary)	90-97 Tneme Zinc	2.5 – 3.5 Mils Dry Film Thickness
Second Field Coat	74 Endura-Shield*	2.0 – 2.5 Mils Dry Film Thickness
Third Field Coat	74 Endura-Shield*	2.0 – 2.5 Mils Dry Film Thickness

\*Color of second and third field coat shall be selected by the Engineer.

3. Metal Roof. Metal roof shall be copper roofing sheet, 16 ounce per square foot, with 1½ inch standing seam “S” lock located 16 inches on center. Contractor shall design fabrication and fastening of the system for an I-60 wind uplift rating, using the purlins as noted on the drawings.

Product data for materials, and fastening devices as well as shop drawings noting assembly and finished product appearance shall be submitted for review and approval of the Engineer. A minimum of eight (8) copies of each is required.

Roof panel system shall be guaranteed by the manufacturer for a period of five (5) years.

4. Display Panel. The display panel shall be an exterior rated panel, with a top hinged impact resistant acrylic cover, cylinder lock and gas cylinder cover supports; baked on enamel finish, metal back with magnetic back (interior); for wall mounting, in a 40-inch high by 60-inch wide size, as the Module x Wide Profile as manufactured by ASI Sign Systems, Matthews International Corp., Mohawk Sign Systems, Inc., or approved equal.

Color of panel shall be selected by the Engineer.

Mounting of panel to metal work shall be reviewed with and approved by the Engineer.

M. Survey Monument.

1. Masonry Components and Concrete. Masonry components and concrete shall conform to the specifications described in Sign (Masonry and Stone), above.
2. Granite. Polished (finish) granite veneer, in the thickness as noted on the drawings. Color shall be selected by the Project Engineer. Method of attachment to masonry and devices for attachment shall be reviewed with and approved by the Engineer.

- N. Car Stop. Car stops shall be six (6) foot long concrete curb (car) stops. Curb stops shall be secured to pavement with two (2) No. 3 reinforcing bars, 24 inches long.

- O. Cigarette Receptacle. Cigarette Receptacles shall be Aladdin Smoker' Station – Model Number R1639E-HCHAR- steel smokers' station, 39 inches high by 16 inches diameter, color – Hammertone Charcoal, as manufactured by Gilmore-Kramer Company, Johnson Environmental Products –Smokers Outpost-black Model Number 710101 , Ashtrays And Urns – Smoker' Station Model Number LL144-1645 , or approved equal.

Cigarette Receptacle shall be secured to pavement with anchoring kit. Method of securing shall be reviewed with and approved by the Engineer.

P. Picnic Shelter:

1. Building Type. Building shall be Icon HIP 16 x 24T as manufactured by Icon Shelter Systems Inc., American Building Products “Navajo Shelters”, Litchfield Industries “Pittsburg Hip End”, or approved equal.
2. Concrete. Concrete shall conform to the specifications described in Sign (Masonry and Stone), above.
3. Description. Picnic shelter shall be 16 feet by 24 feet galvanized steel frame hipped rectangle shelter with standard 24 gage Multi-rib metal roof panels, overhead “Linear” ornaments and square stepped base columns.
4. Submittals. Product data for materials, color charts and fastening devices as well as shop drawings noting assembly and finished product appearance shall be submitted for review and approval of the Engineer.
5. Steel Framing and Finishes. Steel framing, columns, base covers and overhead ornaments shall receive hot-dipped zinc galvanizing prior to finish. A double coat of TGIC polyester powder coating shall be applied. Color shall be “Surrey Beige”, unless another color is selected by the Engineer from manufacturer’s standard 14 colors
6. Base Connection. Base connection shall be surfaced mounted with base covers.
7. Metal Roof Materials. Metal roof material shall be standard 24 gage Galvalume® Multi-rib roof panels with Kynar 500 finish. Color “Copper Penny”, or other color selected by the Engineer. Design fabrication and fastening of system for an UL 90 wind uplift rating. Roof pitch shall be 4:12, unless noted otherwise on Drawings.
8. Warranty. Product shall carry a manufacturer’s standard 10-year warranty

**907-258.03--Construction Requirements.** 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.

- A. Charcoal Grill. The charcoal grill with concrete footing shall be installed in accordance with

the manufacturer's written instructions in the locations as noted on the Drawings.

- B. Drinking Fountain. The drinking fountain shall be installed by skilled plumbers, concrete finishers, and workmen in an approved manner to the satisfaction of the Engineer, to the dimensions and details shown on the Drawings, or approved by the Engineer.

The fountain drain shall be located to drain to the existing drain field or an approved ditch as directed by the Engineer.

The concrete base shall be constructed as shown on the Drawings or as directed by the Engineer. The concrete will be paid for under separate pay item for that class of concrete.

- C. Concrete Picnic Tables and Benches. Concrete picnic tables and benches shall be constructed to the detailed dimensions shown on the Drawings. The handling and placing of concrete shall conform to Subsection 804.10. The top and edge surfaces of the table and benches shall receive a slick smooth finish.

The concrete shall be free of honeycomb and air pockets and in no case have a slump greater than one and one-half inches.

The ground under the slab shall be graded or shaped and compacted when necessary to insure a smooth, firm foundation for the slab. The ground adjacent to the slab shall be sloped to drain away from the slab in a manner so as to preserve the natural shape of the terrain as close as possible.

The concrete slab shall be poured around the table and benches in place and correctly aligned. Care shall be taken to place the expansion joint material around the top and bench supports as shown on the plans in a neat, secure manner. The slab shall be sloped to drain and receive an approved exposed aggregate finish to match the finish on the sidewalk.

The placing and fastening of reinforcement shall conform to Subsection 805.05.

The table shall be located as shown on the Drawings and as directed by the Engineer.

- D. Wooden Picnic Tables and Metal Benches. Wooden picnic tables and metal benches shall be located and secured in an approved manner as shown on the Drawings and as directed by the Engineer.

- E. Trash Receptacle. The trash receptacle shall be installed on and secured to a square concrete pad four inches thick, with outside dimensions six inches greater than the width of the trash receptacle, in locations designated by the Engineer.

The excavation when required to place the trash receptacle into the ground shall be disposed of as directed by the Engineer.

The concrete shall be placed and finished to match the adjacent sidewalk. On locations adjacent to existing sidewalks, top of concrete pad for the receptacle shall meet flush with

existing walk. Slope elevation of pads no more than 1/8 inch per foot in order that water will not stand.

The method to secure the trash receptacle to the concrete pad shall be submitted to the Engineer for approval.

- F. Water Hydrant. Install water hydrant in accordance with the manufacturer's written instructions and the Drawings.
- G. Travel Trailer Sewage Dump Station. The travel trailer sewage dump station shall be constructed by skilled plumbers, concrete finishers, and workmen in an approved manner to the satisfaction of the Engineer, to the details and dimensions shown on the Drawings.
- H. Cast Stone Bench. The cast stone benches shall be a similar design and size as shown on the Drawings. Brochures or shop drawings shall be submitted.

The benches shall be secured to the sidewalk or bench pad in an approved manner with epoxy cement or other approved cement, to the satisfaction of the Engineer.

- I. Sign (Masonry and Stone), Pavilion, and Survey Monument. The excavation required to place the sign and survey monument into the ground shall be disposed of as directed by the Engineer.

The concrete base shall be constructed as shown on the Drawings or as directed by the Engineer. The placing and fastening of reinforcement shall conform to Subsection 805.05.

Concrete Masonry Unit and Brick construction shall be in accordance with Section 611, and to the satisfaction of the Engineer.

Precast architectural concrete panels shall be set straight, plumb, level, and square. Exposed facings shall be cleaned to remove dirt and stains which may be on the units after erection and completion of joint treatments. Panels shall be washed and rinsed in accordance with precast manufacturer's recommendations. Other work shall be protected from damage due to cleaning operations. Do not use cleaning materials or processes which could change the character of exposed concrete finishes.

Letters and symbols shall be attached in accordance with the Drawings, approved shop drawings, and to the satisfaction of the Engineer.

Pavilion and survey monument shall be constructed straight, plumb, level, and square, in accordance with the drawings and to the satisfaction of the Engineer. Welds shall be grinded smooth prior to painting/ coatings application.

- J. Metal Bench. Metal bench shall be located where noted on the Drawings. Metal bench shall be secured to pavement as approved by the Engineer.
- K. Bollard. Bollards shall be constructed plumb and in accordance with the drawings to the satisfaction of the Engineer. Welds shall be ground smooth prior to painting/ coatings

application.

- N. Car Stop. Drive reinforcing bars through holes in car stop and through new asphalt pavement. Top of reinforcing bar shall be driven to a point 1/4 inch below the top of the car stop.
- O. Cigarette Receptacle. Cigarette receptacles shall be located where noted on the Drawings. Secure to pavement as approved by the Engineer.
- P. Picnic Shelter. The excavation required to place the picnic shelter into the ground shall be disposed of as directed by the Engineer.

The concrete base shall be constructed as shown on the Drawings or as directed by the Engineer. The placing and fastening of reinforcement shall conform to Subsection 805.05

Picnic shelter shall be constructed straight, plumb, level, and square, in accordance with the drawings and to the satisfaction of the Engineer. Care shall be taken to protect paint finishes and touch up with matching paint and color to the satisfaction of the Engineer. Items that can not be successfully repaired in the field shall be replaced.

**907-258.04--Method of Measurement.** Miscellaneous Rest Area Facilities, constructed and complete in accordance with the requirements of the contract, and accepted, will be measured by the unit quantity per each unit.

A unit of concrete picnic tables and benches shall consist of one table, two benches, the concrete slab shall be as indicated on the Drawings.

A unit of wooden picnic tables shall consist of one table with benches, and the devices to secure the table when required.

A unit of charcoal grill shall consist of the grill complete with steel post and concrete footing.

A unit of drinking fountain shall consist of all concrete, steel, masonry elements, piping, plumbing elements, and drains as shown on the Drawings.

A unit of trash receptacle shall consist of the receptacle, complete, with leveling devices and approved devices to secure the trash receptacle to the pavement.

A unit of water hydrant shall consist of the hydrant complete with connection to water supply, piping, cut off valve, drain and drain line (where shown), and concrete footing, located where shown on the plans and installed in accordance with manufacturer's directions.

A unit of travel trailer sewage dump station shall consist of one tower, one drain, signs and concrete as shown in the plan details.

A unit of cast stone bench shall consist of one bench seat and three bench supports.

A unit of sign (masonry and stone) shall consist of all concrete, steel, masonry elements, letters,



as symbols shown on the plans.

A unit of bollard shall consist of steel pipe with finial, and concrete for footing and infill, as shown on the plans.

A unit of metal benches shall consist of one bench, and the devices to secure the bench when required.

A unit of pavilion and survey monument shall consist of concrete (not including sidewalk), steel (painted), metal roof, masonry elements, granite, re-location of survey monument, and display panel as applicable and as shown on the Drawings.

A unit of cigarette receptacle shall consist of one receptacle, and the devices to secure the receptacle when required.

A unit of picnic shelter shall consist of concrete (not including sidewalk), steel framing, metal roof, steel columns, and overhead ornaments, as shown on the Drawings.

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 bid per complete items.

**907-258.05--Basis of Payment.** Charcoal grills, drinking fountains, concrete picnic tables and benches, wooden picnic tables and benches, trash receptacles, water hydrants, travel trailer sewage dump station, cast stone benches, sign (masonry and stone), metal benches, bollards, pavilion, survey monument, car stops, cigarette receptacles, and picnic shelters each unit shall be paid for at the contract unit price bid per each, which price shall be full compensation for furnishing all materials and supplies; for performing all work necessary for each completed unit; and for all equipment, tools, labor and incidentals necessary to complete the work.

Payment will be made under:

- 907-258-A: Charcoal Grill - per each
- 907-258-B: Drinking Fountain - per each
- 907-258-C: Concrete Picnic Table and Benches - per each
- 907-258-D: Wooden Picnic Table and Benches - per each
- 907-258-E: Trash Receptacle - per each
- 907-258-F: Water Hydrant - per each
- 907-258-G: Travel Trailer Sewage Dump Station - per each
- 907-258-H: Cast Stone Bench - per each

907-258-I: Sign, Masonry and Stone	- per each
907-258-J: Metal Bench	- per each
907-258-K: Bollard	- per each
907-258-L: Pavilion	- per each
907-258-M: Survey Monument	- per each
907-258-N: Car Stop	- per each
907-258-O: Cigarette Receptacle	- per each
907-258-P: Picnic Shelter	- per each

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-504-2

CODE: (SP)

DATE: 11/29/2017

SUBJECT: Fiber-reinforced Hydraulic Cement Concrete Pavement

Section 907-504, Fiber-reinforced Hydraulic Cement Concrete Pavement, is hereby added to and made a part of the 2017 Edition of the Mississippi Standard Specifications for Road and Bridge Construction as follows.

**SECTION 907-504 - FIBER-REINFORCED HYDRAULIC CEMENT CONCRETE PAVEMENT**

**907-504.01--Description.** This work consists of thin and ultra-thin pavement, composed of fiber-reinforced hydraulic 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.

Thin pavements are defined as pavements greater than or equal to four inches in thickness.

Ultra-thin pavements are defined as pavements less than 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.** Water-reducing or water-reducing/set-retarding chemical admixtures in accordance with Subsection 713.02 shall be used in the concrete mixture. Type S admixtures may also be used.

If fly ash or GGBFS are used as a replacement for hydraulic cement in accordance with the maximum values allowed in Section 701, 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 [Subsection 711.04](#), shall be used in the concrete mixture in accordance with [Note \\*\\*\\*](#) under [Table 1](#).

**907-504.02.1.1--Hydraulic 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 [Hydraulic Cement Concrete Design](#)” listed in [Table 1](#) of this Subsection.

**Table 1**  
**MASTER PROPORTION TABLE FOR [HYDRAULIC CEMENT CONCRETE DESIGN](#)**

<b>Design Property</b>	<b>Requirements</b>
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
<a href="#">Required minimum dosage of fibers</a>	***
Minimum Compressive Strength, psi	
For Opening to Traffic	2500 in 18 hours
For Acceptance	3500

- \* The replacement limits of [hydraulic](#) cement by weight by other cementitious materials (such as fly ash or GGBFS) shall be in accordance with the values in [Section 701](#). Other hydraulic cements may be used in accordance with the specifications listed in [Section 701](#).
- \*\* The slump may be increased up to [eight inches \(8"\)](#) with an approved water reducer, in accordance with [Subsection 713.02](#). Minus slump requirements shall meet those set forth in [Table 3](#) of [AASHTO M157](#) specification.
- \*\*\* [The required minimum dosage synthetic structural fibers shall be 1.25 times the rate required on the Department’s APL. For each inch of slump over four inches \(4”\), an additional pound of fibers per cubic yard shall be included in the concrete mixture in excess of the minimum dosage required on the Department’s APL.](#)

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 hydraulic 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 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 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 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 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.

The plan may also include a written description of how the Contractor plans to adjust a batch of concrete if it determined that the batch does not initially conform to the requirements in Subsections 907-504.02.2.1 and/or 907-504.02.2.2. The Contractor may use this plan to adjust the batch to bring it within the applicable acceptance criteria for slump and/or total air content. The plan to adjust the batch shall conform to the requirements in Subsections 907-804.02.12.1.1 (d) and/or 907-804.02.12.1.1 (f),

**907-504.03.1--Removal of Existing Pavement.** Existing asphalt pavement to be removed and replaced with thin or ultra-thin fiber-reinforced concrete pavement shall be removed only 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. If the milled surface is concrete, the milled surface shall be completely free of the existing asphalt pavement, including any previously applied asphalt bonding materials.

Additionally, areas where traffic is expected to cross the transition from the asphalt 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.

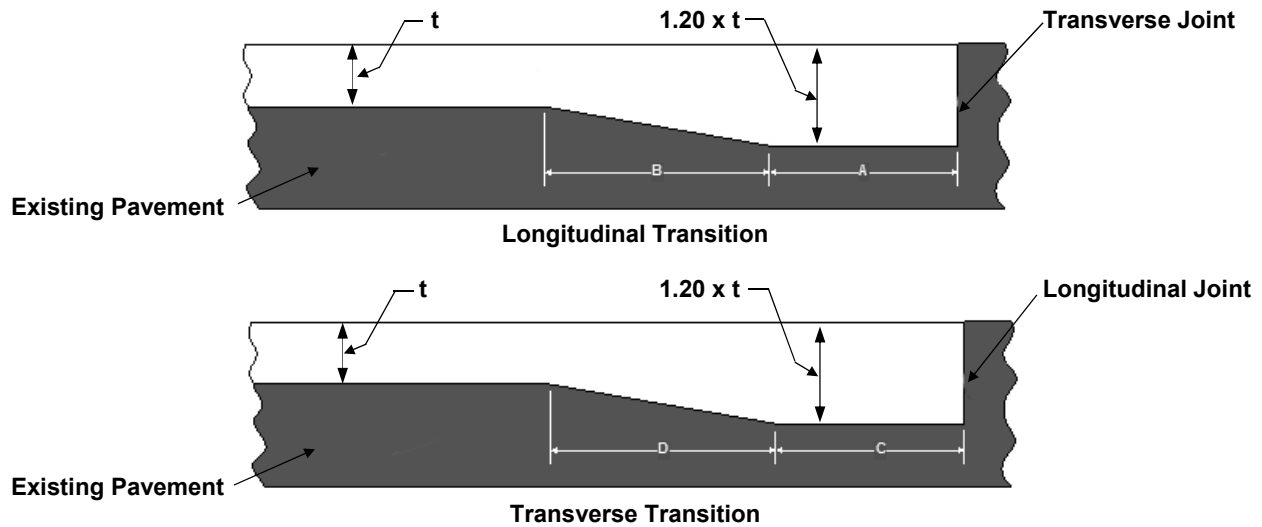


Figure 1

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 asphalt 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  $1.20 \times t$  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 surface shall be cleaned of dust, debris, oils, or all other substances which may potentially interfere with the new concrete pavement from bonding to the surface. The surface cleaning shall be performed using with high-pressure water which does not damage the milled surface. After cleaning the milled surface with water, the milled surface shall be allowed to completely dry prior to placing the concrete. The Contractor shall use fans, blowers, or high-pressure, oil-free compressed air to



dry the milled surface and also remove any remaining dust, debris, or other substances. The application of air by fans, blowers, or high-pressure, oil-free compressed air shall not damage the milled surface. Additionally, the base shall meet the requirements of Subsection 501.03.9 and its subsequent paragraphs, including dampening of the milled surface. There shall be no puddles or standing water on the milled surface prior to placing the concrete.

**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 (Transverse x Longitudinal)	Minimum Joint Depth	
		Within 2 hours of finishing	More than 2 hours after finishing
inches	feet	inches	inches
3	3 x 3	1	1
4	4 x 4	1	1
5	5 x 6	1	1¼
6	5 x 6	1	1½

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](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 M157, Sections 8, 9, 10, and 11 shall be followed. Following AASHTO 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, [including the documentation of the addition of water described above and/or job-site addition chemical admixtures per Subsection 907-504.02.2.](#)

**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. [Surface testing shall be perform in accordance with the requirements of Subsection 501.03.19 for a category A project.](#)

**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 401.02.6.7 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 no additional cost to the Department, with concrete of the same quality as used to construct the pavement.

**907-504.04--Method of Measurement.** Fiber-reinforced 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 asphalt pavement, required to be removed and replaced with concrete pavement, is addressed under Pay Items 406 and 503-C, and shall include saw cutting, milling, and all handwork necessary to ensure removal of pavement to the neat saw cut lines.

**907-504.05--Basis of Payment.**

**907-504.05.1--General.** Fiber-reinforced 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 six feet (6') 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**

<b>Thickness Deficiency Inches</b>	<b>Proportional Part of Contract Price Allowed</b>
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. 907-626-3

CODE: (SP)

DATE: 01/17/2017

SUBJECT: Thermoplastic Markings

Section 626, Thermoplastic Traffic Markings, of the 2017 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows:

**907-626.03.1.2--Construction Details.** After the first sentence of the eighth paragraph of Subsection 626.03.1.2 on Page 494, add the following.

For 4-inch stripe, additional beads by the drop-on method shall be applied at a rate of not less than two pounds of beads per 100 feet of four-inch stripe.

**907-626.04--Method of Measurement.** After the second paragraph of Subsection 626.04 on Page 495, add the following.

Four-inch equivalent 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.

After the last paragraph of Subsection 626.04 on Page 495, add the following.

When transverse railroad bands, pedestrian crosswalks and stop lines are measured by the linear foot of 4-inch equivalent stripe, stripes more than four inches in width will be converted to equivalent lengths of four-inch widths.

**907-626.05--Basis of Payment.** Add the following pay items to the list of pay items on pages 495 & 496.

- 907-626-A: 4" Thermoplastic Traffic Stripe, Skip White - per linear foot or mile
- 907-626-B: 4" Thermoplastic Traffic Stripe, Continuous White - per linear foot or mile
- 907-626-C: 4" Thermoplastic Edge Stripe, Continuous White - per linear foot or mile
- 907-626-D: 4" Thermoplastic Traffic Stripe, Skip Yellow - per linear foot or mile
- 907-626-E: 4" Thermoplastic Traffic Stripe, Continuous Yellow - per linear foot or mile
- 907-626-F: 4" Thermoplastic Edge Stripe, Continuous Yellow - per linear foot or mile

- 907-626-G: Thermoplastic Detail Stripe, Color, 4" Equivalent Length - per linear foot
- 907-626-H: Thermoplastic Legend, Color, 4" Equivalent Length - per linear foot  
or square foot



# MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-636-2

CODE: (IS)

DATE: 11/15/2017

SUBJECT: Electrical Cable

Section 636, Electrical Cable, of the 2017 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows.

**907-636.01--Description.** Delete the last sentence of the last paragraph in Subsection 636.01 on page 555 and substitute the following.

It shall include excavating, laying, placing tracer cable or tape, backfilling, replacing sod, aerial supports and/or pull-through conduits, as applicable; and transformer enclosures and/or terminal boxes when not placed under other items of the contract.

**907-636.02--Materials.** After the paragraph of Subsection 636.02 on page 555, add the following.

## **907-636.02.1--ITS Ground Mounted Meter Enclosure.**

**907-636.02.1.1--Meter Base.** Meter bases shall be NEMA Type 3R with a minimum rating of 100 amps and shall meet the requirements of the local utility. The meter base shall be provided with ampere rating of meter sockets based on sockets being wired with insulated wire rated at least 167°F. The meter base shall be designed for underground service.

Meter bases shall be 4-terminal, 600 volt, single phase, 3-wire furnished with the following:

- (a) Line, load and neutral terminals accepting #8 to 2/0 AWG copper/aluminum wire,
- (b) Ringed or ringless type, with or without bypass,
- (c) Made of galvanized steel,
- (d) Listed as meeting UL Standard UL-414, and
- (e) Underground service entrance as specified.

The meter bases shall have electrostatically applied dry powder paint finish, light gray in color, with a minimum thickness of 2.4 mils.

A 1-inch watertight hub for threaded rigid conduit shall be furnished with meter base.

**907-636.02.1.2--Disconnect.** External electrical service disconnects shall be furnished with a single pole 50-amp inverse time circuit breaker with at least 10,000 RMS symmetrical amperes short circuit current rating in a lockable in open or closed position in accordance with National Electric Code (NEC) and be a NEMA 3R Type enclosure. The disconnect shall be listed as meeting UL Standard UL-489 and marked as being suitable for use as service equipment.

The disconnect enclosure shall be fabricated from galvanized steel and electrostatically apply dry powder paint finish, light gray in color, to yield a minimum thickness of 2.4 mils. Ground bus and neutral bus shall be provided with at least four terminals with minimum wire capacity range of number 14 through number 4.

For 480V service, a local utility approved, lockable, non-fused disconnect switch on the supply side of the meter base shall be furnished, installed, and labeled as "Utility Disconnect". A separate load side disconnect with overcurrent protection shall be provided within two feet (2') of the meter.

**907-636.02.1.3--Ground Mounted – Pedestal – Service Panel.** The pedestal shall be of NEMA Type 3R rainproof construction and shall be UL Listed as "Enclosed Industrial Control Equipment" (UL 508A). External construction shall comply with UL50 requirements and shall be of G90 galvanized steel with light green #14672 Federal Specification 595 polyurethane industrial grade powder paint.

Hinges shall be stainless steel and of the continuous piano hinge type.

The pedestal mounting bolts shall not be externally accessible. The pedestal shall be able to be embedded in concrete or use anchor bolts for mounting on concrete base. Either pedestal mounting base or anchor bolt kit shall be used for installation.

The service pedestal should have three separate isolated sections for metering equipment, utility termination and customer equipment.

The metering section shall be pad-lockable and sealable and have a hinged swing hood with an integral hinged polycarbonate sealable window for access to demand meters. Meter socket type shall meet the requirements of the serving utility.

The utility termination section shall be pad-lockable and sealable and shall have a stainless steel handle provided on a lift-off cover. Sufficient clearance shall be provided for a 4-inch diameter conduit for utility cables entrance. Utility landing lugs shall be UL listed and shall accommodate conductor sizes between AWG #6 – 350 kcmil.

The customer compartment door shall be hinged on the left hand side. A stainless pad-lockable hasp shall be provided to secure customer compartment. A door keeper shall be provided to keep the door in an open position. A print pocket shall be provided on the inside of the door in a weatherproof sleeve. Required UL labeling shall be located on the inside of the customer door. Distribution and control equipment shall be behind an internal dead-front door with a quarter-turn securing latch and be hinged to open more than 90 degrees. The dead-front door shall be hinged on the same side as the customer section door. All distribution and control equipment shall be factory wired using 600-volt wire sized to NEC and UL requirements.

The service pedestal shall be rated for operation at 10K minimum amps interrupting capacity (AIC). The provided documentation shall list circuit breaker combinations and those to be used for de-rated operation for series ratings. Circuit breakers shall be permanently labeled with engraved name plates.

The serving utility shall be contacted for necessary requirements before ordering or installing equipment.

**907-636.02.2--ITS Ground Mounted Transformer Enclosure.**

**907-636.02.2.1--Disconnect.** The disconnect shall meet the requirements of Subsection 907-636.01.2.

**907-636.02.2.2--Ground Mounted - Pedestal – Service Panel.** The ground mounted - pedestal – service panel shall meet the requirements of Subsection 907-636.01.3. In addition, the transformer shall be rated to match the requirement of the primary service and the types of load served as specified in the plans. The transformer unit shall be installed inside the enclosure and meet all applicable codes. Each transformer shall be furnished as one complete unit and wiring of multiple transformers to meet the required ratings at each enclosure location is not allowed. Step-up and Step-down transformers shall be designed specifically for each application. Reverse feeding of step-up and step-down transformers is not allowed. All transformers shall be designed for outdoor installation and rated 600 VAC and below.

**907-636.04--Method of Measurement.** Delete the first paragraph of Subsection 636.04 on page 557, and substitute the following.

Electric cable of the type specified, constructed as specified on the plans, will be measured by the linear foot. Measurement will be computed horizontally along the conduit, messenger cable or mast arm and vertically along the pole. Measurement in underground conduit is only in the horizontal plane and no additional quantity shall be added for conduit depth or change in elevation of the conduit. No extra length will be allowed for cable inside signal heads, drip loops, or sag in aerial supported cable. Tracer tape, when required in the plans, used with tracer cable will not be measured for separate payment but shall be included in the contract price for Tracer Cable. The terminals for the measurements of lengths will be considered specifically as the center of the pull boxes, poles, signal heads or controller cabinets.

After the first paragraph of Subsection 636.04 on page 557, add the following.

ITS Ground Mounted Enclosures, complete in place and accepted, will be measured as a unit quantity per each for a complete and operable unit in accordance with the contract provisions.

**907-636.05--Basis of Payment.** After the first paragraph of Subsection 636.05 on page 557, add the following.

ITS Ground mounted enclosures, measured as prescribed above, will be required wherever ground mounted meter enclosures or step-up or step-down transformers are noted as required in the plans. The enclosures shall be paid for at the contract unit price bid per each; which price shall be full compensation for any transformers (as described in the plans), foundation construction, cabinets, pedestals, meter bases, disconnects, relays, terminals, circuit breakers, sockets, hubs, buses, connectors, mounting material, all other materials for constructing, installing, connecting, testing

and final cleanup; and for all equipment, labor, tools and incidentals necessary to complete the work in accordance with the contract documents.

In the first sentence of the second paragraph of Subsection 636.05 on page 557, change “relaid” to “re-laid”.

Delete the list of pay items on pages 557 and 558, and substitute the following.

- 907-636-A: Electric Cable, Direct Burial, Type, AWG \_\_\_\_, \_\_\_\_ Conductor - per linear foot
- 907-636-B: Electric Cable, Underground in Conduit, Type, AWG \_\_\_\_,  
\_\_\_\_ Conductor - per linear foot
- 907-636-C: Electric Cable, Aerial Supported, Type, AWG \_\_\_\_,  
\_\_\_\_ Conductor - per linear foot
- 907-636-D: Electric Cable, Aerial Supported in Conduit, Type, AWG \_\_\_\_,  
\_\_\_\_ Conductor - per linear foot
- 907-636-E: Electric Cable, Underground in Conduit, Tracer Cable - per linear foot
- 907-636-F: Electric Cable, Repair - per linear foot
- 907-636-G: Underground Cable and Conduit, Removed - per linear foot
- 907-636-H: Underground Cable and Conduit, Removed and Re-laid - per linear foot
- 907-636-I: ITS Ground Mounted \* Enclosure - per each

\* Indicates Meter or Transformer Enclosure Type

# SECTION 905 - PROPOSAL

Date \_\_\_\_\_

Mississippi Transportation Commission  
Jackson, Mississippi

Sirs: The following proposal is made on behalf of \_\_\_\_\_  
\_\_\_\_\_ of \_\_\_\_\_

for constructing the following designated project(s) within the time(s) hereinafter specified.

The plans are composed of drawings and blue prints on file in the offices of the Mississippi Department of Transportation, Jackson, Mississippi.

The Specifications are the current Standard Specifications of the Mississippi Department of Transportation approved by the Federal Highway Administration, except where superseded or amended by the plans, Special Provisions and Notice(s) to Bidders attached hereto and made a part thereof.

I (We) certify that I (we) possess a copy of said Standard and any Supplemental Specifications.

Evidence of my (our) authority to submit the Proposal is hereby furnished. The proposal is made without collusion on the part of any person, firm or corporation. I (We) certify that I (we) have carefully examined the Plans, the Specifications, including the Special Provisions and Notice(s) to Bidders, herein, and have personally examined the site of the work. On the basis of the Specifications, Special Provisions, Notice(s) to Bidders, and Plans, I (we) propose to furnish all necessary machinery, tools, apparatus and other means of construction and do all the work and furnish all the materials in the manner specified. I (We) understand that the quantities mentioned herein are approximate only and are subject to either increase or decrease, and hereby propose to perform any increased or decreased quantities of work at the unit prices bid, in accordance with the above.

I (We) acknowledge that this proposal will be found irregular and/or non-responsive unless a certified check, cashier's check, or Proposal Guaranty Bond in the amount as required in the Advertisement (or, by law) is submitted electronically with the proposal or is delivered to the Contract Administration Engineer prior to the bid opening time specified in the advertisement.

**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) shall submit electronically with our proposal or deliver prior to the bid opening time 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 digital signature and electronic submission via Bid Express 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.

Construction of Ocean Springs Maintenance Headquarters Building and Site Work, known as State Project Nos. BWO-6241-30(001) / 503010301 & LWO-6037-30(002) / 503010303 in Jackson County.

Line no.	Item Code	Adj Code	Quantity	Units	Description[Fixed Unit Price]
<b>Roadway Items</b>					
0020	201-A001		1	Lump Sum	Clearing and Grubbing
0030	202-A001		1	Lump Sum	Removal of Obstructions
0040	202-B123		110	Linear Feet	Removal of Electric Power Cable, Including Hardware
0050	202-B126		258	Linear Feet	Removal of Fence, All Types
0060	202-B188		1,066	Square Yard	Removal of Pavement, All Types and Depths
0070	202-B191		8	Linear Feet	Removal of Pipe, 8" And Above
0080	202-B194		1	Each	Removal of Power/Light Pole
0090	202-B210		1	Each	Removal of Secondary Power Controller
0100	202-B211		1	Each	Removal of Septic Tank, All Sizes
0110	203-A002	(E)	240	Cubic Yard	Unclassified Excavation, LVM, AH
0120	203-EX040	(E)	480	Cubic Yard	Borrow Excavation, AH, LVM, Class B9
0130	203-G002	(E)	390	Cubic Yard	Excess Excavation, LVM, AH
0140	203-I001		1	Acre	Site Grading
0150	209-A005		2,210	Square Yard	Geotextile Stabilization, Type V, Non-Woven
0160	216-B003		1,545	Square Yard	Solid Sodding, St. Augustine
0170	223-A001		1	Acre	Mowing (\$50.00)
0180	234-A001		580	Linear Feet	Temporary Silt Fence
0190	237-A002		64	Linear Feet	Wattles, 20"
0200	249-A001		27	Ton	Riprap for Erosion Control
0210	249-B001		27	Cubic Yard	Remove and Reset Riprap
0220	403-A003	(BA1)	81	Ton	12.5-mm, ST, Asphalt Pavement
0230	403-A006	(BA1)	135	Ton	19-mm, ST, Asphalt Pavement
0240	407-A001	(A2)	92	Gallon	Asphalt for Tack Coat
0250	603-CA011	(S)	48	Linear Feet	18" Reinforced Concrete Pipe, Class III
0260	603-CB003	(S)	2	Each	18" Reinforced Concrete End Section
0270	607-B026		385	Linear Feet	72" Type I Chain Link Fence, Class I, With Top Guard
0280	607-G003		3	Each	Gate, 4' x 6' Chain Link with Top Guard
0290	607-P1018		34	Each	Line Post, 9' x 2" Galvanized Steel
0300	607-P1030		8	Each	Line Post, 14' x 2" Galvanized Steel
0310	607-P2003		1	Each	Brace Post, 6' x 2" Galvanized Steel
0320	607-P2006		8	Each	Brace Post, 8' x 2 1/2" Galvanized Steel
0330	607-P2013		1	Each	Brace Post, 10' x 2 1/2" Galvanized Steel
0340	607-P3008		6	Each	Gate Post, 9' x 2 1/2" Galvanized Steel
0350	608-C001		25	Square Feet	Detectable Warning Panels

Line no.	Item Code	Adj Code	Quantity	Units	Description[Fixed Unit Price]
0360	609-B002	(S)	200	Linear Feet	Concrete Curb, Header
0370	620-A001		1	Lump Sum	Mobilization
0380	622-A004		1	Each	Engineer's Field Office Building, Type 3
0390	630-A001		8	Square Feet	Standard Roadside Signs, Sheet Aluminum, 0.080" Thickness
0400	630-C003		9	Linear Feet	Steel U-Section Posts, 3.0 lb/ft
0410	699-A001		1	Lump Sum	Roadway Construction Stakes
0420	907-258-F001		1	Each	Water Hydrant
0430	907-258-PP005		4	Each	Car Stop, Per Plans
0440	907-504-A003	(C)	217	Square Yard	4" Fiber-reinforced Concrete Pavement
0450	907-626-B001		220	Linear Feet	4" Thermoplastic Traffic Stripe, Continuous White
0460	907-626-G003		105	Linear Feet	Thermoplastic Detail Stripe, Blue-ADA
0470	907-626-H001		1	Each	Thermoplastic Legend, Blue-ADA Handicap Symbol
0480	907-630-PP003		1	Each	Handicap Parking Sign, With Post
0490	907-636-G001		225	Linear Feet	Underground Cable and Conduit, Removed
<b>ALTERNATE GROUP AA NUMBER 1</b>					
0500	304-F002	(GT)	785	Ton	Size 610 Crushed Stone Base
<b>ALTERNATE GROUP AA NUMBER 2</b>					
0510	304-F001	(GT)	785	Ton	3/4" and Down Crushed Stone Base
<b>ALTERNATE GROUP AA NUMBER 3</b>					
0520	304-F003	(GT)	785	Ton	Size 825B Crushed Stone Base
<b>Building Items</b>					
0010	907-242-A001		1	Lump Sum	Construction of Administration Building



SECTION 905 - COMBINATION BID PROPOSAL (Continued)

**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.

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) agree to complete each contract on or before its specified completion date.

\*\*\*\*\*

**COMBINATION BID PROPOSAL**

This proposal is tendered as one part of a Combination Bid Proposal utilizing option \_\_\_\* of Subsection 102.11 on the following contracts:

\* Option to be shown as either (a), (b), or (c).

	<u>Project No.</u>	<u>County</u>	<u>Project No.</u>	<u>County</u>
1.	_____	_____	6.	_____
2.	_____	_____	7.	_____
3.	_____	_____	8.	_____
4.	_____	_____	9.	_____
5.	_____	_____	10.	_____

(a) If Combination A has been selected, your Combination Bid is complete.

(b) If Combination B has been selected, then complete the following page.

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.					

For Informational Purposes Only

SECTION 905 - COMBINATION BID PROPOSAL (Continued)

Project Number	Pay Item Number	Unit	Unit Price Reduction	Total Item Reduction	Total Contract Reduction
9.					
10.					

(c) If Combination C has been selected, then initial and complete ONE of the following.

\_\_\_\_\_ 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.



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 \_\_\_\_\_

**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-6241-30(001)/ 503010301000 & LWO-6037-30(002)/ 503010303000**

in **Jackson** \_\_\_\_\_ 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 exist and are made a part thereof?            Yes / No

Any exceptions shall address to whom it applies, initiating agency and dates of such action.

Note: Exceptions will not necessarily result in denial of award but will be considered in determining bidder responsibility. Providing false information may result in criminal prosecution or administrative sanctions.

All of the foregoing is true and correct.

(1/2016 S)

SECTION 902

CONTRACT FOR BWO-6241-30(001)/ 503010301000 & LWO-6037-30(002)/ 503010303000

LOCATED IN THE COUNTY(IES) OF Jackson

STATE OF MISSISSIPPI,  
COUNTY OF HINDS

This contract entered into by and between the Mississippi Transportation Commission on one hand, and the undersigned contractor, on the other witnesseth;

That, in consideration of the payment by the Mississippi Transportation Commission of the prices set out in the proposal hereto attached, to the undersigned contractor, such payment to be made in the manner and at the time of times specified in the specifications and the special provisions, if any, the undersigned contractor hereby agrees to accept the prices stated in the proposal in full compensation for the furnishing of all materials and equipment and the executing of all the work contemplated in this contract.

It is understood and agreed that the advertising according to law, the Advertisement, the instructions to bidders, the proposal for the contract, the specifications, the revisions of the specifications, the special provisions, and also the plans for the work herein contemplated, said plans showing more particularly the details of the work to be done, shall be held to be, and are hereby made a part of this contract by specific reference thereto and with like effect as if each and all of said instruments had been set out fully herein in words and figures.

It is further agreed that for the same consideration the undersigned contractor shall be responsible for all loss or damage arising out of the nature of the work aforesaid; or from the action of the elements and unforeseen obstructions or difficulties which may be encountered in the prosecution of the same and for all risks of every description connected with the work, exceptions being those specifically set out in the contract; and for faithfully completing the whole work in good and workmanlike manner according to the approved Plans, Specifications, Special Provisions, Notice(s) to Bidders and requirements of the Mississippi Department of Transportation.

It is further agreed that the work shall be done under the direct supervision and to the complete satisfaction of the Executive Director of the Mississippi Department of Transportation, or his authorized representatives, and when Federal Funds are involved subject to inspection at all times and approval by the Federal Highway Administration, or its agents as the case may be, or the agents of any other Agency whose funds are involved in accordance with those Acts of the Legislature of the State of Mississippi approved by the Governor and such rules and regulations issued pursuant thereto by the Mississippi Transportation Commission and the authorized Federal Agencies.

The Contractor agrees that all labor as outlined in the Special Provisions may be secured from list furnished by

It is agreed and understood that each and every provision of law and clause required by law to be inserted in this contract shall be deemed to be inserted herein and this contract shall be read and enforced as though it were included herein, and, if through mere mistake or otherwise any such provision is not inserted, then upon the application of either party hereto, the contract shall forthwith be physically amended to make such insertion.

The Contractor agrees that he has read each and every clause of this Contract, and fully understands the meaning of same and that he will comply with all the terms, covenants and agreements therein set forth.

Witness our signatures this the \_\_\_ day of \_\_\_\_\_, \_\_\_\_\_.

\_\_\_\_\_  
Contractor(s)

By \_\_\_\_\_

MISSISSIPPI TRANSPORTATION COMMISSION

Title \_\_\_\_\_

By \_\_\_\_\_

Signed and sealed in the presence of:  
(names and addresses of witnesses)

Executive Director

\_\_\_\_\_

\_\_\_\_\_

Secretary to the Commission

Award authorized by the Mississippi Transportation Commission in session on the \_\_\_ day of \_\_\_\_\_, \_\_\_\_\_, Minute Book No. \_\_\_\_\_, Page No. \_\_\_\_\_.

Revised 8/06/2003

**SECTION 903**  
**PERFORMANCE AND PAYMENT BOND**

CONTRACT BOND FOR: BWO-6241-30(001)/ 503010301000 & LWO-6037-30(002)/ 503010303000

LOCATED IN THE COUNTY(IES) OF: Jackson

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





# BID BOND

KNOW ALL MEN BY THESE PRESENTS, that we \_\_\_\_\_  
Contractor

\_\_\_\_\_  
Address

\_\_\_\_\_  
City, State ZIP

As principal, hereinafter called the Principal, and \_\_\_\_\_  
Surety

a corporation duly organized under the laws of the state of \_\_\_\_\_

as Surety, hereinafter called the Surety, are held and firmly bound unto State of Mississippi, Jackson, Mississippi

As Obligee, hereinafter called Obligee, in the sum of **Five Per Cent (5%) of Amount Bid**

Dollars(\$ \_\_\_\_\_ )

for the payment of which sum will and truly to be made, the said Principal and said Surety, bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has submitted a bid for **Construction of Ocean Springs Maintenance Headquarters Building and Site Work, known as State Project Nos. BWO-6241-30(001) / 503010301 & LWO-6037-30(002) / 503010303 in Jackson 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\_\_

\_\_\_\_\_  
(Witness)

\_\_\_\_\_  
(Principal) (Seal)

By: \_\_\_\_\_  
(Name) (Title)

\_\_\_\_\_  
(Witness)

\_\_\_\_\_  
(Surety) (Seal)

By: \_\_\_\_\_  
(Attorney-in-Fact)

\_\_\_\_\_  
(MS Agent)

\_\_\_\_\_  
Mississippi Insurance ID Number